Climate Protection Manual

F O R C I T I E S

Natural Capitalism Solutions

In collaboration with:

ICLEI Local Governments for Sustainability

Sponsored by:

PNE

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Climate Protection Manual **FOR CITIES**

Table of Contents:

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This Manual is developed by Natural Capitalism Solutions (NCS), a 501(c)3 non-profit whose mission is to educate senior decision-makers in business, government and civil society about the principles of sustainability. NCS shows how to restore and further enhance the natural and human capital while increasing prosperity and quality of life. In partnership with leading thinkers and groups, NCS creates innovative, practical tools and implementation strategies for companies, communities and countries.

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Chapter 1: **Introduction** 2 February 2007

This manual is for you. Whether you are a public official or citizen, we encourage you to download it from www.climatemanual.org and share it with as many people as you want.

Protecting the climate is the defining challenge of our time. Every era has its opportunity to improve the world. This is ours. How we deal with the very real threats to the stability of the climate will shape our future, the economy and the sort of a world we will leave to our grandchildren. It will determine whether many species, perhaps even our own, will live or die.

This manual will show mayors how to reduce greenhouse gas emissions in his/her unique community.

This manual has gone through an extensive peer review process. And was released at the ICLEI Sundance Summit, for comment from the mayors and city officials assembled there. But the world of climate protection is changing very rapidly. Please contact us if you have corrections, additions, suggestions for improvement, or if you want help in implementing the ideas contained here. Natural Capitalism offers consulting services in climate protection, and implementation of sustainability to communities, companies and countries worldwide.

What follows is a brief summary of each of the documents that comprise the seven chapters of this manual.

Chapter 2 begins the manual by concisely describing the benefits of taking action now. It echoes the conclusion of the International Panel on Climate Change 2007 report, issued in Paris, which, "In a grim and powerful assessment of the future of the planet, the leading international network of climate scientists has concluded for the first time that global warming is "unequivocal" and that human activity is the main driver….". The report stated that, "the world was in for centuries of climbing temperatures, rising seas and shifting weather patterns - unavoidable results of the buildup of heat-trapping gases in the atmosphere." But in the only hope offered by the report, it concluded that, "warming and its harmful consequences could be substantially blunted by prompt action."[1]

The purpose of this Chapter is to arm mayors with the ammunition they need to build political support for their leadership by making the business case, the tax-savings case, the environmental case, the public health case, etc., for climate protection. This chapter has five different sections, each of which can be used individually, as needed.

The next section of the Manual follows ICLEI's Cities for Climate Protection Campaign proven five-step methodology. This process starts with conducting a baseline inventory. It then requires that a city make a commitment to reduce global warming emissions. The amount of time each city needs to complete each milestone depends on its size and complexity, the availability of data, staff and resources. A city then moves to create a plan, implement that plan, measure its success, verify that and report on it.

[1] New York Times, www.nytimes.com/2007/02/03/science/earth/03climate.html?_r=1&ref=todayspaper&oref=slogin, 1 February 2007.

The five steps of ICLEI's CCP milestone process are:[2]

1. Develop a baseline inventory of GHG emissions
2. Establish a target to lower emissions
3. Develop a local climate action plan to implement actions that reduce GHG emissions
4. Implement the local action plan
5. Measure, verify and report performance

The five-step methodology provides a simple, effective, standardized means a community can use to reduce the emissions from both government operations and the community as a whole. The various steps can be worked on concurrently, but each should receive separate consideration in the process of developing a Local Action Plan.

Chapter 3 describes the purpose of a baseline emissions inventory, why it is important and what will be involved. It provides cities with the tools and options available to conduct a baseline inventory, which include the ICLEI CACP tool, the use of outside consultants and performing a self-inventory.

A baseline inventory identifies and quantifies the global warming pollution produced by a city's public and private sectors in a particular year. The inventory should also include a forecast of probable future emissions that will result if nothing is done. This provides a benchmark against which the city can measure progress in terms of its own operations and the community as a whole. The emissions analysis identifies activities that contribute to global warming pollution and the quantity of pollution generated by each of these activities.

An inventory is established by collecting energy use and waste data. A local government can calculate global warming pollution for a base year (e.g., 1990, 2000 or any other year for which the city has good data) and for a forecast year (e.g., 2012). Expertise in climate science, outside technical expertise or consultants are not necessary, although many cities do hire such outside expertise. Government staff members, employees from public works, environment and facilities departments can conduct an inventory. The differences in standards and how to conduct an inventory to make a standard more useful for the following steps are explained. Finally, this chapter provides examples of completed inventories.

Chapter 4 discusses setting a reduction target for greenhouse gas emissions by creating a tangible goal and metric (system of measurements) to guide the planning and implementation of a community's action plan. The target in the U.S. Mayors Climate Protection Agreement is to reduce emissions by a minimum of 7% below 1990 levels by 2012. Current science, however, indicates a need to reduce GHG emission dramatically below that in the next 10 years. The chapter explains the background science and provides examples of the timeframe and goals that cities and other organizations are currently setting. It also works through a 15-step process cities can use to establish their own emission reduction goals.

Chapter 5 presents 5 sections and 15 sub-sections (18 documents total in the Table of Contents). These look at all the elements involved in developing and implementing a Local Climate Action Plan. A Plan is a customized roadmap that includes a timeline, costs and financing mechanisms, assignments to city departments and actions the city must implement to achieve its target. This large chapter provides resources, tools, programs and case studies of how cities and communities have worked to reduce their emissions, reduce the impact of their current emissions and adapt to the changes created by global warming.

The first section in chapter 5, stakeholder engagement, presents different strategies cities can use to work with their community leaders in developing and implementing climate protection programs. It recommends creating partnerships with various stakeholders to create momentum, longevity and success for programs. The remaining four sections of Chapter 5 present the best bets actions for the short term, as well as long term initiative programs that cities can implement to reduce emissions and adapt to climate impacts that are already inevitable.

[2] ICLEI's First Responder Handbook, www.coolmayors.org.

The 9 sub-sections in "Best Bets" describe initiatives that have lower initial costs, short payback, positive return on investment and can quickly reduce GHG emissions. In evaluating what programs cities should put in place, cities should consider first the greatest sources of emissions, as shown by the baseline inventory and then create the best package of programs to quickly control emissions.

The purpose of chapter 5 is to provide you a variety of programs and case studies. The sections show how these programs have worked for other cities, describe their return on investment (ROI) and provide resources for more information. Chapter 5's Best Bets Section (9 documents) highlights best practices cities can implement within their own municipal operations, as well as programs cities can put into place to help residents and businesses reduce their emissions and become more energy efficient (bold green text signifies best practices).

Best bets include:

In municipal buildings cities can retrofit city buildings with energy efficient lighting and appliances, establish LEED/energy efficient standards for new municipal construction and major renovations, and perform energy audits for existing municipal buildings.

For other infrastructure within the city, best practices include installing Light-Emitting Diode (LED) traffic signals and traffic flow management systems, updating to high efficiency street lighting, increasing efficiency of water and wastewater utilities and establishing landfill to gas energy projects.

Municipalilities can modify city transportation in addition to the residential transportation options (see residential transportation below). Cities can reduce emissions from municipal vehicle fleets through the use of hybrids, alternative fuel vehicles and idle reduction policies and campaigns as well as establishing programs to reduce city employee driving. Municipalities can also modify school buses, waste haulers, ambulance services and other contracts to use alternative fuels.

Municipal waste reduction and recycling programs can reduce emissions.

The city can also establish purchasing programs to procure energy efficient appliances, purchase materials that require less energy, and reduce the amount of waste it produces. The best practice is to create efficiency standards for office equipment, adopt recycled/salvage product use policies, and develop local purchasing programs.

Finally cities can work to encourage utility providers to offer energy efficiency services and to have a minimum commodity that is to be from renewable sources.

Cities can work to support local businesses in their transition to energy efficient technology and practices. The best practices in doing this are: promoting the use of audits, provide incentive programs for private developers to provide higher energy efficiency standards, establishing energy efficiency standards in city building codes, work with power plants and other significant emitters, while helping small and local businesses to save money by undertaking energy savings measures.

The best ways to support residents in increasing their energy efficiency at home is by supporting residential home efficiency upgrades, establishing local policies to promote renewable energy, providing lower-income weatherization assistance, addressing split-incentives in renter occupied homes, creating home size restrictions and taxing large residential energy consumers, and promoting energy and water efficiency by smart metering, price signals and price structuring.

The residential transportation section discusses how after public transportation options are established; cities can offer residents and businesses incentives to modify their transportation uses. The best practices are to first make cities pedestrian and bicycle friendly, implement school and campus transportation management programs, encourage or require local businesses to implement commuter trip reduction programs, provide better

access to public transportation, install park & ride facilities and provide car sharing programs, offer location efficient mortgages and provide incentives for hybrid or low emission vehicle use.

Chapter 5's Long Term Initiatives section (5 sub-sections) gives cities a look at more comprehensive carbon reduction opportunities. It packages the best bets with those that have lower or longer paybacks. That way, fast payback measures can "subsidize" the longer-payback measures, enabling cities to achieve even greater carbon reductions. This section describes the issues that need to be considered in the transition to radically reduced emissions.

Long term initiatives include:

Sustainable urban planning, including case studies of cities using smart growth concepts in the redesign of the community or housing;

Sustainable agriculture, including examples of how communities are supporting the conversion to organics, no-till and sustainable practices;

Transitioning to alternative fuels, including examples of cities supporting the diversification of fuel as well as discussing ethanol, biodiesel, wind powered, plug-in electric/hybrid;

Sustainable energy planning, including information on sustainable energy options and distributed generation;

Education, including examples of educational programs and materials that cities are using to promote energy efficiency and climate protection; and

Waste management, including waste disposal options and waste reduction goals.

The last two sections of chapter 5 discuss ways to reduce the impact of continuing emissions (including urban reforestation, sequestration, and carbon offset and cap and trade programs). It also discusses policies cities can implement to help residents adapt to climate impacts, making the adjustments to survive the global warming already underway.

Chapter 6 covers how cities should monitor the reductions they achieve through implementation of actions to reduce GHG emissions. Tracking progress builds political support, informs the process and often drives more investment by the city in advancing climate protection. Verification of progress ensures integrity and accuracy in the city's efforts to achieve its GHG reduction target. This chapter discusses metrics, how to measure performance and how often to do it. Any system of metrics should include not only actual emissions reductions, but also a way to evaluate progress on a city's long term goals with the use of indicators. The chapter recommends that a city celebrate its successes to build on momentum and encourage future participation. Examples of awards are provided.

Chapter 7 Successful implementation of actions identified in the Local Climate Action Plan depends on a number of factors including management and staffing, financing, a realistic timeline and stakeholder involvement in appropriate aspects of the plan to build community support. Most cities find it useful to appoint a climate coordinator to ensure continued implementation. This manual includes a list of city and state climate action plans in the last chapter 7.

The Chapter also presents the extensive resources that Natural Capitalism Solutions, manual contributors and reviewers have collected while writing and editing this manual. This section includes sample Local Climate Action Plans, which will be very useful to those cities just initiating this process.

Notes on reading this manual

These documents have been through a peer-review process. But they can always be made better. Please contact office@natcapsolutions.org with any questions, comments you have, or mistakes you find.

An effort has been made to archive all .pdf document referenced on the Natural Capitalism Solutions web site to ensure access to these documents in the future. Unfortunately, this precaution cannot be taken for web pages, which may go out of date over time. The day each site was accessed is included in the footnotes.

CHAPTER 2: **Why Act Now**

DOCUMENT CONTENTS

Each of the following three sections serves as individual arguments. Feel free to read and use these sections individually:

Drivers of Change

Humans love to predict the future. Few succeed. Those who come closest do so by understanding the trends that are driving change. In a meeting of experts convened to create a "Greenprint" to guide the city of Denver, Hunter Lovins stated that cities must be aware of the existing global forces that will shape their future. As these forces begin to impact cities like Denver, they could dramatically shift the metrics by which a Mayor judges whether or not a program to save energy or reduce carbon emissions is cost effective. Mayor John Hickenlooper answered by recounting his visit to New Orleans a year following Hurricane Katrina. "It is an awesome experience," he stated, "for a big city Mayor to drive for blocks and see no one living there. We lost a major American city. The unthinkable is no longer unthinkable."

One hurricane is not a trend. But as the impacts of global warming become more obvious, Mayor Hickenlooper's reaction will become more common. And climate change is only one of the drivers facing us.

This chapter discusses some of those drivers. They will bring change to your community whether you like it or not. These drivers may seem out of your control, but if you can understand the nature of them you can put in place the sorts of programs that can enable you to cope. Understanding these drivers can also enable you to create new businesses, reduce costs for existing companies and capture an array of opportunities that will arise in your community as the future unfolds.

You can ride the waves of change instead of being engulfed by them by exploring:

How larger forces may make "business as usual" difficult or impossible;

How you can take action to minimize these negative impacts; and

How larger forces may create opportunities that can enhance the success of your programs.

The list of trends that follows is far from a comprehensive accounting of the challenges facing us, but it covers the primary drivers relevant to global warming that will shape the future, including:

The Undeniable Science of Climate Change ;

Loss of Natural Capital, the need for more honest accounting;

Strategic Resource Trends: Peak oil, water scarcities and other constraints;

Lifestyles of Health and Sustainability The Sustainability Imperative ; and

Each of these trends is discussed in more detail.

Global Warming: Undeniable Science

When asked to name a global trend many people reply, "terrorism." That is indeed a phenomenon of modern life. But terrorism is far less likely to impact you personally than an array of other changes sweeping the planet.

Munich Re, the world's largest reinsurance company, stated, after assessing the total insurance losses due to the September 11th events, that it is more concerned about climate change than future terrorist risks.

This trend may be the central driver that led you to pick up this manual. A stable climate is of inestimable value to companies, to residents of cities and ultimately to all life on earth. Yet, we are losing this essential foundation of a successful economy.

As the climate changes, the intensity and frequency of what have been considered "natural" disasters like flooding and hurricanes are increasing.[3] The changing climate is forcing cities to deal with such acute challenges as storms, heat waves and water shortages. It also imposes a wide array of long-term impacts such as droughts, the spread of diseases and the demise of historically important industries. In December 2005, at the International Climate Conference in Montreal, Munich Re Foundation released figures showing $200 billion in weather related losses that year, breaking

[3] Pew Center for Global Climate Change, www.pewclimate.org/hurricanes.cfm, 30 November 2006.

the previous record of $145billion[4] in 2004. In contrast, the World Trade Center losses were less than $40 billion.[5]

The money paid out by insurance companies for weather-related losses in 2004 was more than double its payouts in 2003 ($65 billion) and more than four times its payouts in 2001 ($36 billion).[6] This reflects the number of people at risk in storm-prone areas like coasts, and the increasing value of their property. But it also results from larger areas along and inland from the coasts experiencing more severe weather patterns that cause more extensive and expensive damage. Hurricane Katrina in August 2005 was only one of the catastrophic storms around the world.

The frequency of major natural disasters is now *three times* what it was in the 1960s. CGNU, the largest insurance company in the U.K., forecasts that at the current rate of increase of the property damages, by the year 2065, the cost of these disasters will be higher than the entire world economic production.[7]

The following figure shows the evolution of the economic costs, and insured costs of natural disasters worldwide over the past decades.

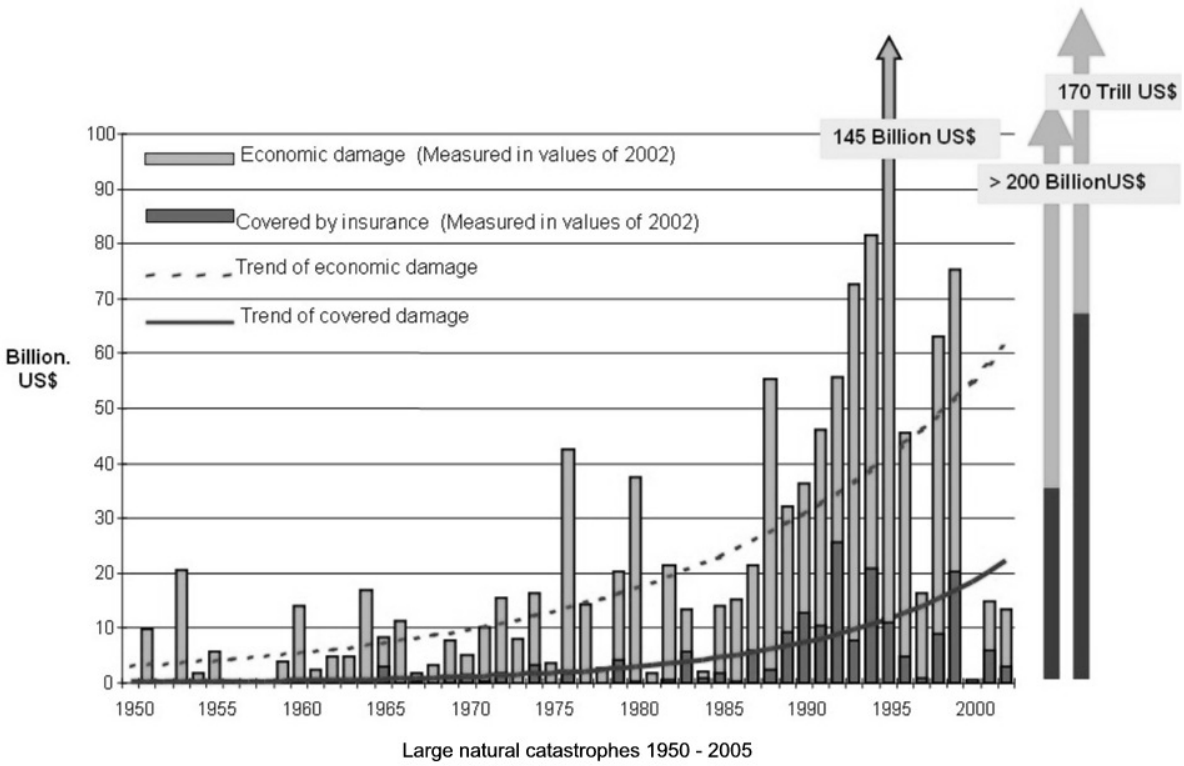

Figure: Evolution of Economic Costs and Insured Costs of Natural Disasters Worldwide [8]

In 2005, insurers faced claims for seven of the ten most expensive hurricanes in history. In response, insurers like AIG, one of the world's largest, announced that they would give customers who reduce their carbon emissions a break on their rates.[9] National Oceanic and Atmospheric Administration (NOAA) Administrator D. James Baker says, "Our climate is

[4] Jim Lobe, "2005 Costliest Year for Extreme Weather", Interpress Service, 7 Dec 2005 Available at, www.truthout.org/docs_2005/120705E.shtml, 30 October 2006.
[5] Thomas Atkins, "Insurer warns of global warming catastrophe", Reuters, 3 March 2004.
[6] Munich re, website: www.munichre.com/, 19 July 2006.
[7] Dr. Andrew Dlugolecki, director of the CGNU, sixth largest insurance company in the world, in his report to the 6th Conference of Parties (COP 6) at the UN Framework Convention on Climate Change, 23 November 2000. See www.unepfi.org/fileadmin/events/2001/cop65/cc_unep_press_cop65_20010718.pdf, 30 October 2006.
[8] © 2003 GeoRisikoForschung, Münchenеruck.
[9] "Insurance Giant AIG Poised To Issue Climate Change Strategy," 5 April 2006, Inside Green Business.

warming at a faster rate than ever before recorded. Ignoring climate change and the most recent warming patterns could be costly to the nation. Small changes in global temperatures can lead to more extreme weather events including, droughts, floods and hurricanes."[10] Hurricane Katrina, which in 2005 destroyed much of New Orleans, may cost insurers as much as $60 billion.[11]

Early in 2007 the Director of the National Hurricane Center resigned in frustration that politicians were refusing to listen to his warnings that, "We're eventually going to get a strong enough storm in a densely populated area to have a major disaster." The Los Angeles Times reported, "Mayfield, 58, leaves his high-profile job with the National Weather Service more convinced than ever that U.S. residents of the Southeast are risking unprecedented tragedy by continuing to build vulnerable homes in the tropical storm zone and failing to plan escape routes."[12]

His is only the latest voice in a rising chorus of concern. The prestigious American Geophysical Union (AGU) is an apolitical international organization of scientists. Its 35,000 members include most of the foremost specialists who study both historical and current evidence of global climate change in the atmosphere, glaciers, oceans, forests and deserts. In a 1999 report, the AGU concluded that,

> Greenhouse gases rising into the atmosphere from burning fossil fuels and other pollutants will increase the pace of global warming and disrupt many regions of the world. Those gases could persist in the atmosphere for thousands of years, and despite uncertainties about just how high worldwide temperature might go and how to combat the climate changes, new strategies must be developed to deal with the problem.[13]

In January 2005, Dr. Rajendra Pachauri, the chairman of the Intergovernmental Panel on Climate Change (IPCC), the international scientific body charged with establishing the science of climate change, told an international conference attended by 114 governments that the world has "already reached the level of dangerous concentrations of CO_2 in the atmosphere," and called for immediate and "very deep" cuts in emissions. He cited a multi-year study by 300 scientists showing that the Arctic was warming twice as fast as the rest of the world, and that its ice cap had shrunk by up to 20% in the past three decades. Remaining ice is 40% thinner than it was in the 1970s and is expected to disappear altogether by 2070. As he spoke, arctic temperatures were eight to nine degrees centigrade higher than normal.[14]

Pachauri stated that because of inertia built into Earth's natural systems, the world is now only experiencing the result of pollution emitted in the 1960s, and much greater effects would occur as the increased pollution of later decades works its way through. Carbon released into the atmosphere today will still be insulating the earth for decades. Pachauri concluded, "Climate change is for real. We have just a small window of opportunity and it is closing rather rapidly. There is not a moment to lose. We are risking the ability of the human race to survive."[15]

In April 2005, a NASA study demonstrated a rise in the temperature of the deep oceans that matched the predictions of computer models. Announcing

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[10] NOAA web site: see www.noaanews.noaa.gov/stories/s412.htm, 18 April 2000.
[11] news.ninemsn.com.au/article.aspx?id=62176, 11 September 2006.
[12] Los Angeles Times, "Hurricane Center Chief Issues Final Warning", Williams, Carol, http://www.latimes.com/news/nationworld/nation/la-na-hurricane3jan03,1,7549657.story?coll=la-headlines-nation, 7 January 2007.
[13] Perlman, David "Warning of Impact of Global Warming: Scientists forecast economic disruptions." San Francisco Chronicle (29 January 1999) pg A-4.
[14] Geoffrey Lean, "Global Warming Approaching Point of No Return, Warns Leading Climate Expert," The Independent (U.K.), 23 January 2005.
[15] What makes Pachauri's noteworthy is that he was put into his position by the Bush administration as a Chairman who would not make climate an issue. "A memorandum from Exxon to the White House in early 2001 specifically asked it to get the previous chairman, Dr. Robert Watson, the chief scientist of the World Bank, "replaced at the request of the U.S." The Bush administration then lobbied other countries in favor of Dr. Pachauri—whom the former vice-president Al Gore called the "let's drag our feet" candidate, and got him elected to replace Dr. Watson, who had repeatedly called for urgent action." Global Warming Approaching Point of No Return, Warns Leading Climate Expert By Geoffrey Lean, *The Independent on Sunday* U.K, 23 January 2005.

the results, Dr. Jim Hansen, the chief scientist on the NASA study stated,

> We have found the smoking gun. There can no longer be substantial doubt that human-made gases are the cause of most observed warming.

The study also found that the ocean is slowly releasing this stored heat, worsening the changes in climate already measured. Previously, skeptics claimed that the models linking human GHG emissions to observed changes in the temperature of the world's atmosphere could not account for all of the warming that *should* be taking place, if the connection between human activity and climate change were as strong as some scientists claimed.[16]

In March 2006, the UN's weather agency, the World Meteorological Organization (WMO) warned that greenhouse gases (GHGs) including carbon dioxide (CO2)—the main cause of global warming and climate change—had reached their highest atmospheric levels ever in human history. Such emissions, WMO stated, must be slowed and reduced if the earth is,to avoid climatic havoc with devastating heat waves, droughts floods and rising sea-levels sinking low-lying island states and hitting seaboard cities.[17]

Human activity has increased the CO_2 content of the atmosphere by 20% in the last four decades, and today adds three times more annually than in 1960.[18] The levels of CO_2 have leapt abruptly over the past two years, suggesting that climate change may be accelerating out of control.

Scientists are growing increasingly worried that climate instability will pass a threshold, after which human action will be unable to stop "runaway climate change." In 2001, the New Scientist reported, "Climate scientists have for the first time formally warned that global warming could unleash catastrophic and irreversible changes to key planetary processes that make the world habitable"[19]
Indeed, recent science has raised the concern that global warming may be happening faster than the models predicted; raising the threat that abrupt climate change could occur. This increases the urgency of corporate and municipal action.[20]

The International Energy Agency projects global emissions to climb another 60% by 2030.[21]

Many scientists now state that to stabilize climate, the world will need to reduce emissions of CO2 and other GHGs 60-80% below current levels. In June 2006, California Governor Arnold Schwarzenegger called for that state to achieve an 80% reduction by 2050.[22]

The United Kingdom had already pledged to implement such cuts and sees the economic feasibility of doing so. In October 2006 a report to the British Government concluded,

> "Global warming could cost the world's economies up to 20% of their gross domestic product (GDP) if urgent action is not taken to stop floods, storms and natural catastrophes…. Sir Nicholas told the Cabinet the world would have to pay 1% of its annual GDP to avert catastrophe. But doing

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[16] J. Hansen, et al, "Earth's Energy Imbalance: Confirmation and Implications," Science magazine, Vol. 308, 3 June 2005, p. 1431. See pubs.giss.nasa.gov/abstracts/2005/Hansen_etal_1.html, 30 October 2006. The article stated that the climate model, driven mainly by increasing human-made greenhouse gases and aerosols among other forces, calculates that Earth is now absorbing 0.85±0.15 W/m2 more energy from the Sun than it is emitting to space. This imbalance is confirmed by precise measurements of increasing ocean heat content over the past 10 years. Implications include:
(i) expectation of additional global warming of about 0.6°C without further change of atmospheric composition;
(ii) confirmation of the climate system's lag in responding to forces, implying the need for anticipatory actions to avoid any specified level of climate change; and
(iii) likelihood of acceleration of ice sheet disintegration and sea level rise.

[17] Reuters, "WMO Sees Link Between Global Warming and Hurricanes," www.planetark.com/dailynewsstory.cfm/newsid/35795/story.htm, 27 March 2006.

[18] WorldWatch Institute, Vital Signs 2003. Molly O. Sheehan wrote "Carbon Emissions and Temperature Climb," pp. 40-41. In this section there is a chart called "Global Average Temperature and Carbon Emissions from Fossil Fuel Burning, 1950-2002, and Atmospheric Concentrations of Carbon Dioxide, 1960-2002."

[19] New Scientist.com, www.newscientist.com/article.ns?id=dn443, 01 February 2007.

[20] Geoffrey Lean, "Global Warming Approaching Point of No Return, Warns Leading Climate Expert," The Independent, (U.K.) January 23, 2005.

[21] International Energy Agency, "World Energy Outlook 2004," published October, 2004. www.iea.org, 30 October 2006.

[22] Carolyn Marshall, The New York Times, 1 June 2005.

> nothing could cost 5 to 20 times that amount. He told them: "Business- as-usual will derail growth."…. The massive 700-page report - commissioned by the Chancellor, Gordon Brown - was described as "hard-headed" and "frighteningly convincing." It focused on the economic peril now confronting the world, unless action was taken to combat harmful CO_2 emissions that contribute to global warming.[23]

The planet faces unprecedented perils. However, as described in the body of this manual, the answers exist and are cost effective. The problem is that we have failed so far to implement them.

Stabilizing atmospheric CO_2 levels will not be easy, but it can be done. Using a combination of energy efficiency and renewable energy, communities can shift from an economy based on hydrocarbons to one running on carbohydrates. All of the technologies exist to shift from coal and oil to much more benign sources of energy. In his book, *Plan B 2.0: Rescuing a Planet Under Stress and a Civilization in Trouble*, Lester Brown describes a policy to cut carbon emissions in half by 2015.[24]

An analysis by the German Environment Agency showed that world GHG emissions could be halved by 2050 at a cost of just 1% of global gross domestic product. Without action to restrain emissions, the cost of global warming-linked weather changes could cut 10% of world GDP.[25]

This Climate Protection Manual describes how *you* can implement such a plan.

Loss of Natural Capital

A stable climate is an important contributor to economic stability, but it is only one of the many services that intact ecosystems provide to our economy. Healthy ecosystems provide the provision of clean water, productive soils, the ability to detoxify society's wastes and dozens of other services that we take for granted, but which we would sorely miss if they were to cease to function.

Such scientists as Dr. Gretchen Daly and economists like Dr. Robert Costanza estimate that the economic value of the services that intact ecosystems provide to our economy is at least $30 trillion dollars a year, or the same as the entire value of the economy that *is* counted.[26] None of this "capital" appears on conventional balance sheets, however, so "business as usual" treats these "ecosystem services" as having a value of zero. Because the way in which people around the world meet their needs does not make protection of the environment as a priority, every major ecosystem on the planet is in decline. The loss of the services that these ecosystems provide to us for free, will force businesses and communities to pay for replacements. This, of course, assumes that humans are even capable of creating substitutes for the contributions that intact ecosystems deliver.

Lester Brown of the Earth Policy Institute points out that.

> Accounting systems that do not tell the truth can be costly. Faulty corporate accounting systems that leave costs off the books have driven some of the world's largest corporations into bankruptcy. The risk with our faulty global economic accounting system is that it so distorts the economy that it could one day lead to economic decline and collapse.

In the same article, Brown also quotes Øystein Dahle, former Vice President of Exxon for Norway and the North Sea, who stated, "Socialism collapsed because it did not allow the market to tell the economic truth. Capitalism may collapse because it does not allow the market to tell the ecological truth."[27]

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[23] Andy McSmith, Colin Brown, Climate change: US economist's grim warning to Blair's Cabinet, 27 October 2006, news.independent.co.uk/environment/article1932727.ece.

[24] Excerpted from Chapter 10, "Stabilizing Climate," in Lester R. Brown, W.W. Norton & Company, 2006.

[25] Environment DAILY, 21 March 2006, www.wbcsd.org/Plugins/DocSearch/details.asp?DocTypeId=32&ObjectId=MTg1NTE&URLBack=%2Ftemplates%2FTemplateWBCSD2%2Flayout%2Easp%3Ftype%3Dp%26MenuId%3DMTY5%26doOpen%3D1%26ClickMenu%3DLeftMenu%26CurPage%3D3%26SortOrder%3Dpubdate%2520desc%2C%2520source%2520asc, 30 October 2006.

[26] Costanza, Robert and Carl Folke. 1997. "Valuing Ecosystem Services with Efficiency, Fairness, and Sustainability as Goals, in Gretchen Daily, ed., Natures Services: Societal Dependence on Natural Ecosystems, Island Press, Washington, D.C., pp. 49-68, William K. Stevens, "How Much Is Nature Worth? For You, $33 Trillion," New York Times, 20 May 1997.

[27] Earth Policy Institute, www.earthpolicy.org/Books/Seg/PB2ch12_ss2.htm, 11 September 2006.

In 1992, 1,600 scientists, including a majority of living Nobel Prize winners in the sciences, issued the warning that:

> A great change in stewardship of the Earth and the life on it is required if vast human misery is to be avoided and our global home on this planet is not be irretrievably mutilated...If not checked, many of our current practices may so put at serious risk the future that we wish for human society and the plant and animal kingdoms, and may so alter the living world, that it will be unable to sustain life in the manner that we know. Fundamental changes are urgent if we are to avoid the collision our present course will bring about.[28]

In 1998, the American Museum of Natural History surveyed professional biologists. A striking 69% of them agree that we are living now through the "sixth extinction." This species extinction seems to be happening more rapidly and affecting a wider range of biodiversity than any of the previous five. It is even faster than the last extinction, over 60 million years ago, when the dinosaurs disappeared. The scientists claim that we will lose between 30% and 70% of the planet's biodiversity within a time span of only 20 to 30 years.[29] The difference from all previous extinctions is that this one is due to the actions of one species—our own—the species that claims to be endowed with intelligence and consciousness.

In April 2005, the United Nations released the Millennium Ecological Assessment.[30] The study by 1,360 experts in 95 nations drew on the work of 22 national academies of science from around the world. It reported that a rising human population has polluted or over-exploited two-thirds of the ecological systems on which life depends, ranging from clean air to fresh water, in the past 50 years.

"At the heart of this assessment is a stark warning," said the 45-member board of the Millennium Ecosystem Assessment. "Human activity is putting such strain on the natural functions of Earth that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted.[31]

UN Secretary-General Kofi Annan observed, "The Assessment shows how human activities are causing environmental damage on a massive scale throughout the world, and how biodiversity—the very basis for life on earth—is declining at an alarming rate."

Asked what we should do now and what we should plan to do over the next 50 years, the Assessment's Director, Dr. Reid replied that there must be a fundamental reappraisal of how we view the world's natural resources. "The heart of the problem is this: protection of nature's services is unlikely to be a priority so long as they are perceived to be free and limitless by those using them."

"We simply must establish policies that require natural costs to be taken into account for all economic decisions," he added.

The Board of Directors of the Millennium Assessment stated:

> The overriding conclusion of this assessment is that it lies within the power of human societies to ease the strains we are putting on the natural services of the planet, while continuing to use them to bring better living standards to all…Achieving this, however, will require radical changes in the way nature is treated at every level of decision-making and new ways of co-operation between government, business and civil society. The warning signs are there for all of us to see. The future now lies in our hands.

Strategic Resource Trends: Peak Oil and Sweet Water

There are two key resources that communities have taken for granted for at least a century: cheap fossil energy and the availability of sweet, or sufficient drinking, water. There is a growing consensus that the availability and cost of these two

[28] Union of Concerned Scientists, www.worldtrans.org/whole/warning.html, 11 September 2006.
[29] Janet Larson, The Sixth Great Extinction: A status report, Earth Policy Institute, March 2004 www.earth-policy.org/Updates/Update35.htm, 30 October 2006.
[30] Millennium Ecosystem Assessment, www.maweb.org/, 30 October 2006.
[31] "The State of the World? It Is on the Brink of Disaster", The Independent UK, Wednesday 30 March 2005, www.independent.co.uk/c/?ec=500, and www.truthout.org/cgi-bin/artman/exec/view.cgi/34/10059, 30 October 2006.

vital resources are going to significantly change over the next few decades. They are both intimately wrapped up with the issue of climate change.

Peak Oil

Geologist M.K. Hubbert, who worked for Shell Oil, predicted in the 1950s that the U.S. production of fossil energy would peak in the 1970s, and that world production would peak in the decade of 2010. This forecast was denied by the oil industry until recently. However, the U.S. production did peak during the 1970s, despite massive investment in exploration and new extraction techniques. Many signs indicate that Hubbert's forecast will be true for the world as a whole.[32]

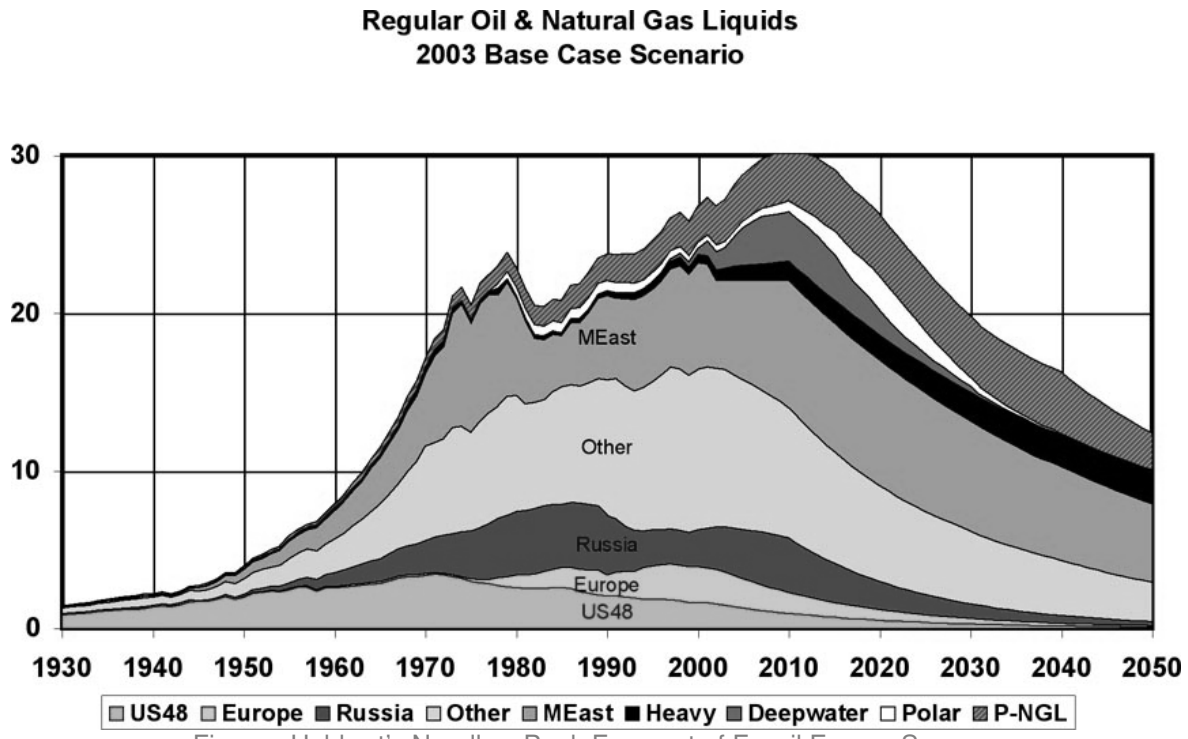

Figure: Hubbert's Needle—Peak Forecast of Fossil Energy Sources

If Hubbert is right, and world oil production will peak in 2010, this is bad news for economies that depend on fossil fuels. Authors like James Kuntsler, in his book, *The Long Emergency*, predict that peak oil literally will result in the end of civilization, as we know it.[33] The Department of Energy funded a study in 2005 that predicted peak global production in 2020, but it also stated that it would take us at least ten years to adjust so that we avoid unprecedented economic disruption.[34] Recent price run-up in oil may be the beginning of this phenomenon. Whatever their cause, high and rising energy prices are already devastating many communities. They are also wreaking havoc on developing countries.

Part of the reason that the world oil prices are now at record heights is that China has entered the world oil market. If the Chinese use oil at the same rate as Americans, and continue to grow their economy at their current rate, by 2031 China will need 99 million barrels of oil a day. The world currently extracts 89 million barrels per day and may not be able to lift more. Withdrawing oil too rapidly can cause fields to collapse, actually reducing the

[32] Hubbert Peak of Oil Production website: www.hubbertpeak.com/hubbert, 13 September 2006.
[33] James Kuntsler, *The Long Emergency*, Grove Press, 2006.
[34] Department of Energy, Peaking of World Oil Production: Impacts, Mitigation & Risk Management, Feb. 2005. www.netl.doe.gov/publications/others/pdf/Oil_Peaking_NETL.pdf, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter8/DOE_peakoil.pdf, 26 September 2006.

amount that can ultimately be extracted.

It is not only liquid petroleum resources being tapped out. Though less often discussed, the U.S. also faces declining output of natural gas fields in the foreseeable future. Natural gas is often considered the transition fuel that will enable society to move away from dependence on more carbon intensive coal and oil. It is already in widespread use. Heating homes, producing electricity, agricultural fertilizers and pesticides, and numerous other products use natural gas. Demand for natural gas has increased nearly 200% in the past five years and has almost tripled in cost.[35] Neither demand nor price for natural gas is expected to decrease any time in the near future. Moreover, it is very expensive to import from overseas in liquid form and we lack the port facilities to receive foreign shipments. Rising natural gas costs almost always translate into higher electricity costs, as most peak power generation across the U.S. comes from gas-fired combustion turbines or combined-cycle plants.As supplies tighten, geo-political concerns also rise. Russia, the world's largest gas supplier, has repeatedly threatened to turn off the supply unless various European countries take a more congenial position to its demands. In May 2006, The financial Times reported, "Dick Cheney, the U.S. Vice-President, delivered a stinging criticism of Russian president Vladimir Putin's rule, warning the Kremlin against using gas and oil supplies as "tools of intimidation and blackmail" and accusing the Russian authorities of "unfairly" restricting the rights of their citizens."[36]

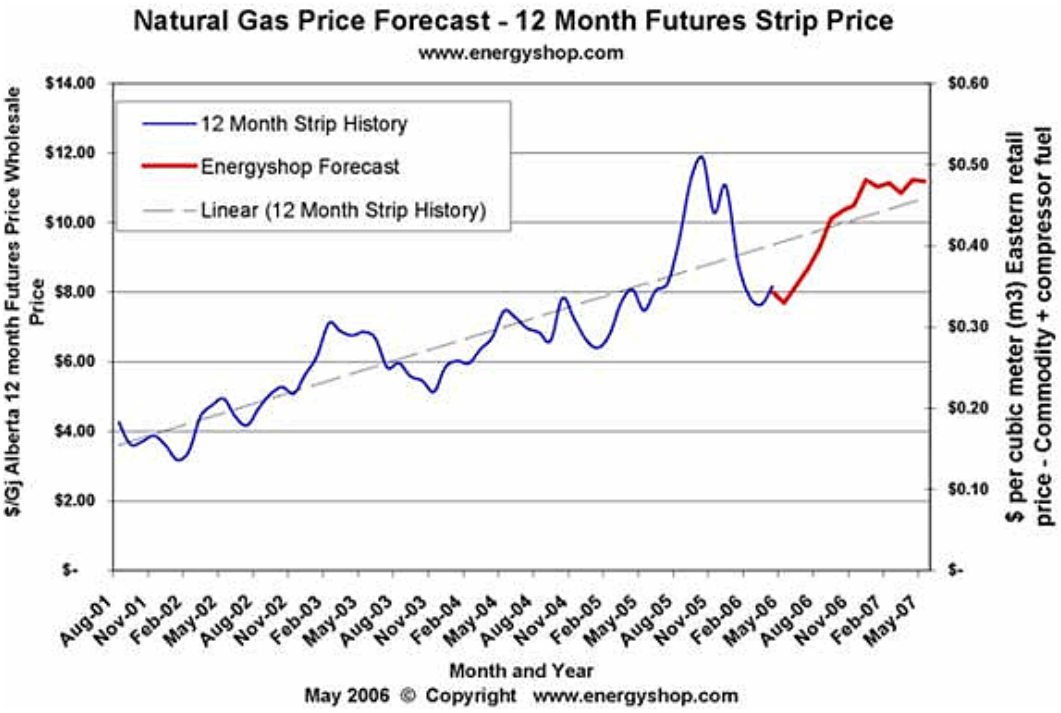

Table: Price Forecast for Natural Gas

Combined with the challenge of climate change, peak oil and gas is very worrisome for many communities. As far back as the 1950s, the Paley Commission of the U.S. government recommended an urgent transition to renewable energy. An increasing number of communities are deciding that the time has come to heed this advice.[37] As described more, there is a great deal that individuals and communities can do to extract themselves from the

[35] Energy Shop, website: www.energyshop.com/es/homes/gas/gaspriceforecast.cfm, August 23, 2006.
[36] Stefan Wagstyl, "Cheney rebukes Putin on energy 'blackmail'," Financial Times, www.ft.com/cms/s/25eb1452-db62-11da-98a8-0000779e2340.html, 4 May 2006.
[37] Post Carbon Institute, website: www.postcarbon.org/, 11 September 2006.

globalized energy market.

Indeed, several cities have adopted "Peak Oil Resolutions," including Franklin, New York, San Francisco, California, Portland, Oregon and Bloomington, Indiana.[38] These resolutions call for a concentrated look at how the cities can prepare for the inevitability of sustained, higher oil prices.

For example, the resolution passed by Bloomington, Indiana states:

The Bloomington City Council acknowledges the unprecedented challenge of peak global petroleum production.

The Bloomington City Council recognizes that the city of Bloomington must prepare for the inevitability of oil peak, and encourages the community to become better informed on energy-related matters.

The Bloomington City Council supports the adoption of a global depletion protocol that will reduce petroleum use, conserving what remains, decreasing the likelihood of a rapid production decline, and lending predictability to supply and limiting market volatility.

The Bloomington City Council directs the City Clerk to distribute this Resolution to the attention of the Indiana Congressional delegation, the Governor of the State of Indiana, and all members of the Indiana Statehouse, and urges them to take action on the impending peak in petroleum production and prepare for its consequences.[39]

Other cities will likely follow this lead. Preparing for higher energy prices and the multiple environmental, economic and health impacts of climate.

Interestingly, the solutions communities can implement to come to grips with peak oil look remarkably like what a city would do to deal with climate change: energy efficiency and renewable energy. It is also interesting that these are the energy options now winning in the market. As described in more detail below, around the world, energy efficiency is the fastest growing way of meeting people's needs for energy services, followed by using the sun to produce heat, followed by wind power, followed by solar electricity. In good sites, bringing wind on line costs less than running an existing coal or gas plant. A number of studies have shown that it will be possible for communities and countries to make the shift to renewable energy.[40]

An increasing number of homes are being equipped with solar electricity and heat.[41] The country of Spain recently mandated that all new homes will be equipped with solar and that renovations must include solar, as well.[42] It is not uncommon now to have homes that produce their own energy or interconnect to the grid at will. Individuals and communities are setting up small-scale biodiesel production facilities, using waste vegetable oil, or the output from special crops.[43] The University of Colorado runs its bus fleet on biodiesel, and the program spun-off a for profit company to make the fuel. Biodiesel is also being co-produced with ethanol. In Brazil, 77% of new cars can run on locally produced ethanol, which supplies over half of the country's need for vehicle fuel.[44] Even poor communities like Curitiba, Brazil, have created public transportation systems that enable people to get everywhere they need to go and are affordable. Communities like Austin, Texas are encouraging "plug-in hybrid" vehicle programs.

The long term initiatives section in Chapter 5 of this manual details programs that you can implement to increase the amount of renewable energy in your community.

Drinking Water

Far more challenging than shifting to renewable energy will be providing sufficient drinking, or "sweet," water to all of the world's population. Drinkable

[38] Post Carbon Institute, www.postcarbon.org/involved/resolution, 20 July 2006.
[39] City of Bloomington, Indiana, website: bloomington.in.gov/egov/docs/1153747651_559687.pdf, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter8/Bloomington.pdf, 20 July 2006.
[40] List studies, For a discussion of this see Lovins, Lovins, Brittle Power, Chapter 17, www.natcapsolutions.org/publications_files/brittlepower.htm, 30 October 2006.
[41] Earth Policy Institute, Eco-Economy Indicators, www.earth-policy.org/Indicators/2004/indicator12.htm, 30 October 2006.
[42] Reuters News Service, "Spain Makes Solar Panels a Must on New Buildings," http://www.planetark.com/dailynewsstory.cfm/newsid/38965/story.htm, SPAIN, 14 November 2006.
[43] Collaborative Biodiesel Tutorial, www.biodieselcommunity.org/, 30 October 2006.

water, vital to businesses as well as individuals, has been taken for granted in modern society for many decades. Water scarcity, however, is already serious in many areas of the change seems unavoidable world and there is a growing consensus that it will become a critical issue for only more cities and countries.
In 1999, the World Bank reported that 2 billion people, or 40% of the world's population, lacked access to clean drinking water or sanitation. Worldwide demand for water is doubling every 21 years, more in some regions. Water supply cannot remotely keep pace with demand, as populations soar and cities explode.[45] The report stated:

> Population growth alone does not account for increased water demand. Since 1900, there has been a six-fold increase in water use for only a two-fold increase in population size. This reflects greater water usage associated with rising standards of living. It also reflects potentially unsustainable levels of irrigated agriculture. World population has recently reached six billion and United Nation's projections indicate nine billion by 2050. What water supplies will be available for this expanding population?[46]

In 2003, the United Nations Environment Programme released a report from 200 water experts around the world stating that within 50 years half of humankind will be living with water shortages, depleted fisheries and polluted coastlines. The severe water shortages that now affect people in 80 countries will affect 4 billion people by the middle of the century.[47]

Obviously, these trends interact with each other: global warming is likely to worsen droughts around the world. Proposed solutions like inter-basin water transfers and desalination require large amounts of energy. Overuse of water is worsening the loss of intact ecosystems. Thus, it is likely that any solution to these interrelated challenges posed in isolation will fail.

Communities must start to consider all of these trends together, and put in place whole-systems solutions that solve many problems at once.[48]

Oil and water, of course, are only two resources. Similar challenges exist for all basic commodity resources. Inefficient resource use, the hallmark of Western economies since the First Industrial Revolution, will be a luxury unavailable to developing economies, as they seek to lift themselves out of poverty. They will not achieve their goals if they replicate industrialized countries' inefficient use of resources. Doing this would require finding three more Earth's worth of resources to meet the demands of the world's consumers.[49] By 2030, if China's use of coal equaled current U.S. levels (nearly 2 tons per person), China would use 2.8 billion tons annually—more than the 2.5 billion tons the *entire* world now uses.[50] Cement is already in short supply because of China's demand, as is steel. Such resource constraints are likely to worsen, as growing and increasingly wealthy populations demand more stuff.

The trends mentioned thus far are challenging and scary. As described below, there are also trends that are hopeful, and together with the rapidly emerging solutions to the more worrisome trends, offer an array of business opportunities.

Lifestyles of Health and Sustainability (LOHAS): The Sustainability Imperative

There exists a large and growing market in the U.S. and Europe for goods and services produced in ways that do not harm the environment or people.[51] Approximately 30% of the

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[44] BBC News, "Brazil's Alcohol Cars Hit 2 Million Mark", Friday 18 August 2006.
[45] Arizona Water Resource, cals.arizona.edu/AZWATER/awr/dec99/Feature2.htm, 11 September 2006.
[46] Ibid.
[47] USA Today, www.usatoday.com/news/nation/2003-01-26-water-usat_x.htm, 11 September 2006.
[48] Hawken, Lovins, Lovins 1999, *Natural Capitalism*, Little Brown, P. 107-124.
[49] Global Footprint Network, www.footprintnetwork.org/, 30 October 2006.
[50] "Learning From China, Why the Western Economic Model Will not Work for the World", www.earth-policy.org/Updates/2005/Update46.htm, Lester R. Brown, March 9, 2005.
[51] 2006 saw cover stories on the Green Trend in such mainstream magazines as Newsweek, Time, Vanity Fair, Elle, Fortune, Wired, Business Week and others. "Carbon neutral" was the New Oxford American Dictionary "word of the year," blog.oup.com/oupblog/2006/11/what_do_al_gore.html.

adults in the U.S., or 63 million people place significant value on buying goods that do not worsen the trends mentioned above or that help to solve them. These individuals are part of a tectonic shift in consumer awareness and behavior.[52]

Research by sociologist Paul Ray found that this population comprises a growing market segment of educated consumers who make conscientious purchasing and investing decisions based on social and cultural values.[53]

Identified in a research report by Conscious Medium, this industry has been named "Lifestyles of Health and Sustainability," or "LOHAS." LOHAS consumers are driving a number of market changes by demanding goods and services that meet their desires to enhance health, environment, social justice, personal development and sustainable living. The products, is at least $81 billion growing sustainability movement, combined with the instant access to information that the Internet provides, has resulted in a more educated and discerning consumer than may have been apparent in past surveys of the general market. LOHAS is a worldwide market conservatively estimated at $228.9 billion, and growing. In the U.S., the market supporting what are called ecological lifestyles, including purchases of organic a year.[54]

The emergence of this market segment as a driver is unparalleled in U.S. history. These consumers will determine the future of many businesses. Some analysts are now calling the sustainability movement the largest phenomenon in human history. Hundreds of thousands of organizations throughout the world are working to achieve social justice, alleviate poverty, enhance standards of living for all and achieve environmental protection—in short, a more sustainable world.[55]

[52] LOHAS website, www.lohas.com/about.htm, 11 September 2006.
[53] Ray, Paul, and Anderson, Sherry, *The Cultural Creatives*, Three Rivers Press (October 2, 2001) ISBN: 0609808451
[54] LOHAS website, www.lohas.com/about.htm, 30 October 2006.
[55] Paul Hawken, Natural Capital Institute, www.naturalcapital.org/Projects.html, 30 October 2006.

The Business Case for Protecting the Climate

Consumers' desire for a healthier, more sustainable world has driven even mainstream institutions to make major changes. Perhaps most exciting, the business community is joining the effort to reduce global warming and to implement more sustainable practices.

In May 2005, Jeffrey Immelt, the man who replaced Jack Welch at the helm of General Electric (GE), stood with Jonathan Lash, the President of World Resources Institute (WRI), a leading environmental organization, to announce the creation of GE Ecomagination. The two co-authored an article in *The Washington Post* titled, "The Courage to Develop Clean Energy."[56]

Immelt committed GE, the sixth largest company in the world, and the only company that would have been on the Fortune 500 list if it had existed in 1900 and is still on it today, to implement aggressive plans to reduce emission of GHGs, spending $1.5 billion a year on research in cleaner technologies. As part of the initiative, Immelt promised to double GE's investment in environmental technologies to $1.5 billion by 2010, and reduce the company's GHG emissions by 1% by 2012. Without any action, GE's emissions would have gone up 40%.[57]

GE's announcement was rapidly followed by an even more significant environmental commitment from Wal-Mart, now considered the largest company in the world. In 2006, Lee Scott, the CEO of Wal-Mart, announced that his company would undertake a major effort to reduce its emissions of GHGs. He set a goal of supplying his stores with 100% renewable energy. Wal-Mart is experimenting with green roofs and green energy (which is now used to power four Canadian stores, for a total of 39,000 megawatts—the single biggest purchase of renewable energy in Canadian history). The company pledged to become the largest organic retailer and to increase the efficiency of its vehicle fleet by 25% over the next three years. It will eliminate 30% of the energy used in store and invest $500 million in sustainability projects.[58]

An unabashedly astonished article in the *San Francisco Bay Guardian* reflected:

> Wal-Mart's rationale for all of this, of course, has absolutely zero to do with any sort of deep concern for the planet (though it does make for good PR), nothing at all about actual humanitarian beliefs or honest emotion or spiritual reverence, and has absolutely everything to do with the corporation's rabid manifesto: cost-cutting and profit.
>
> The reason Scott promised that Wal-Mart will double the fuel efficiency of their huge truck fleet within a decade? Not to save the air, but to save $300 million in fuel costs per year. The reason they aim to increase store efficiency and reduce greenhouse gasses by 20% across all stores worldwide? To save money in heating and electrical bills, and also to help lessen the impact of global warming, which is indirectly causing more violent weather, which in turn endangers production and delivery and Wal-Mart's ability to, well, sell more crap. Ah, capitalism.[59]

In reviewing the leading business stories of the year 2006, columnist Joel Makower, a veteran commentator on green issues wrote:

> Two thousand six may be the year that green business crossed the line from a movement to a market. It was long in coming, of course, with several watershed moments…In 2006, GE initiatives to harness "green" as an engine for topline growth hit their stride… ahead of its plan to reach

[56] Jeffrey Immelt and Jonathan Lash, Washington Post, May 21, 2005; Page A19.
[57] Marc Gunther, "The Green Machine," Fortune Magazine, July 27 2006 money.cnn.com/magazines/fortune/fortune_archive/2006/08/07/8382593/index.htm, 30 October 2006.
[58] Ibid.
[59] Mark Morford SF Gate, "Can You Still Hate Wal-Mart? It's a shockingly eco-friendly plan from the world's most toxic retailer. Did hell just freeze over?" SF Gate, May 24, 2006 www.sfgate.com/cgi-bin/article.cgi?file=/gate/archive/2006/05/24/notes052406.DTL, 30 October 2006.

$20 billion in annual sales of Ecomagination products by 2010.

Dupont launched its own initiative, committing to $6 billion in new revenue from "business offerings addressing safety, environment, energy, and climate challenges." Dow came on board with the aforementioned water initiative. Carpet maker Interface introduced a consulting service to help organizations as diverse as Sara Lee and NASA get their sustainability programs off the ground. Caterpillar launched an ambitious business unit to develop a remanufacturing industry in China. And a wide range of innovators developed new, clean technologies for everything from bottles to buildings to boats—part of the year's overall boom in clean-tech activity….

Shareholders—specifically, large institutional investors like pension funds and university endowments -- are emerging as the real power brokers in the climate arena...

The leading investment firms are jumping in, too. Merrill Lynch, for one, issued a report profiling seven companies it believes are best positioned to capitalize on what it calls the "clean car revolution." Citigroup, JP Morgan Chase, and Morgan Stanley also published research reports analyzing the financial performance of the carbon markets, sometimes identifying who's naughty and nice—that is, the leaders and laggards in their various sectors.[60]

The business community is actually often ahead of the government in being willing to take an aggressive stance on protecting the climate. For years, many American businesses succumbed to the concerted media campaign claiming that taking action against global warming will harm businesses and the economy.[61] Now, business leaders are recognizing that, in fact, quite the opposite is true: The conventional wisdom that businesses will oppose efforts to implement programs to protect the environment is increasingly antiquated thinking.

Many business leaders see a need to abate climate change for moral reasons. Lee Scott, CEO of Wal-Mart, stated in the pages of Fortune Magazine:

> There can't be anything good about putting all these chemicals in the air. There can't be anything good about the smog you see in cities. There can't be anything good about putting chemicals in these rivers in Third World countries so that somebody can buy an item for less money in a developed inherently wrong, whether country. Those things are just you are an environmentalist or not.[62]

There is an opportunity now to begin a new conversation between citizens, the companies that deliver the services we all desire, and the government we have empowered to set policy to achieve the sort of future we all desire.

No Regrets Strategy

Companies often start a program of GHG reductions because they realize that acting now is a "no regrets" strategy. If climate change turns out to be real, they will already be in a leadership position by dealing responsibly with it. Even if the scientists are wrong and there is no threat to the climate, these are actions that a well-managed business would want to take anyway, because doing so is profitable. Enormous opportunities exist to reduce costs by reducing the energy they use to run their operations. It just happens that this is exactly the same strategy they would employ to reduce their GHG emissions.

There is a very solid business case for such a position. Adopting an aggressive program of GHG reductions can be highly profitable for companies and

[60] Greenbiz.com, Joel Makower, Top Green Business Stories of 2006, January 3 2007, www.greenbiz.com/news/reviews_third.cfm?NewsID=34384.
[61] USA Today, "Group: ExxonMobil paid to mislead public," http://www.usatoday.com/money/industries/energy/2007-01-03-global-warming_x.htm, Updated 4 January 2007.
[62] Marc Gunther, "The Green Machine," Fortune Magazine, July 27 2006 money.cnn.com/magazines/fortune/fortune_archive/2006/08/07/8382593/index.htm, 30 October 2006.

cost-effective for non-profit (including government) organizations.[63] Reducing the amount of energy that a business uses reduces costs and directly enhances a company's bottom line. Failing to reduce energy use, and tolerating carbon emissions as part of "business as usual" is actually a high-risk strategy for a business or for a community.

Companies that reduce GHG emissions, especially in the context of a broader whole-system corporate sustainability strategy, will achieve multiple benefits for shareholders beyond reducing their contribution to global climate change. Governments that take a similar course will accrue similar benefits to their citizen stakeholders.[64]

These benefits include:

Enhanced financial performance from energy and materials cost savings in:

- **industrial processes;**
- **facilities design and management;**
- **fleet management;** and
- **government operations.**

Enhanced core business value:

- **sector performance leadership;**
- **greater access to capital;**
- **first mover advantage;**
- **improved corporate governance;**
- **the ability to drive innovation and retain competitive advantage;**
- **enhanced reputation and brand development;**
- **market share capture and product differentiation;**
- **ability to attract and retain the best talent;**
- **increased employee productivity and health;**
- **improved communication, creativity, and morale in the workplace;**
- **improved value chain management;** and
- **better stakeholder relations.**

Reduced Risk:

- **insurance access and cost containment;**
- **legal compliance;**
- **ability to manage exposure to increased carbon regulations;**
- **reduced shareholder activism; and**
- **reduced risks of exposure to higher carbon prices.**

Leading CEOs around the world know this. CEOs surveyed by the World Economic Forum in Davos in 2000, stated that for them, "The greatest challenge facing the world at the beginning of the 21st Century—and the issue where business could most effectively adopt a leadership role—is climate change."[65] The Climate Group website[66] lists case studies of companies and communities that are reducing their emissions and saving money.

Businesses Face Growing Pressure to Reduce Emissions

In November 2004, essentially all of the world's industrial nations ratified the Kyoto Protocol to reduce the emissions of GHG gasses (the U.S. and Australia are the only significant holdouts). The Protocol came into force February 16, 2005, launching a new "carbon-constrained" era for the 141 countries that ratified it.[67] Among its many provisions, the accord established regulations limiting the amount of carbon that nations can emit, and created a carbon market through which companies that reduce further than they are required can sell this extra reduction to companies unable to meet their targets.

European countries, as members of the Kyoto Protocol, are now bound by this mandatory trading regime. The European Commission plans to cut energy use 20% by 2020 and increase European use of renewable energy to 12% by 2012.

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[63] Amory Lovins and L. Hunter Lovins, *Climate: Making Sense and Making Money*, Rocky Mountain Institute, 1997.
[64] For a detailed synthesis of this thesis refer to K. Hargroves, and M. Smith, *The Natural Advantage of Nations: Business Opportunities, Innovation and Governance in the 21st Century*, Earthscan, (2005). Developed by The Natural Edge Project www.naturaledgeproject.net, 30 October 2006.
[65] Douglas G. Cogan, "Corporate Governance and Climate Change: Making the Connection", a CERES Sustainable Governance Project Report Prepared by the Investor Responsibility Research Center, June 2003.
[66] The Climate Group, www.theclimategroup.org/, 11 September 2006.
[67] As of February 2005, 141 countries have ratified the Kyoto Protocol. Seven including the United States, Australia and Indonesia signed it but have so far refused to ratify.

This should reduce Europe's emissions by a third. The program is projected to save 60 billion Euros, create millions of new jobs and increase European competitiveness. American businesses are at risk of losing ground to European competitors as they innovate to meet these goals.

For example, STMicroelectronics (ST), a Swiss-based, $8.7 billion, multi-national semiconductor company, set a goal of zero net GHG emissions by 2010 while increasing production 40-fold.[68] The main sources of ST's GHG emissions are 45% facility energy use, 35% industrial process (PFC[69] and SF6[70]) emissions and 15% more efficient transportation. Its strategy is to reduce on-site emissions by investing in co-generation (efficient combined heat and electricity production[71]) and fuel cells (efficient electricity production).

By 2010 co-generation sources should supply 55% of ST's electricity with another 15% coming from fuel switching to renewable energy sources. The rest of the reductions ST is seeking will be achieved through improved energy efficiency (hence reducing the need for energy supply) and various projects to sequester carbon.

ST's commitment has driven corporate innovation and improved profitability. During the 1990s, its energy efficiency projects averaged a two-year payback (a nearly 71% after-tax rate of return).[72]

Making and delivering on this promise has also driven ST's corporate innovation and increased its market share, taking the company from the number 12 micro-chip maker to the number six in 2004.[73] By the time ST meets its commitment, it predicts that it will have saved almost a billion dollars.

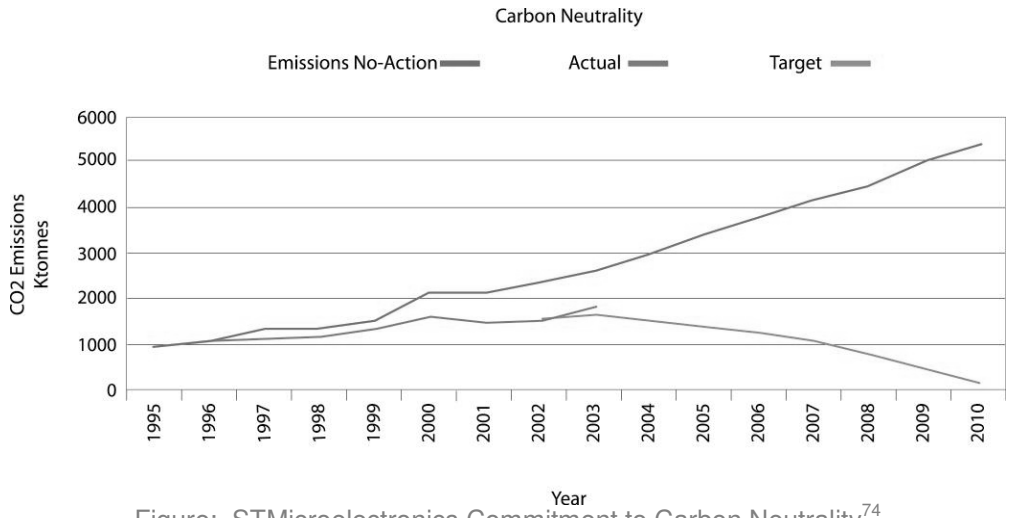

Figure: STMicroelectronics Commitment to Carbon Neutrality[74]

[68] STMicroelectronics (2003) Sustainable Development report, www.bl.uk/pdf/eis/stmicroelectronics2003is.pdf, 11 September 2006, 30 October 2006.
[69] PFC (perfluorocarbon) is a powerful greenhouse gas emitted during the production of aluminum; a fluorocarbon is a halocarbon in which some hydrogen atoms have been replaced by fluorine; used in refrigerators and aerosols.
[70] Sulfur Hexafluoride (SF6) is another potent greenhouse gas. It one of the most popular insulating gases.
[71] Conventional power stations that burn fossil fuels give off a lot of heat, wasting as much as 70% of the energy they consume.
[72] STMicroelectronics Environmental Report, 2001. It further reported that no energy efficiency project undertaken incurred more than a three year payback. The source of the correlation of years payback to real after-tax rate of return is Hawken, Lovins, and Lovins, Natural Capitalism, p.267.
[73] IC Insights, IC Insights Announces 1Q 05 Top Ten Semiconductor Supplier Ranking," from www.icinsights.com, 30 October 2006
[74] STMicroelectronics Sustainable Development Report 2003.

The Emerging Greenhouse Gas Marketplace

In January 2005, an independent commission of businesspeople, politicians and scientists[75] released a report to the G8 meeting, urging member countries to cut carbon emissions, double their research spending on green technology and work with India and China to build on the Kyoto Protocol's mechanisms for carbon-saving projects. The report recommended that the major countries agree to generate a quarter of their electricity from renewable sources by 2025 and to shift agricultural subsidies from food crops to biofuels.

The report recommended wider international use of emission trading schemes, which are already in use in the European Union, under which unused CO_2 quotas are sold.

The profit motive, stated the report, is expected to drive investment in new technology to cut emissions further.

The advent of the Chicago Climate Exchange (CCX) carbon trading mechanism provides companies and other organizations emitting GHGs both the opportunity to systematically reduce their emissions, sell greater reductions in emissions and participate in a proven risk-management system of futures contracts and financial derivatives.[76]

CCX is North America's only, and the world's first, GHG emission registry, reduction and trading system for all six GHGs of which CO_2 dominates. It recently announced a partnership to create the Canadian Climate Exchange, and is in negotiations with such countries as China and India. It also offers offset projects in the United States, Canada, Mexico and Brazil. It is a self-regulatory, rules-based exchange designed and governed by its members.

Members make a voluntary but legally binding commitment to reduce GHG emissions. By the end of Phase I (December, 2006) all members will have reduced direct emissions 4% below a baseline period of 1998-2001. Phase II, which extends the CCX reduction program through 2010, will require all new members to reduce GHG emissions 6% below baseline and extends current members commitment to an additional 2% reduction below baseline. In the first year, members of the exchange collectively reduced their carbon emissions by 9%, or 2% more than would have been required had the U.S. been a member of the Kyoto Protocol. Companies undertaking such programs are finding that it can save significant amounts of money. Opening with 16 members in December of 2004, CCX now has over 200 members (including such businesses as DuPont, and American Electric Power, IBM, Ford Motor Co. IBM, Motorola, Dow Corning, Waste Management and Baxter Health Care) representing over 8% of all direct U.S. GHG emissions. The State of New Mexico, cities such as Chicago and Boulder, universities such as Presidio School of Management, Tufts and University of Oklahoma, and a wide array of smaller businesses and non-profit groups are also members.[77]

CCX has proven that businesses can engage in reduction of emissions and remain profitable. But it is only the first of a growing number of efforts to create carbon markets in the United States. The seven Northeastern states have approved the Regional Greenhouse Gas Initiative, a mandatory regulatory scheme. Over 20 states have already either passed or proposed legislation on CO_2 emissions, or have developed carbon registries.

In August 2006, California became the first state in the nation to impose mandatory limits on GHG emissions, requiring a 25% cut in GHGs by 2020 that would affect companies from automakers to manufacturers. The state is the 12th largest carbon emitter in the world despite leading the nation in energy efficiency standards and its lead role in protecting its environment.[78]

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[75] "Global Warming Approaching Critical Point 'An Ecological Time-bomb is Ticking Away'," CNN Report, Monday, 24 January 2005.
[76] Chicago Climate Exchange, www.chicagoclimatex.com/, 11 September 2006.
[77] Natural Capitalism was one of the earliest members.
[78] San Francisco Chronicle "Landmark Deal on greenhouse gas emissions", 30 August, 2006, sfgate.com/cgi-bin/article.cgi?f=/c/a/2006/08/30/MNGBMKS7733.DTL, 12 September 2006.

The California Chamber of Commerce opposed the bill, but such business groups as A New Voice for Business[79] supported the measure, stating that it would create jobs and help to launch a whole new industry in California. Many believe the legislation will be the turning point in the country's global warming policy.

There is now such a proliferation of inconsistent carbon reduction regimes that in April 2006, a group of major businesses called on Congress to pass national legislation capping carbon emissions to relieve them of having to navigate the competing schemes.

At the hearing before the Senate Energy and Natural Resources Committee leaders representing eight big energy companies, including GE, Shell and the two largest owners of utilities in the United States, Exelon and Duke Energy, spoke. Six of the eight said they would welcome or accept mandatory caps on their GHG emissions. Wal-Mart executives also spoke in favor of carbon caps. The companies stated that federal regulations would bring stability and sureness to the market. David Slump, the top marketing executive in GE's energy division, stated, "GE supports congressional action now." Two representatives from the energy sector, Southern Company and American Electric Power, called for a voluntary rather than mandatory program, but they acknowledged that regulations may be coming, and offered detailed advice on how they should be designed. [80]

At subsequent Senate hearings on global warming, Senator Bingaman asked representatives of CCX whether there were any reasons that the U.S. should not simply implement CCX as the basis for a regulated U.S. carbon market. Cities, counties and companies that join CCX might, thus, just be ahead of the regulatory game.

The Business Case for Not Waiting for Regulation

While it is highly likely that some form of national cap and trade system will emerge in the U.S. soon, companies should not wait until they are forced to limit their emissions. The early adopters gain substantial first mover advantages.

As energy prices have risen, many companies have chosen to go ahead and implement energy savings measures. Over a 12-year period in the 1980s, Dow's Louisiana plant was able to save enough energy implementing worker suggested savings measures to add $110 million each year to the bottom line. Each measure also reduced Dow's carbon footprint.[81]

In 2000, as part of re-branding itself as "Beyond Petroleum," British Petroleum (BP) announced a corporate commitment to reduce its emissions of GHGs. In 1997, in a speech at Stanford University, California, group chief executive Lord Browne stated, "BP accepted that the problem was potentially very serious and that precautionary action was justified." BP then announced a target for 2010: that GHG emissions from its own operations would be 10% lower than emissions in 1990. BP achieved that target at the end of 2001, nine years ahead of schedule, and gained around $750 million in net present value through increased operational efficiency, the application of technological innovation and improved energy management. While returns on traditional investments average 40-50%, investments in increasing energy efficiency often return 70% or more.[82] BP is now one of the world's largest solar companies and sees its 50-year future as one of transition away from fossil fuels to becoming an energy company.

Financial savings are not the only reason that companies engage in such behavior. Rodney Chase, a senior executive at BP, subsequently reflected that even if the program had cost BP money, it would have been worth doing because it made them the kind of company that the best talent wants to work for.[83] It is reducing costs, gaining market

[79] New Voice of Business, www.newvoiceofbusiness.org/, 12 September 2006.
[80] Conceding on Climate Change: For the first time, energy execs are requesting caps on carbon emissions. But will new regulations be too little, too late? By Amanda Griscom Little www.salon.com/opinion/feature/2006/04/10/muckraker/index_np.html, 12 September 2006.
[81] Hawken, Lovins, Lovins 1999, *Natural Capitalism*, Little Brown P. 245. *Natural Capitalism* and *Factor Four*, Lovins, Lovins von Weizsacker, 1997, Earth Scan, document hundreds of such savings opportunities.
[82] BP 2003 Sustainability Report.
[83] Personal communication with Hunter Lovins, 2002 Fortune Magazine Annual Meeting, Aspen, CO.

share and attracting and retaining the best talent.[84]

DuPont, an even earlier entrant into the field, committed itself to reducing its GHGs by 65% from 1990 to 2010. The company also set plans to raise revenues 6% per year from 2000-2010 with no increase in energy use; and by 2010, source 10% of its energy and 25% of its feed-stocks from renewable sources. The company announced these goals in the name of increasing "shareholder and societal value."

To date, DuPont has kept energy use the same and increased production by 30%. Globally, DuPont's emissions of GHGs are down 72%. Global energy use is 7% below 1990 levels, and the company is on track with its renewable energy targets. It estimates that this program has already saved the company $3 billion.[85] In one example, four engineers at DuPont recently figured out how to spend less than $100,000 to save nearly $7 million per year in energy costs.[86]

Under CEO Mike Eskew, United Parcel Service (UPS) has assembled one of the biggest alternative-fuel fleets, around 1,500 vehicles strong. In February 2006, UPS announced that it had placed an order for 50 new-generation hybrid-electric delivery trucks, which will reduce fuel consumption by 44,000 gallons over the course of a year.[87]

Many participants in the voluntary U.S. EPA performance-challenge programs (such as 33/50[88] and Green Lights[89]) reported that energy efficiency enabled them to capture multiple benefits. For example, Sony Electronics' U.S. and Mexican facilities voluntarily installed energy efficient lighting where it was cost-effective and did not interfere with the quality of light. By the end of 1994, the organization had upgraded approximately 6.1 million square feet of floor space with new lighting fixtures, reduced its operating expenses by more than $915,000 per year and lowered energy demand by almost 12 million kilowatt hours annually. In addition, these lighting changes indirectly prevented more than 7,300 tons of air pollution from being emitted by local utility companies.[90]

Sony found its participation in the EPA's Green Lights program often improved visual performance so significantly that it led to significant increases in labor productivity and reductions in error rates. The financial benefits from this far outweigh the value of the energy savings. For example, Boeing implemented a lighting system retrofit in its design and manufacturing areas. The program cut lighting energy costs by 90% with a less than 2-year payback, but because workers could see better they avoided rework—the error rate decreased 30%—which increased on-time delivery, and enhanced customer satisfaction.[91]

Lockheed commissioned a new headquarters building for its Sunnyvale facility. The architects successfully argued that the "literium" that provided day-lighting throughout the structure was not merely a worker amenity, but was essential to the performance of the building. They were right: the lighting system resulted in a 75% reduction in lighting energy usage. This contributed to enabling the building to use half the energy of a comparable standard building. The different design added $2 million to the cost of the building—the reason the "value engineers" sought to eliminate it from the design.

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[84] BP now states this on its website and in its advertisements.
[85] Marc Gunther, "The Green Machine," Fortune Magazine, July 27 2006 money.cnn.com/magazines/fortune/fortune_archive/2006/08/07/8382593/index.htm, 30 October 2006.
[86] DuPont reports: www1.dupont.com/NASApp/dupontglobal/corp/index.jsp?page=/social/SHE/usa/us3b.html, 12 September 2006.
[87] Marc Gunther, "The Green Machine," Fortune Magazine, July 27 2006 money.cnn.com/magazines/fortune/fortune_archive/2006/08/07/8382593/index.htm, 30 October 2006.
[88] Arora, S. and Cason, T., "An Experiment in Voluntary Environmental Regulation: Participation in EPA's 33/50 Program," Journal of Environmental Economics & Management, vol. 28, no 3, 1995, pp. 271–286. Also see Arora, S. and Cason, T., "Why do Firms Volunteer to Exceed Environmental Regulations? Understanding Participation in EPA's 33/50 Program," Land Economics, November 1996, pp 413–432.
[89] DeCanio, S., "The Efficiency Paradox: Bureaucratic and Organizational Barriers to Profitable Energy-Saving Investments," Energy Policy, vol. 26, no 5, 1998, pp. 441–454. Also see S. DeCanio and Watkins, W., "Investment in Energy Efficiency: Do the Characteristics of Firms Matter?" Review of Economics and Statistics, February 1998, pp. 95–107.
[90] Sony Electronics Inc. is not only committed to being the best at bringing advanced technology together with the needs of the end-user, it is also dedicated to protecting and improving the environment in all areas of the company's operations, news.sel.sony.com/en/corporate_information/environmental, 30 October 2006.
[91] Romm and Browning, *Greening the Building and the Bottom Line: Increasing Productivity Through Energy-Efficient Design*, 1994.

However, it is saving Lockheed $500,000+ per year worth of energy, or a four-year payback. The greatest benefit to Lockheed was the effect on their human capital: because workers enjoyed the space, absenteeism dropped by 15% and productivity increased 15%. The gains from this won Lockheed a very competitive contract, the profits from which paid-off the entire costs of the building.[92]

It appears that people simply perform better in well-designed spaces. A study by Pacific Gas and Electric Company (PG&E) showed that in good "green" buildings, day-lighting can enable students to achieve 20 to 26% higher test scores, and retail stores to have up to 40% higher sales than conventional stores.[93]

In 1987, the former NMB Bank in The Netherlands completed a new 538,000 square foot headquarters. The bank's management, desiring to improve the somewhat stodgy image of the company, commissioned the creation of a "green headquarters." The building uses 10% of the energy of a similar building constructed at the same time (90% savings). The annual energy savings of $2.9 million required only $700,000 additional building cost—a three-month payback on energy costs alone. Employees reported being more comfortable and absenteeism declined 15%, dramatically increasing project return on investment. The new headquarters achieved its goal: it dramatically improved the image of the bank—which became the second largest bank in the Netherlands. The bank renamed itself ING and subsequently bought Bearings.[94]

The Impact on Small Businesses

Community programs to reduce energy use are particularly good for small businesses. Back in the 1970s when energy prices were rising, communities began implementing programs to reduce their use of energy. The results were extraordinary, and can be replicated today.

In 1974, the Osage Municipal Utility was faced with the need to build a new power plant to meet growing demand. Its general manager, Wes Birdsall, realized that if he built the plant, it would increase everyone's rates. Instead, he stepped across the meter to his customers' side and helped them use less of his product: electricity. Why on earth would a businessman ever do that?

Birdsall realized that what his customers wanted was not raw kilowatt-hours, but the energy "services" of comfort in their homes: shaft-power in factories, illumination, cold beer and the other services that energy delivers. People buy energy, but what they really want is the service. If they can get the same or improved service more cheaply using energy more efficiently or from a different source, they will jump at it. Birdsall realized that if he raised his prices, not only would he be doing his customers a disservice, but that they might turn to other options. By meeting their desires for energy services at lower cost, he retained them as customers, and began one of the most remarkable economic development stories in rural America.

Birdsall's program was able to save over a million dollars a year in this town of 3,800 people and generate over 100 new jobs. A report on the program found that, "Industries are expanding and choosing to remain in Osage because they can make money through employees who are highly productive and through utility rates that are considerably lower than neighboring cities."[95] Birdsall was able to reduce electric bills to half that of the state average and unemployment to half that of the national average, because with the lower rates new factories came to town. He held electric growth level until 1984. The program was profiled in the *Wall Street Journal*, and was copied by other utilities.

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[92] Ibid.
[93] Heschong Mahone Group, www.h-m-g.com/projects/daylighting/projects-PIER.htm, 8 September 2006 .
[94] Hawken, Lovins and Lovins, *Natural Capitalism* p 52. Also see Rocky Mountain Institute, www.rmi.org/sitepages/pid208.php, 30 October 2006.
[95] Health and Energy Company, a Nebraska energy testing company, healthandenergy.com/osage_energy_efficiency.htm, 12 September 2006.

According to a USDA study of Osage, "The local business people calculated that every $1 spent on ordinary consumer goods in local stores generated $1.90 of economic activity in the town's economy. By comparison, petroleum products generated a multiplier of $1.51; utility services, $1.66; and energy efficiency, $2.23. Moreover, the town was able to attract desirable industries because of the reduced energy operating costs resulting from efficiency measures put in place. Energy efficiency has a long and successful track record in Osage as a key economic development strategy."[96]

Thirty years later, a June 2006 article in Business Week pointed out that small businesses, the economic engine of growth, will be especially hard hit by climate change, and can disproportionately benefit from programs to reduce their emissions, stating:

> It's increasingly likely that a mandatory program to reduce greenhouse gas emissions will come to pass. This prospect of further government regulation is one reason small business owners should pay attention. But it's not the only one. Small firms could well be among the hardest hit victims of climate change.
>
> Extreme weather events, for example, can wipe out an entire region's small businesses in one fell swoop. And they can't readily bounce back from disruptions caused by natural disasters. Look at the impact of Hurricane Katrina on small businesses in the Gulf Coast region, where they constituted the backbone of the economy….
>
> There's been virtually no research on what global warming means for small business, even though 23 million U.S. small businesses constitute one-half of the economy.
>
> There is some good news for small businesses, however. To start with, reducing energy waste in U.S. homes, shops, offices, and other buildings must, of necessity, rely on tens of thousands of small concerns that design, make, sell, install and service energy-efficient appliances, lighting products, heating, air-conditioning and other equipment.
>
> What's more, devising technological fixes to curb GHG emissions must rely on the capacity of small business innovators and entrepreneurs to produce "clean-tech" breakthroughs in photovoltaics, distributed energy, fiber-optic sensors, and the like.
>
> Finally, every single small business in the nation can profit by making its own workplace more energy-efficient. According to the EPA's Energy Star Small Business program, small firms can save (at least) 20% to 30% on their energy bills through off-the-shelf cost-effective efficiency upgrades. The job consists largely of installing the same few simple devices—programmable thermostats, for example—over and over again in millions of small business workplaces.[97]

Small office buildings can achieve similar savings. A project to remodel a 2,800 square foot law office in Louisiana improved employee productivity with energy systems that saved over $6,000 while eliminating 50 tons of CO_2 emissions per year.[98]

Combining Energy Efficiency and Renewables

In 1989, the municipal utility in Sacramento, California shut down its 1,000-megawatt nuclear plant. Rather than invest in any conventional centralized fossil fuel plant, the utility met its citizens' needs through energy efficiency and such renewable supply technologies as wind, solar, biofuels and distributed technologies like co-generation, fuel cells, etc. In 2000, an econometric study showed that the program has increased the regional economic health by over $180 million, compared to just

[96] "The Jobs Connection: Energy Use and Local Economic Development," Tomorrow's Energy Today, US Department of Energy, 1994.
[97] Byron Kennard, "Global Warming on Main Street," Business Week, 27 June 2006.
[98] Case study from greenerbuildings.com: www.greenerbuildings.com/case_studies_detail.cfm?LinkAdvID=38528, 12 September 2006.

running the existing nuclear plant. The utility was able to hold rate levels for a decade, retaining 2,000 jobs in factories that would have been lost under the 80% increase in rates that just operating the power plant would have caused. The program generated 880 new jobs, and enabled the utility to pay off all of its debt.

Toyota's Torrance, California office complex, completed in 2003, combines energy-efficiency strategies such as roof color, photovoltaic solar electricity and "little things," including an advanced building automation system, a utilities metering system, natural-gas-fired absorption chillers for the HVAC system, an Energy Star cool roof system and thermally insulated, double-paned glazing. The 600,000+ square foot campus exceeds California's stringent energy efficiency requirements by 24% at no additional cost than a conventional office building.[99]

A recent article by utility regulator S. David Freeman, once Chair of the Tennessee Valley Authority, and Jim Harding of the Washington State Energy Office announced that a company called Nanosolar is building a $100 million manufacturing facility in California to produce solar cells very cheaply. The resulting solar panels would bring the cost of power to below what is now available in a large part of the world. Backed by a powerful team of private investors, including Google's two founders and the insurance giant Swiss Re, Nanosolar announced plans to produce 215 megawatts of solar energy next year, and soon thereafter be capable of producing 430 megawatts of cells annually.

What makes this particular news stand out? Cost, scale and financial strength. The cost of the facility is about one-tenth that of recently completed silicon cell facilities.

Second, Nanosolar is scaling up rapidly from pilot production to 430 megawatts, using a technology it equates to printing newspapers. That implies both technical success and development of a highly automated production process that captures important economies of scale. No one builds that sort of industrial production facility in the Bay Area—with expensive labor, real estate and electricity costs—without confidence.

Thin solar films can be used in building materials, including roofing materials and glass, and built into mortgages, reducing their cost even further. Inexpensive solar electric cells are, fundamentally, a "disruptive technology," even in Seattle, with below-average electric rates and many cloudy days. Much like cellular phones have changed the way people communicate, cheap solar cells change the way we produce and distribute electric energy. The race is on. The announcements are good news for consumers worried about high energy prices and dependence on the Middle East, utility executives worried about the long-term viability of their next investment in central station power plants, transmission, or distribution, and for all of us who worry about climate change. It is also good news for the developing world, where electricity generally is more expensive, mostly because electrification requires long-distance transmission and serves small or irregular loads. Inexpensive solar cells are an ideal solution–by far the least expensive way to bring electric power to areas not now served by an electric grid, safer from terrorists and saboteurs, and able to be put "on-line" years ahead of traditional central generation plans and their elaborate transmission and distribution systems.

Meanwhile, the prospect of this technology creates a conundrum for the electric utility industry and Wall Street. Can—or should—any utility, or investor, count on the long-term viability of a coal, nuclear or gas investment? The answer is no. In about a year, we'll see how well those technologies work. The question is whether federal energy policy can change fast enough to join

[99] Larry Flynn, "Driven to be Green," Building Design and Construction Magazine, 1 November 2003, www.bdcnetwork.com/article/CA335621.html?text=driven+to+be+green, 30 October 2006.

what appears to be a revolution.[100]

Renewable options are not only the best choice for developing countries; they are now the fastest growing form of energy supply around the world, and in many cases are cheaper than conventional supply. Solar thermal is outpacing all conventional energy supply technology around the world. Modern wind machines come second, delivering almost 8,000 megawatts of new capacity a year, or more than nuclear power did at the peak of its popularity. The next fastest growing energy supply technology is solar electric, even at current prices.[101]

Renewables can also be cheaper than any conventional supply. Energy from wind turbines in good sites now costs 3¢ per kilowatt-hour (kWh).[102] And once the turbine is constructed, the fuel is free forever more. Just running an existing coal plant costs 5¢ to 6¢ per kWh. Solar electric is more expensive, although about a dozen companies are competing to deliver amorphous thin-film solar at 3¢ per kWh. Such renewable technologies lend themselves to construction and delivery by small to medium sized enterprises - the backbone of most economies around the world.

The Governor of Pennsylvania recently announced the opening of a factory to make wind machines. Creating 1,000 new jobs over the next five years, it is the biggest economic development measure for Johnstown, PA, in recent memory. The city of Chicago underwrote Spire solar to enable the company to open a manufacturing plant in Chicago. The city wanted the jobs and to be able to install solar on municipal buildings. California has announced that it will spend over $8 million installing solar in 2006, and create a $1.5 billion investment fund to help environmentally responsible companies that are developing cutting-edge clean energy technologies.

A 2006 study by University of California professors recently found that investments in renewable energy create ten times as many jobs as investments in fossil supply.[103]

Ability to Capture Opportunities

Business success in a time of technological transformation demands innovation. Since the Industrial Revolution, there have been at least six waves of innovation, which shifted the technologies that underpinned economic prosperity. In the late 1700s textiles, iron mongering, water-power and mechanization enabled modern commerce to develop.

The second wave saw the introduction of steam power, trains and steel. In the 1900s, electricity, chemicals and cars began to dominate. By the middle of the century it was petrochemicals, and the space race, along with electronics. The most recent wave of innovation has been the introduction of computers, also known as the digital or information age. As the industrial revolution plays out and economies move beyond iPods, older industries will suffer dislocations, unless they join the increasing number of companies implementing the array of sustainable technologies that will make up the next wave of innovation.

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[100] Dave Freeman and Jim Harding, "Solar Cells Change Electricity Distribution," The Seattle Post Intelligencer, Thursday 10 August 2006 seattlepi.nwsource.com/opinion/280625_solarcell10.html, 30 October 2006.

[101] Solar photovoltaic prices are falling rapidly. A company in California is introducing a new production process that will reduce prices to 3¢/kWh within four years. Wind in good cites now costs 3¢/kWh, and in conventional sites. National Renewable Energy Laboratory. Wind Energy Myths Fact Sheet: www.nrel.gov/docs/fy05osti/37657.pdf#search=%22wind%203%C2%A2%2FkWh%22, 10 June 2005.

[102] Lovins, A., Datta, K., Feiler, T., Rábago, K., Swisher, J., Lehmann, A. and Wicker, K. (2002) *Small Is Profitable: The Hidden Economic Benefits of Making Electrical Resources the Right Size*, available from Natural Capitalism Solutions: www.natcapsolutions.org, 30 October 2006.

[103] Robert Sanders, "Investment in renewable energy better for jobs as well as environment," www.berkeley.edu/news/media/releases/2004/04/13_kamm.shtml, 13 April 2004.

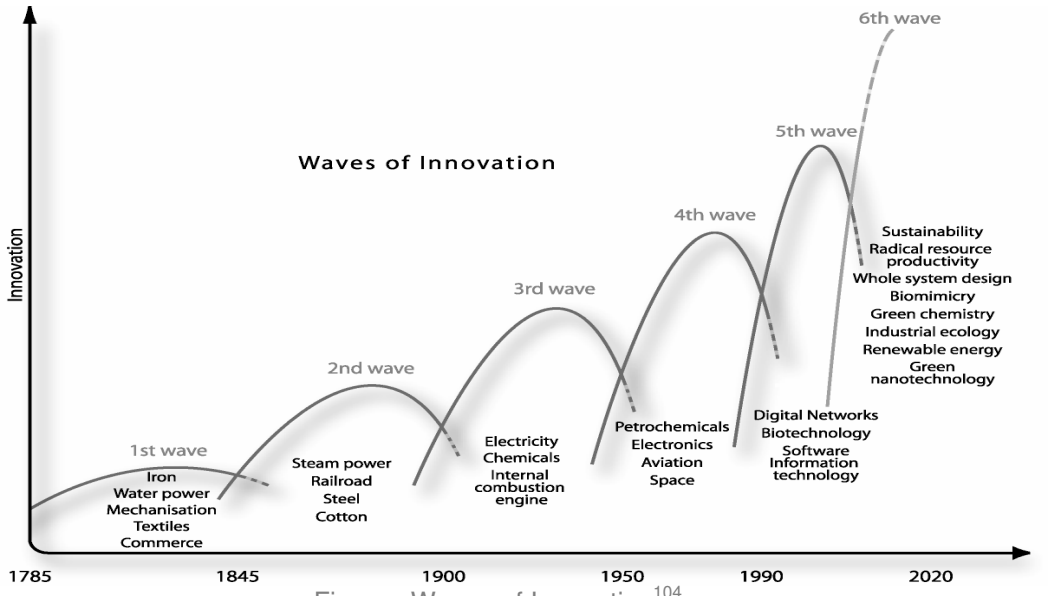

Figure: Waves of Innovation[104]

Aidan Murphy, vice president at Shell International, stated in 2000:

> The Kyoto treaty has prompted us to shift some of its [Shell's] focus away from petroleum toward alternative fuel sources. While the move has helped the company make early strides toward its goal of surpassing treaty requirements and reducing emissions to 10% less than 1990 levels, *Shell is being driven largely by the lure of future profits*… We are now involved in major energy projects involving wind and biomass, but I can assure you this has nothing to do with altruism… *We see this as a whole new field* in which to develop a thriving business for many years to come. Capital is not the problem, it's the lack of ideas and imagination.[105]

Sweden has set a national goal of an oil-free economy by 2020 without building any new nuclear plants. A report in the BBC stated, "The country aims to replace all fossil fuels with renewables before climate change damages economies and growing oil scarcity leads to price rises." The program is driven in part by worry on the part of The Royal Swedish Academy of Sciences that oil supplies are peaking, and that high oil prices could cause global economic recession. In 2003, 26% of all energy consumed came from renewables.[106]

To drive such innovation, Sweden, along with Germany and other European nations are experimenting with what is called "Tax Shifting." This would increase the taxes on resource use, while lowering employment taxes and other disincentives to use more people. Lester Brown recently reported that,

> A four-year plan adopted in Germany in 1999 systematically shifted taxes from labor to energy. By 2001, this plan had lowered fuel use by 5%. It had also accelerated growth in the renewable energy sector, creating some 45,400 jobs by 2003 in the wind industry alone, a number that is projected to rise to 103,000 by 2010.

Both Japan and China are now considering implementing such tax shifts.[107]

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[104] The Natural Edge Project, Australia, www.naturaledgeproject.net/, 30 October 2006.
[105] W. Drozdiak, "Big Corporations Alter View of Global Warming," Washington Post Service, Friday, 24 November 2000.
[106] BBC, Wednesday, 8 February 2006, 17:14 GMT news.bbc.co.uk/1/hi/sci/tech/4694152.stm, 30 October 2006.
[107] Lester Brown, "It's Income Tax Time for Americans, and It's Time For the Entire World to Lower Income Taxes and Raise Environmental Taxes," www.earthpolicy.org/Books/Seg/PB2ch12_ss2.htm, 30 October 2006.

Recently, 2,500 economists, including eight Nobel Prize laureates in economics, endorsed the concept of tax shifts. Harvard economics professor N. Gregory Mankiw wrote in Fortune:

> Cutting income taxes while increasing gasoline taxes would lead to more rapid economic growth, less traffic congestion, safer roads and reduced risk of global warming—all without jeopardizing long-term fiscal solvency. This may be the closest thing to a free lunch that economics has to offer.[108]

Without such a shift in policies, jobless growth for major corporations worldwide is likely to remain not a forecast, but an established trend. The world's 500 largest corporations have managed to increase their production and sales by 700% over the past 20 years, while at the same time *reducing* their total workforce. The outsourcing of industrial jobs to China and service jobs to India has accelerated the impact of this process.[109]

At the same time however, good people are increasingly critical for the functioning of any business that seeks to compete in the Knowledge Economy. Tom Peters, one of the world's leading business authors, states:

> We are in the midst of redefining our basic ideas about what enterprise and organization and even being human are–about how value is created and how careers are pursued.
>
> Welcome to a world where "value" (damn near all value!) is based on intangibles—not lumpy objects, but weightless figments of the Economic Imagination. We have entered an Age of Talent. People (their creativity, their intellectual capital, their entrepreneurial drive) is all there is. Enterprises that master the market for talent will do better than ever. But to attract and retain the Awesome Talent, an organization must offer up an Awesome Place to Work.[110]

As stated above, this is driving such companies as BP to make public commitments to cut their emissions as a strategy for attracting and retaining the best talent.

Richard Florida, in his book, *The Rise of the Creative Class*,[111] points out that the cutting-edge businesses follow the knowledge workers, establishing corporate operations where they can access this new class of talent. He notes that regions that wish to be economically successful will do what it takes to attract the knowledge workers, which includes preserving the environment and establishing the sort of innovative cultural atmosphere that such people treasure.

Cities and Companies—The New Leaders

The failure by the American federal government to take action on global warming has created a leadership vacuum that is rapidly being filled by cities, states and businesses.
In the U.S., over 355 cities have formally committed to take the following three actions:

1. Strive to meet or beat the Kyoto Protocol targets in their own communities, through actions ranging from anti-sprawl land-use policies to urban forest restoration projects to public information campaigns;
2. Urge their state governments, and the federal government to enact policies and programs to meet or beat the GHG emission reduction target suggested for the United States in the Kyoto Protocol—7% reduction from 1990 levels by 2012; and
3. Urge the U.S. Congress to pass the bipartisan GHG reduction legislation, which would establish a national emission trading system[112]

[108] Ibid.
[109] William Greider: One World: Ready or Not (New York: Simon and Schuster, 1997; juxtaposition quoted in Success Digest March 1997).
[110] Tom Peters, Re-image, www.tompeters.com/reimagine/toc.php, 12 September 2006.
[111] Richard Florida, *Rise of the Creative Class*, Basic Books, 2002, www.creativeclass.org/press.htm, 12 September 2006.
[112] U.S. Mayors Climate Protection Agreement website, www.ci.seattle.wa.us/mayor/climate/default.htm#what, 11 January 2007.

The International Council for Local Environmental Initiatives' (ICLEI) "Cities for Climate Protection Program"[113] offers a coherent program a community can follow to implement a global warming mitigation program. This manual is offered as part of that program.

Tax Savings

These cities now understand a simple but important formula: climate protection saves tax dollars. In fact, climate protection can protect a city and its taxpayers from one of the most volatile demands that municipal budgets are likely to face in the years ahead: fossil energy prices.

In longhand, the formula goes like this: Global warming is slowed by reducing GHG emissions. GHG emissions are cut by reducing the consumption of fossil fuels. Fossil fuel use is cut by employing energy efficiency measures. Energy efficiency measures lead to lower energy bills. Lower energy bills mean lower operating costs. Lower costs for city operations save citizens tax dollars. So, taking action to slow global warming is one way to reduce tax expenditures. The savings can be used to cut taxes, to slow their growth, to improve critical city services that have been under-funded in the past, or to invest in more energy efficiency improvements (see box).

Tax Savings

CASE STUDY: States of Michigan and Oregon

In Ann Arbor, Michigan, a Municipal Energy Fund was established in 1998 to be a self-sustaining source of funds for investment in energy-efficient retrofits at city facilities, so the city would be able to continually reduce its operating costs over time. The city operates 60 facilities and spends $4.5 million per year on energy (out of an annual budget of $288 million in 2005). The Fund is administered by the city's Energy Office under the supervision of a three-person board, which must approve all projects. The Fund has invested in street light improvements, parking garage lighting, a boiler, two electric vehicles and photovoltaic cells. By providing the difficult up-front costs and then capturing 80% of the resulting savings, the Fund motivates facility managers to undertake energy efficient projects, and became self-sustaining in 3-5 years requiring no additional annual appropriations.

To launch its energy efficiency program, in the late 1990s, Portland, Oregon created a "One Percent for Energy" program. It assessed eight municipal bureaus 1% of their energy bill to raise $70,000 a year for efficiency improvements without requiring direct support from the city's general fund. In return, contributing bureaus were given technical assistance to help them save money through energy efficiency improvements. The 1% is based on previous years energy bills including transportation, fuels, electricity, etc with a max of $15,000 per bureau. To date, the program successfully brings in approximately $70,000 each year.

CONTACT

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[113] ICLEI, www.iclei.org/index.php?id=1118, 11 September 2006.

Energy costs—and potential savings—are likely to increase in the future. Many experts predict that the volatility in fossil energy supplies and prices will continue. Most scientists now agree natural gas and oil are finite resources and that world oil production is expected to peak in the next couple of decades. China, India and other rapidly developing countries are competing with the U.S. for the same supplies, pushing up prices. Severe storms like Hurricane Katrina, which experts predict will become more common with global warming, can cause petroleum supply disruptions. Conflicts in, or political disputes with, oil-producing countries also will cause disruptions to oil and gas supplies. Even coal, which the U.S. currently mines in abundance, may prove to be a more expensive way to produce electricity in the future, as the industry invests in new processing technologies and sequestration measures to reduce carbon emissions.

During the winter of 2005-2006, the Massachusetts Municipal Association asked city managers around the state whether they expected increased energy costs. Sixty-five percent said they believed that energy costs would increase by more than 10% in the coming year—and one in four expected costs to increase by more than 25%.

Coast-to-Coast Pioneers

In 1991, well before global warming because a prominent issue for the public, Portland launched a "City Energy Challenge" to cut the annual energy bill of city buildings by 10% over 5 years. Over the last 15 years, the city saved $15 million and generated an additional $1.2 million in incentive payments from state government and utilities.

In addition, the city negotiated a purchase of wind energy from Portland General Electric, further reducing its demand for coal-fired electricity, preventing 4,500 metric tons of CO_2 emissions over five years, and deriving part of the city's energy from a resource that is immune from volatile price spikes because wind is a "free" fuel.

The city of New Haven, Connecticut, another leader in picking the low-hanging fruit of energy efficiency, created an energy conservation program in 1994 and estimates it has saved $24.7 million since then by doing simple measures.

Local schools provide a dramatic example of the savings waiting to be captured by public institutions. Schools in the U.S. reportedly spend more than $6 billion each year on energy, more than they spend on computers and books combined. In the typical school, about a third of that energy is wasted. Cost effective energy efficiency measures could easily save 25 to 30% of school energy bills, enough to hire 30,000 new teachers[114] while reducing the schools' contributions to global warming. Yet, some of the most obvious ways to save energy remain undone. An example: In the fall of 2005, two energy consultants in New Haven, CT, found a way to save the local school district $1.1 million in one year—by the elementary act of turning down thermostats when school buildings were not in use.[115]

These stories—and similar examples in cities across the U.S.—illustrate the multiple benefits of a municipal climate protection program. In this time of global warming and energy volatility, energy efficiency, renewable energy technologies and climate protection are three pillars of sound fiscal stewardship.

By investing in energy efficiency and renewable energy systems, local communities are also preparing themselves for the possibility of heightened regulations regarding GHGs coming in the future. Cities and companies that adopt the Kyoto Protocol agreements, and reduce GHG emissions below 1990 levels, will be able to sell their emission credits in any one of several carbon emission exchanges and stand a better chance of avoiding down-graded bond or stock ratings.

[114] "Reducing Greenhouse Gas Emissions: Municipal Solutions – Fact Sheet #5", Waquoit Bay National Estuarine Research Reserve, August 2002.
[115] Rebuild America, rebuild.gov, 30 October 2006.

Coast to Coast Pioneer

CASE STUDY: U.S. Army

Energy efficiency and renewable energy are of particular interest to the U.S. military. It has not been lost on those tasked with the security of the country that wasted energy, and dependence of foreign sources compromises their mission. A growing number of bases and commanders are implementing programs to reduce waste and secure greater energy supplies from local sources.

At Fort Detrick, Maryland, an energy performance contract will save 33,000 tons of CO_2 and $2.9 million annually.[116] Fort Carson's goal is 100% renewable energy by 2027; it is a 25 year plan initiated in 2002. Fort Carson also has interim goals to achieve 40% of electricity and 10% of facility heat from renewable sources by 2013.[117]

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The bottom line is simple: Protecting the climate is good fiscal stewardship. Global warming is an issue with many dimensions. For many people, the most important issue is the pocketbook—and the pocketbook is a strong argument for municipal climate action, sooner rather than later.

Business Risks of Failing To Address Climate Change

In a world that overwhelmingly recognizes climate change as a serious threat, businesses within a community that ignore it are increasingly seen as irresponsible. Conversely, an aggressive business posture to reduce GHG emissions is becoming a proxy for competent corporate governance. A 2003 Columbia Journal of Environmental Law article demonstrated the legal feasibility of lawsuits holding companies accountable. Though the effects of such litigation on companies' market value and shareowner value remains to be seen, the first such suits have already been filed.[118]

Legal Risks

In the U.S., the Sarbanes-Oxley Act[119] makes it a criminal offense for the Board of Directors of a company to fail to disclose to shareholders information that might materially affect the value of the stock. This includes environmental liabilities (including GHG emissions) that could alter a reasonable investor's view of the organization. In France, The Netherlands, Germany[120] and Norway, companies are already legally required to publicly report their GHG emissions.

A group of 143 institutional investors writes annually to the Financial Times 500, the largest quoted companies in the world by market capitalization, asking for disclosure of investment-relevant information concerning

[116] U.S. Department of Energy, www.eere.energy.gov/news/archive.cfm/pubDate=%7Bd%20'2002-10-30'%7D, 12 September 2006.
[117] Fort Carson Sustainability Program and SEMS, sems.carson.army.mil, 12 September 2006.
[118] Friends of the Earth, in conjunction with Greenpeace and several western cities, filed one of the first climate change lawsuits in 2004. The suit charges two U.S. government agencies with failing to comply with National Environmental Policy Act (NEPA) requirements to assess the environmental impact of projects they financed over the past decade. The states of Connecticut, Massachusetts and Maine have also filed a climate change lawsuit against another U.S. government bureau, the Environmental Protection Agency, for failing to regulate carbon dioxide emissions under the Clean Air Act.
[119] Francis X. Lyons, a former US EPA regional administrator now with Gardner, Carton & Douglas LLP, "Sarbanes-Oxley and the Changing Face of Environmental Liability Disclosure Obligations," Trends, Volume 35 No. 2, Nov/Dec 2003. Available from. www.gcd.com/db30/cgi-bin/pubs/Sarbanes2.pdf, 12 September 2006.
[120] In Germany, only "heavy" industry is currently required to report greenhouse gas emissions.

their GHG emissions.[121] Initially, perhaps 10% of the recipients bothered to answer the survey. In 2005, 60% answered. Companies like Ford Motor Company produced a major report detailing its emissions. Why the change? Passage that year of Sarbanes Oxley clearly played a role. Perhaps more significantly, the Carbon Disclosure Project represents institutional investors with assets of over $31.5 trillion. Increasingly, companies that wish to limit their risk exposure, obtain insurance or get financing are implementing programs to reduce their emissions of GHGs. for climate change.

The FTSE Index, the British equivalent of Dow Jones, states:

> The impact of climate change is likely to have an increasing influence on the economic value of companies, both directly, and through new regulatory frameworks. Investors, governments and society in general expect companies to identify and reduce their climate change risks and impacts, and also to identify and develop related business opportunities.[122]

The banking industry is also reducing its greenhouse footprint. In 2006, HSBC won the Financial Times' First Sustainable Banking Awards for being the first bank to become carbon neutral. It has purchased renewable energy for itself, and provided financing for renewable energy companies.[123]

Wall Street's most prestigious investment bank, Goldman Sachs, is putting $1 billion into clean-energy investments. It has also pledged to purchase more products locally.[124]

In March 2006, the business and investment network CERES released a report showing that many major American companies were more potentially liable for lawsuits and other risks than their European counterparts because of their emissions of climate changing gasses. The New York Times stated,

> Dozens of U.S. businesses in various climate-vulnerable sectors ... are still largely dismissing the issue or failing to articulate clear strategies to meet the challenge. Companies that disclose the amount of emissions of heat-trapping gases they produce and take steps to limit them cut their risks, including potential lawsuits from investors.[125]

Risk of Shareholder Resolutions

A growing number of investors are concerned about climate change. The number of investors participating in the Investor Network on Climate Risk (INCR, the leading group on sustainable investing) has quadrupled in the past three years, and the collective assets of INCR members increased from $600 billion to $2.7 trillion (an increase of 450%).[126] While cities are not directly involved, it is important to understand the trends occurring in the financial sector.

Large institutional investors are leading the way. Institutional investors have reason to be concerned about the impact of climate risk on their portfolios, and have been successful in urging companies to increase disclosure of climate risk by engaging the companies with an enduring shareholder campaign. Despite these successes, some investors are still frustrated with the Securities and Exchange Commission, which has done little to mandate disclosure of climate risk, and with many companies that have not yet taken proactive steps to address climate risk.

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[121] "Big Investors Demand Disclosure on Corporate Climate Practices," from GreenBiz.com, at website: www.greenbiz.com/news/news_third.cfm?NewsID=27640, 1 August 2006.
Joel Makower, Top Green Business Stories of 2006, www.greenbiz.com/news/reviews_third.cfm?NewsID=34384, 3 January 2007.

[122] "Market Consultation to the FTSE4 Good Climate Change Criteria", 2006 www.ftse.com/Indices/FTSE4Good_Index_Series/Downloads/FTSE4Good_Climate_Change_Consultation_Aug_06.pdf, 12 September 2006.

[123] Financial Times, 13 June 2006, Sustainable Bank of the Year, . news.ft.com/cms/s/c1f6fade-fafa-11da-b4d0-0000779e2340.html, 12 September 2006.

[124] Marc Gunther, "The Green Machine," Fortune Magazine, 27 July 2006 money.cnn.com/magazines/fortune/fortune_archive/2006/08/07/8382593/index.htm, 12 September 2006.

[125] Planet Ark, U.S. Oil Majors Seen Lagging in CO_2Risk Management www.planetark.com/dailynewsstory.cfm/newsid/35747/story.htm, 22 March 2006.

[126] Investor Network on Climate Risk, website: www.incr.com/, 31 July 2006.

A group of 28 leading institutional investors from the U.S. and Europe, who manage over $3 trillion in assets, announced a ten-point action plan which calls on investors, leading financial institutions, businesses, and government to address climate risk and seize investment opportunities.[127] The plan represents the first time that American and European investors have cooperated on a comprehensive climate risk initiative.

The 2005 action plan calls on U.S. companies, Wall Street firms and the Securities and Exchange Commission to intensify efforts to provide investors with comprehensive analysis and disclosure about the financial risks presented by climate change. The group also pledged to invest $1 billion in prudent business opportunities emerging from the drive to reduce GHG emissions.

Climate change will have an impact on the value of investments, and could cost U.S. public companies billions of dollars, ranging from unexpected drops in earnings due to fines and clean-up costs (following the violation of environmental laws), increased operating costs (following changes in environmental regulations), and greater than expected management costs due to understated or undisclosed liabilities.

Investors are starting to evaluate corporations on the basis of their preparedness for associated risks and opportunities. Indeed, some investors believe that companies that can't adapt to a carbon-constrained world will be forced to compete with forward-thinking competitors ready to leverage new business models and capitalize on emerging markets in renewable energy and clean technologies.

Despite the likely threat of global warming, the largest CO_2 polluters in the U.S. are failing to address the related financial risks. A recently released study by the nonprofit Investor Responsibility Research Center (IRRC) finds that while foreign rivals struggle to meet European Union CO_2 emission reduction targets, American companies such as ChevronTexaco, ExxonMobil, General Electric and Xcel Energy continue to ignore the threat of global warming.[128]

While it is not a current threat, cities may find their own bond ratings down-graded if they fail to take steps to prepare their own buildings and the homes and buildings of their residents and businesses to meet the climate challenge.

Other investors are using the power of shareholder resolutions, which mandate yes or no votes on specific practices at corporate annual meetings to affect company policies on climate change. According to the nonprofit Investor Network on Climate Risk, 28 shareholder resolutions calling for companies to either quantify and reduce GHG emissions or disclose corporate responses to climate change risks and opportunities were filed at 22 companies in 2004.[129] While the majority of such resolutions fail, the pressure often makes an impact, sending executives scurrying to make changes in anticipation of growing investor concern.

Companies which received resolutions included Allergan, Anadarko Petroleum, Analog Devices, Apache, Avery Dennison, Centex, Chevron, Corning, Dominion Resources, Dow Chemical, ExxonMobil, FirstEnergy, Ford Motor Company, General Motors, Health Care Property, JPMorgan Chase, Lennar, Liberty Property Trust, Newell Rubbermaid, Progress Energy, Ryland Group, Simon Property Group, Tesoro, Unocal, Vintage Petroleum, Wachovia, Wells Fargo and XTO Energy.[130]

In July 2004, eight state attorney generals and New York City led the first-ever climate change lawsuit against five of the nation's largest electric power generating companies to require them to reduce their CO_2 emissions.

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[127] Institutional Investor Summit on Climate Risk (2005), Summary, By Investor Network on Climate Risk, website: www.incr.com/index.php?page=19, 31 July 2006.

[128] A comprehensive discussion about corporate responsibility and shareholder resolutions is "Corporate Governance and Climate Change: Making the Connection," by Douglas Cogan for the Investor Responsibility Research Center, 2003, at website: www.irrc.com/company/CERES.Corp.Gov.Report.pdf, 30 October 2006.

[129] For a comprehensive list of climate-related shareholder resolutions, please see website hosted by the Investor Network on Climate Risk, at www.incr.com/index.php?page=ia&nid=186, 30 October 2006.

[130] Ibid.

In 2005, investor intervention and persuasion contributed to the decisions by several large companies (Anadarko Petroleum, Apache, Chevron, Cinergy, DTE Energy, Duke, First Energy, Ford Motor, GE, JPMorgan Chase and Progress Energy) to make new commitments such as supporting mandatory limits on GHGs, voluntarily reducing their emissions, or disclosing climate risk information to investors.[131]

The United Nations Environmental Programme (UNEP), working with the organization Ceres, announced a new Climate Risk Disclosure Initiative to create a global standard for climate risk disclosure.[132] The UNEP is developing Principles for Responsible Investment to align the long-term goals of sustainable development with the obligations of institutional investors. Ceres and UNEP are establishing a new international forum for collaboration and information sharing by institutional investors on climate risk.

In another ominous sign for chief executives and board members, some experts in corporate governance say company officers could be held accountable for failing to protect their companies from climate-related risk. And the lawsuits could come from governments as well as investors and other aggrieved parties.

Peter Lehner, chief of the New York attorney general's Environmental Protection Bureau, said the bureau was studying the issue of climate change and might sue polluters along the lines of the successful tobacco litigation by states in the 1990's.[133]

Risks of Higher Insurance Costs and Burdens

Perhaps the greatest pressure for change, however, will come from the insurance industry. As described above, the insurance companies are already being battered by losses from the increase in the violence of storms. In 2003, *The Wall Street Journal* reported that,

With all the talk of potential shareholder lawsuits against industrial emitters of greenhouse gases, the second largest re-insurance firm, Swiss Re has announced that it is considering denying coverage, starting with directors and officers liability policies, to companies it decides aren't doing enough to reduce their output of greenhouse gases.[134]

In March 2004, Reuters reported: "The world's second largest re-insurer, Swiss Re, warned … that the costs of natural disasters, aggravated by global warming, are spiraling out of control, forcing the human race into a catastrophe of its own making."[135]

In the Fortune Magazine article "Cloudy with a Chance of Chaos,"[136] author Eugene Linden reported, already the pain of weather-related insurance risks is being felt by owners of highly vulnerable properties such as offshore oil platforms, for which some rates have risen 400% in one year. That may be an omen for many businesses. Three years ago John Dutton, dean emeritus of Penn State's College of Earth and Mineral Sciences, estimated that $2.7 trillion of the $10-trillion-a-year U.S. economy is susceptible to weather-related loss of revenue, implying that an enormous number of companies have off-balance-sheet risks related to weather—even without the cataclysms a flickering climate might bring.

In 2004, Swiss Re, a $29 billion financial giant, sent a questionnaire to companies that had purchased its directors-and-officers coverage, inquiring about their corporate strategies for dealing with climate change regulations. D&O insurance, as it is called, insulates executives and board members from the costs of lawsuits resulting from their companies' actions;

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[131] Ibid.
[132] CERES website, www.ceres.org/pub/, 1 August 2006.
[133] Press Statement of Peter Lehner Chief of Environmental Protection Bureau, New York State Attorney General's Office Re: Corporate Governance and Climate Change: Making the Connection, at website: www.ceres.org/news/news_item.php?nid=57, 1 August 2006.
[134] Jeffrey Ball, Wall Street Journal, 7 May 2003.
[135] Thomas Atkins, "Insurer warns of global warming catastrophe", Reuters, 3 March 2004.
[136] Eugene Linden, "Cloudy with a Chance of Chaos", *Fortune Magazine*, Tuesday 17 January 2006, money.cnn.com/2006/01/17/news/economy/climate_fortune/index.htm, 30 October 2006.

Swiss Re is a major player in D&O reinsurance.

What Swiss Re is after, says Christopher Walker, who heads its Greenhouse Gas Risk Solutions unit, is reassurance that customers will not make themselves vulnerable to global-warming-related lawsuits. He cites Exxon Mobil as an example: The oil giant, which accounts for roughly 1% of global carbon emissions, has lobbied aggressively against efforts to reduce GHGs. If Swiss Re judges that a company is exposing itself to lawsuits, says Walker, "We might then go to them and say, 'Since you don't think climate change is a problem, and you're betting your stockholders' assets on that, we're sure you won't mind if we exclude climate-related lawsuits and penalties from your D&O insurance.'" Swiss Re's customers may be put to the test soon in California, where Governor Arnold Schwarzenegger is pushing to restrict carbon emissions, says Walker. A customer that ignores the likelihood of such laws and, for instance, builds a coal-fired power plant that soon proves a terrible bet could face shareholder suits that Swiss Re might not want to insure against.

Alarmed at the sharply rising cost of hurricanes and other disasters, home insurers are pulling back from some U.S. coastal markets, warning of gathering financial storm clouds over how the U.S. pays for the damage of catastrophe. This development is another fallout of Hurricane Katrina, whose mounting toll of destruction along the Gulf Coast has precipitated a growing industry debate about the combined effect of climate trends and population growth in coastal areas. Seven of the 12 costliest insured disasters in U.S. history occurred in the past two years. At $57.7 billion, private insured losses in 2005 were more than double those of 2004. Meanwhile, government-provided crop and flood insurance programs are experiencing rising losses, wildfire events are causing two times more damage compared to a few decades ago and coastal erosion insurance is now entirely unavailable.[137] In March 2006, catastrophe modeler Risk Management Solutions Inc. raised its estimate of insurance losses this year by nearly 50% above pre-2004 baselines for the East and Gulf coasts. The company, whose estimates are used by insurers to calculate premiums, blamed "higher sea surface temperatures."[138]

Credit Risks

Rating agencies are putting large insurers such as Allstate and State Farm on notice for possible ratings downgrades. Significant premium increases, tightening terms and market withdrawals are sure to come next. Companies are shedding homeowner's policies and driving residents to taxpayer-funded state insurance plans:[139]

Florida's Citizens Property Insurance Corp., for example, has 815,000 policyholders and is adding 40,000 a month.

Poe Financial Group collapsed in 2005, and many of its 316,000 policyholders probably will move to Citizens, which already faces a $1.7 billion deficit.

Since 29 August 2005, when the Katrina hurricane hit along the Gulf Coast, Allstate Corp., the industry's second-largest company, has ceased writing homeowners policies in Louisiana, Florida and coastal parts of Texas and New York State. They have stopped underwriting earthquake coverage in California and elsewhere.

Louisiana Citizens Property Insurance Corp., the state's last-resort insurer, expects to reach 200,000 policies this year; it had none in 2004. Texas' insurer of last resort says it is down to $1.3 billion in reserves and wants to raise rates by at least 22%.

Homeowners are moving to state-backed insurer plans of last resort, whose costs are rising. Taxpayers, who subsidize such plans, are already feeling the impact. While Katrina caused an estimated $38-$50 billion in private insured losses, it also cost the federal flood insurance

[137] "Insurers see more disasters due to climate change," Planet Ark, website: www.planetark.org/dailynewsstory.cfm/newsid/13100/story.html, 27 July 2006.
[138] "Insurers Retreat From Coasts: Katrina Losses May Force More Costs on Taxpayers," By Spencer S. Hsu, Washington Post Staff Writer, Sunday, 30 April 2006; www.washingtonpost.com/wpdyn/content/article/2006/04/29/AR2006042901364_pf.html, 27 July 2006.
[139] Ibid.

program $50 billion and prompted federal relief spending of more than $100 billion.[140] That includes about $10 billion for Mississippi and Louisiana homeowners.

Governments assume a considerable share of the exposures to the costs of weather-related events. Requests for all forms of disaster relief (including those for the agriculture sector) doubled between the mid-1980s and mid-1990s and total federal disaster-related payments amounted to $120 billion between 1993 and 1997. Federal aid for Hurricane Katrina alone is anticipated to top $200 billion.[141]

Climate stresses will place more political and financial burden on federal and local governments as they assume broader exposures and are pressured to serve as insurers of last resort. Governments also are compelled to address events for which there is no insurance at all, while paying for disaster preparedness and recovery operations. For example, federal and local governments are incurring substantial liability and expenses due to landslides in southern California, with losses averaging $100 million per year.[142] Business and consumers will be burdened because cash-strapped governments generally cap paid losses and shift greater portions of risk back to consumers.

Conclusion

There is a business case for aggressively moving to limit emissions of the gasses that are changing the climate, and companies are implementing it. Books like the international bestseller, *Natural Capitalism* and a staggering array of others prove how the rapidly emerging best practice in sustainable technologies can meet basic human needs around the world and solve most of the environmental problems facing the planet *at a profit*.

There are enormous risks to companies and communities that do not participate in such programs.

This manual describes how your community can work with its business community to enable citizens and companies to capture these advantages, and avoid these risks.

[140] Ibid.
[141] Ibid.
[142] Ibid.

Risk Mitigation

City governments and communities face multiple risks related to energy production and consumption. Those risks span the spectrum from economic risks, to risks of power supply interruptions, to those risks related to environmental conditions and human health.

Many of these risks would exist even if climate change were of no concern. Interestingly, however, the measures a city would take to reduce these risks are often exactly what it would do to reduce the threat of global warming. In fact, while reducing GHGs is often seen only as a morally important policy position, the risk mitigation benefits that accompany a smart climate protection action plan confer such important value to cities that they can often convince skeptics to accept a climate protection program. Climate protection and risk mitigation go hand in hand.

The Risks Citizens Face are Real

For a variety of reasons, disruptions to power supplies are becoming more common. Power blackouts are more than an inconvenience and an economic hardship. They are also a security threat and a threat to human health.

In 2000 and 2001, California faced an energy crisis beset by rolling blackouts and skyrocketing electricity and natural gas prices. From 1999 to 2000, electricity costs in the state rose from roughly $6 billion to over $25 billion.

Major utilities were forced into bankruptcy. Blackouts caused hundreds of millions of dollars of lost economic output. Power intensive industries, such as aluminum smelters and manufacturing, were shut down, and the confidence of firms with high power-reliability requirements, such as computer chip manufacturers, was shaken.

There were multiple causes of the California breakdown, including lower-than-expected hydro-electricity production in the West due to drought conditions, higher-than-expected wholesale natural gas prices nationwide, "market manipulation," and an inadequately designed deregulation plan. The system simply was not sufficiently robust to manage human errors and unusual conditions, natural and otherwise.

In 2002, a similar rolling blackout afflicted much of the upper Midwest and Northeast. Power outages were felt in 11 states (over 80 million people) that took some places more than five days to restore. Again, the blackouts caused untold millions of dollars of lost economic output and discomfort for millions of people, some of who required special medical attention.

The power outages described above came from a variety of causes. However, climate change is creating a positive feedback loop between increased power demand in the summertime and more frequent and stronger summer storms likely to cause regional power failures. As average summer temperatures rise, as they have for the past 15 years, more utility customers are using electricity to power their air-conditioning (AC) units, thus putting increased pressure on power system summer peak loads. In fact, much of the need for the new (often natural gas-fired) power plants in the past two decades has arisen to meet growing summertime peak demand loads, largely driven by higher AC usage. This increased demand for natural gas has been an important factor driving up wholesale gas prices by close to 300% in the past three years.

Energy consumers (especially the elderly or ill) will be come more dependent on AC as summer temperatures increase, which will become increasingly expensive to operate and increasingly likely to fail during heat-related storms.

Again, these are not dystopian fantasies. In July 2006, the governor of Missouri sent the National Guard to evacuate people from their sweltering homes after storms knocked out power to nearly half a million St. Louis-area households and businesses in the middle of a heat wave.[143] More than 90 people had died in the previous few days in California.

Utility crews raced to restore electricity, and Illinois Governor, Matt Blunt, declared a state of emergency, granting the St. Louis mayor's request to send in 250 troops to take people to air-

[143] Power remains out for 231,000 in St. Louis, MSNBC website: www.msnbc.msn.com/id/13954663/, 24 July 2006.

conditioned public buildings and to clear debris.

"We can't overemphasize the danger of this heat," Mayor Francis Slay said. "The longer the heat goes on and the power is out, the riskier it is."[144] Police used public-address speakers from their squad cars to announce locations of the community centers and other places designated as cooling centers. Volunteers went door to door, checking on people with no power to run fans or air conditioners. Utility workers urged customers to find a cool place to stay. They warned that power could be out in some areas for three to five days.

Preparing communities for the more extreme heat conditions in the summertime that can be expected in a warming world is an important service public officials need to do, and not something communities can expect their electric or gas utilities to do for them.

The Risk Profiles of Most Communities

The energy-related risks that cities face, and which local communities *can* (and arguably *must*) manage, covers a broad spectrum of issues, but generally include:

A. Risks of blackouts and/or power interruptions (due to system failure, natural causes such as severe weather events, extended droughts and terrorist actions);
B. Risks of volatile or higher-than-expected wholesale electricity, natural gas and gasoline prices, causing economic hardship to ratepayers, customers and commuters;
C. Risks to human health and ecological resources that derive from point and non-point pollution sources and increased temperatures;
D. Risks of greater liability and higher insurance costs;
E. Risks of more expensive capital and financing, due to increased concern from capital markets, lower bond ratings or shareholder resolutions; and
F. The risk of increased or greater regulation coming from federal or state law-making bodies regarding greenhouse gas emissions or environmental protection.

Many of these specific risks are borne by electric utilities. Cities with municipal utilities have more authority to enforce regulations, ordinances and policy resolutions on these issues than do cities or communities that are customers of investor-owned utilities or rural cooperatives. Cities have to work closely with both electric and gas utilities to create the most effective and far-reaching incentive programs and information campaigns that make sense for their region.

City governments can also work independently of their utilities to manage these risks. Some cities are levying taxes to fund energy efficiency programs that augment and supplement utility efficiency programs. City governments may also participate in utility regulatory commission hearings as interveners and argue for sound, integrated resource planning that takes a city's local risks into formal consideration. A more detailed list of remedies can be found below.

Many of these risks can be managed on a local level if city governments and local communities implement a sustainable energy plan. Doing this also confers important direct, economic and quality of life benefits. Indeed, the economic benefits alone would be cause for voluntary implementation. Given climate change and increased vulnerabilities, the risk mitigation benefits make it almost imperative.

Risks of Blackouts or Power Interruptions

The risk of prolonged power outages due to system failure, natural causes, (such as severe weather events or extended droughts), market manipulations and terrorist actions or acts of sabotage are higher now than they were before. Hotter summer temperatures, deregulation of the electricity sector, growing peak demand and political instability have made utility grids more vulnerable to failure or attack.

[144] Heat Up St. Louis, website: www.heatupstlouis.org/News.html, 24 July 2006.

Risks of Volatile Fuel Prices

All energy customers are subject to the vicissitudes of wholesale energy prices. When coal or natural gas prices increase, utilities often raise their electric rates and pass the costs through to their customers. Since 2001, dozens of utilities across the nation have filed for higher electricity rates, often citing higher natural gas prices as a driving factor.

Again, climate changes can worsen these risks. Low rainfall or extended drought can worsen the problem, as lost output from hydroelectric dams (traditionally used to meet daytime peaks) produces more pressure on natural gas-fired plants to produce energy, often driving short-term gas prices up. Moreover, strong hurricanes can devastate gas refineries along the Gulf Coast, where on any given month up to 70% of the U.S.' natural gas is refined and sent to market. The price of natural gas spiked right after Hurricane Katrina hit the Louisiana coast and stayed high for most of the following winter.[145] Fortunately 2005-2006 was not a severe winter.

Even without storms, natural gas prices are particularly volatile. For example, they shot up from an average of roughly $2.70 per million BTUs in 1999 to $4.40 in 2000.[146] Again they went from an average of roughly $3.50 per million BTUs in 2002 to over $5.20 in 2003. Over the past 20years they have fluctuated about 10-15% per year, on average, and have gone upwards on average 5% per year. This impacts customers in both their electric rates and monthly heating costs. It also drives up the cost of commercial fertilizer to farmers and the costs of other gas-derived products, which affects food prices and trickles down to make everything more expensive.

Less progress has been made in implementing and offering gas efficiency programs than electricity efficiency. Cities can encourage and work with their gas utilities to design and implement rebates and retrofit programs for greater gas efficiency. Driving down the demand for gas and increasing reliance on other resources are important actions cities can take to mitigate the risk of higher gas prices. Energy efficiency and a more diversified energy portfolio can hedge against such price volatility.

Cities also need to take an interest in the types of resources their utilities plan to install in the future to meet future load growth. Most utilities turn a blind eye to the fact that natural gas prices are increasing nationwide, and are still planning to construct large natural gas-fired generating resources to meet demand growth in the 2006-2012 planning horizon. California, alone, is looking at building over 15,000 MW of new gas-fired generation in the next 5-6 years.[147] Though natural gas is less polluting than coal-fired generation, such responses to load growth do not protect utility customers from volatile and rising fuel costs.

The other fuel that has gone up in cost, and much more visibly to the public eye, is gasoline. Costs of gasoline at the filling station in the summer of 2006 were over $3.00 per gallon, or almost twice as much as they were two years ago. Fuel costs to commuters have gone up significantly. Cities can help their citizens save energy, save money and reduce their emissions by increasing public transit and light rail. Issues related to transportation are covered more fully in the best bets sections of Chapter 5.

Risks to Human Health and Ecological Resources

> *Climate is the context for life on earth. Global climate change and the ripples of that change will affect every aspect of life, from municipal budgets for snowplowing to the spread of disease.*
> *– Center for Health and the Environment, Harvard Medical School*

[145] For more information about the impacts of Hurricane Katrina on gas supplies and prices, see Congressional Research Report R22233, "Oil and Gas: Supply Issues After Katrina," Robert L. Bamberger and Lawrence Kumins, September 2005, at: www.fas.org/sgp/crs/misc/RS22233.pdf, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter8/RS22233.pdf, 11 September 2006.

[146] Data from Energy Shop, www.energyshop.com/es/homes/gas/gaspriceforecast.cfm, 25 July 2006.

[147] For more information about new supply requirements in California, see the published reports and proceedings on the California Public Utilities Commission website: www.cpuc.ca.gov/PUBLISHED/REPORT/58641.htm, 30 October 2006.

There is a direct relationship between human and environmental health. There has to be. We breathe. We drink. We eat food grown in the soil. We are only as healthy as the air, the water, the ground and the climate around us.

Recognizing this symbiosis over the decades, the federal government has implemented regulations to protect parts of the ecosystem. Thanks to federal efforts to reduce pollution from power plants and other sources, for example, fewer Americans are dying today from dirty air.[148] The Clean Air Act, Clean Water Act and similar regulations are an institutionalized acknowledgement that the environment influences public health and that intervention often is needed to protect both.

There is no doubt that global warming is a public health issue. "As the climate changes, natural systems will be destabilized, which would pose a number of risks to human health," according to the U.S. Environmental Protection Agency.[149] These adverse impacts are complicated by the fact that America's population is aging rapidly. Global warming is occurring just as the Baby Boom generation reaches its senior years and becomes more vulnerable to health problems.

The potential impacts include the following:

Environmental Risks

Producing energy has large impacts on water supply and the ecological integrity of riparian areas. Extraction of coal, oil and gas causes massive environmental harm, from disruption of ecosystems, to water consumption and pollution, to spills and other forms of pollution. Large dams built on major river-ways (particularly, but not limited to the Colombian and Colorado River Basins) radically alter water temperature, sediment loading, fish habitat, and stream flows.[150] Moreover, gas and coal-fired electric generation requires large amounts of water for their cooling towers. Billions of gallons of water are used ever year for cooling in gas and coal-fired plants. In the event of a prolonged drought and a heat wave, water use may have to be carefully rationed between several vital agriculture, energy and residential services.

Heat-Related Deaths and Illnesses

During the summer of 2006, more than 200 Americans died of causes related to the record temperatures that extended throughout the country. In 1995, 465 people died as a direct result of high temperatures in Chicago alone. Studies of selected U.S. cities "indicate that the number of heat-related deaths would increase substantially by the year 2050 under some climate change scenarios."[151]

Dr. Jonathan Patz, one of the nation's top experts in the health effects of climate, cites studies that predict a 3- to 4-fold increase in heat mortality in large temperate U.S. cities, if current levels of fossil fuel emissions continue.[152]

Higher Levels of Air Pollution

Rising temperatures will bring more heat-related air pollution, aggravating cardiovascular and respiratory diseases, if we continue using fossil fuels as we do today. "The net effect on human health from simultaneous exposure to stressful weather and air pollution may be greater than the separate effects added together," EPA says.[153]

Point and non-point pollution sources as well as increasing mean temperatures adversely affect human health. Point-source pollution (from electric generating plants) includes sulfur dioxide, nitrogen oxides and mercury.

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[148] Despite improvement, air quality needs continuing work. The American Lung Association reports that 150 million Americans still live in counties where they are exposed to unhealthful levels of air pollution. Most at risk are the very young, the very old, and people with asthma and pulmonary diseases. American Lung Association: State of Air 2006 report (April 2006) lungaction.org/reports/stateoftheair2006.html, 30 October 2006.

[149] EPA Fact Sheet No. 236-F-97-005, "Climate Change and Public Health". (October 1997). Available at yosemite.epa.gov/OAR/globalwarming.nsf/UniqueKeyLookup/SHSU5BNNXJ/$File/ccandpublichealth.pdf, 30 October 2006

[150] "Western Hydropower: Changing Values/New Visions," Report to the Western Water Policy Review Advisory Commission, by Bruce C. Driver and Gregg Eisenberg, 1997, at website: hdl.handle.net/1928/2807, 30 October 2006.

[151] Ibid.

[152] "Climate Change and Health: Need for Expanded Scope of Occupational and Environmental Medicine," Dr. Jonathan Patz, Department of Occupational and Environmental Medicine, Johns Hopkins School of Public Health. 1995.

[153] Ibid

Over 50% of the sulfur dioxide (SO_2) emitted nationwide comes from coal-fired electric power stations, as do roughly 25% of the nation's nitrogen oxides emissions and most mercury emissions in the U.S..[154] Close to 50% of the nation's CO_2 emissions derive from fossil fuel combustion for electricity production.

Sulfur dioxide (SO_2) and nitrogen oxides (NOx) contribute to a variety of public health and environmental problems, including asthma, emphysema and other respiratory disorders as well as regional haze and ecological damage.[155] In addition to the health impacts discussed below, ecosystem damage and regional haze adversely affect quality of life in urban areas, quality of crop production in agricultural areas, and the health of pristine wilderness areas.[156] Particulate emissions, NOx and SO_2 are national problems, but are particularly acute in the American West, where visibility has been impaired in such prominent national parks as the Grand Canyon.

Both SO_2 and NOx react in the atmosphere to form compounds that affect human respiratory and cardiovascular systems.[157]

The respiratory effects associated with particulate matter include asthma, decreased lung functioning, emphysema and bronchitis. Cardiovascular effects include higher risk of heart attacks and cardiac arrhythmias. Nitrogen oxides also contribute to the formation of ground-level ozone, or smog. Ozone damages lung tissues and makes people more susceptible to respiratory infections.

Mercury emissions from power plants also have adverse human health and ecological impacts. When mercury deposits in surface water, it can accumulate to toxic levels in fish, and up the food chain in animals that eat fish.[158] Humans exposed to mercury contained in fish can suffer genetic disorder and birth effects. In some states, the problem has gotten severe. In Montana, for example, over 75% of lake acres are under fish consumption advisories, almost all of which are attributable to mercury.[159]

Increases in Infectious Diseases

Due to habitat shifts from changing climate, the risk of infectious diseases will increase as warming allows disease-carrying animals, insects and parasites to thrive where they could not survive before.

A 2005 study by the Center for Health and Global Environment at Harvard Medical School found that climate change will significantly affect the health of humans and ecosystems and these impacts will have economic consequences.[160] It stated,

> Warming and extreme weather affects the breeding and range of disease vectors such as mosquitoes responsible for malaria, which currently kills 3,000 African children a day, and West Nile virus, which cost the U.S. $500 million in 1999.
>
> Lyme disease, the most widespread vector-borne disease, is currently increasing in North America as winters warm and ticks proliferate. The study notes that the area suitable for tick habitat will increase by 213% by the 2080s.

[154] For more emissions statistics, visit the Department of Energy, Energy Information Administration, Report#: DOE/EIA-0573, "Emissions of Greenhouse Gases in the United States," Released Date: December 2005, at: www.eia.doe.gov/oiaf/1605/ggrpt/index.html, 30 October 2006.
[155] For information about the health and respiratory impacts of pollution, see The American Lung Association for a list of articles, at website: www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=33347, 30 October 2006.
[156] For more information on the impacts of pollution transport, see "Grand Canyon Visibility Transport Commission: Recommendations for Improving Western Vistas," by the Western Governors Association, 1995, at www.westgov.org/wga/publicat/epafin.htm, 30 October 2006.
[157] Ibid, footnote 25.
[158] For information about mercury accumulation in fish, visit the website hosted by the U.S. Department of Health and Human Services, at: www.cfsan.fda.gov/~frf/sea-mehg.html, 30 October 2006.
[159] A Balanced Energy Plan for the Interior West," Produced by Western Resources Advocates, 2004, at website: www.westernresourceadvocates.org/, 31 July 2006.
[160] "Climate Change Futures: Health, Ecological and Economic Dimensions", Epstein, Paul, 1 November 2005, web.med.harvard.edu/sites/RELEASES/html/11_1Epstein.html, 7 January 2007.

The Study's author, Dr. Paul Epstein, in a subsequent article in Forbes Magazine, stated, Climate change is already having a less conspicuous, but just as dangerous, impact on humans and the natural systems upon which we depend. Of immediate concern are the implications for human health. For example, asthma rates have quadrupled in the U.S. since 1980. Recent research reveals that rising carbon dioxide--itself, the driver of photosynthesis--stimulates ragweed and some flowering trees to produce an inordinate amount of pollen. Some soil fungi produce many more spores when grown under conditions of elevated CO_2. These "aeroallergens" are carried deep inside our lungs by diesel particles common in urban areas. This unwelcome synergy may be contributing to acute and chronic lung disease. And this factor will grow stronger in a world with increasing levels of CO_2.

Another cause of respiratory disease: Dust clouds emanating from Africa's expanding deserts. Drought in Africa exacerbates this factor, and the clouds are propelled across the Atlantic Ocean by the pressure contrasts between warmer, saltier tropical seas and cooler, fresher water from Arctic and Greenland ice melting into the North Atlantic. The particles (and microbes) in these dust clouds then settle into the lungs of children in Florida and on Caribbean islands in which asthma rates have risen some twentyfold in the past several decades. A rise in wildfires with climate-change-exacerbated droughts are also projected to adversely affect respiratory health.[161]

Storm-Related Deaths and Injuries

Casualties occur not only as the direct result of hurricanes, floods and other extreme weather events, but also as a result of secondary factors such as the contamination of water from the flooding of sewage treatment plants. Deaths from storms include not only direct causes such as drowning, traumatic injury, exposure and starvation, but also slow killers such as infections, viruses and cancer.

Mitigating the Heath Risks

Communities have more power than they might imagine to minimize global warming's threats to public health. A team of health specialists led by scientists from Johns Hopkins University and the Centers for Disease Control and Prevention assessed the potential health impacts of climate change and came to conclusions consistent with those cited above we take action now.[162]

First, every community—and every energy consumer—should take immediate and sustained steps to prevent global warming from getting worse. That means decisive action to reduce the use of fossil energy—coal, oil and natural gas—which emit the greenhouse gases that contribute substantially to climate change. But there is no reason for "doom and gloom," the team concluded, if if we take action now. As described throughout this manual, energy efficiency is the first and most cost-effective path. See Chapter 5 for examples.

Municipal governments can have an important influence on the greenhouse gas emissions from the two biggest anthropogenic sources: vehicles and buildings[163]. Mayors can lead by acting upon the many suggestions contained throughout this manual; turning city buildings and operations into models of energy efficiency; pushing for implementation of local policies that encourage more compact development to reduce the consumption of gasoline; and passing and enforcing progressive energy efficiency codes for buildings, to cite a few examples.

"Gains in energy efficiency of 10 to 30% above present levels are feasible at little or no cost through conservation measures, use of available technologies;

[161] Paul R. Epstein and Evan Mills, "Climate Change Is Hazardous To Your Health" *Forbes*, 16 November 2005, www.forbes.com/2005/11/15/energy-pollution-oil_cx_1116energy_epstein_mills.html.
[162] "Expert scientific panel releases national assessment of climate change and health in the United States," 30 April 2001, new release from Johns Hopkins University Bloomberg School of Public Health.
[163] Gasoline consumption produces carbon emissions. The electricity used in the operation of buildings is most often generated by coal-burning power plants.

development of new energy technologies and better land management practices," EPA reports.

The next step is to replace fossil fuels with clean, renewable energy resources, such as solar power, wind power, geothermal energy and some of the cleaner types of bioenergy. Among the other renewable energy actions mentioned elsewhere in this manual, explore the possibility of obtaining energy from the methane emitted by your local landfill. Many communities are taking this step. Methane is one of the most potent of the greenhouse gas emissions that contribute to global warming—23 times more powerful a heat-trapping gas than CO_2.

While it may be many years before measures like these cause noticeable reductions in global warming, they can produce immediate benefits for public health by improving air quality, lowering energy bills (leaving more family income for health care) and making buildings more livable during periods of excessive heat.

Another leadership opportunity for Mayors is to reduce the "urban heat island effect"—i.e., higher temperatures in inner-city areas caused by paved surfaces and dark-colored roofs. The air temperature within cities typically is several degrees higher than in the surrounding countryside, resulting in a nasty cycle: greater use of air conditioning, which increases the use of fossil fuels at the power plant, which causes more greenhouse gas emissions, which cause higher temperatures, and so on.

Among the antidotes to the urban heat island effect are creating and maintaining natural areas and engaging in urban forestry. For example, as part of Denver's most recent effort to reduce greenhouse gas emissions, Major John Hickenlooper announced a "Greenprint" campaign in July 2006, including a commitment to triple the city's tree coverage by planting 1 million trees over the next two decades. (That's an average of about 137 tree plantings each day for 20 years.)

The Center for Urban Forest Research has found that parking lots occupy about 10% of the land area in many U.S. cities. Their dark surfaces are one of the causes of the urban heat island effect—the higher temperatures that are found inside cities, compared to surrounding countryside. The Center reports that the city of Sacramento, where trees now shade only 8.1% of parking lot surfaces, has passed an ordinance to increase shading to 50%. That requirement is expected to provide Sacramento with $4 million annually in benefits for improved air quality. Sacramento is also placing photovoltaic arrays over parking lots, providing shading and generating electricity at the same time.

Communities must adapt to the climate change effects that already are underway. Adaptation measures include:
Improving the local public health infrastructure;

Creating early warning systems for severe weather and pollution;

Implementing stricter zoning and building codes to minimize storm damage;

Improving disease surveillance and prevention programs;

Educating local health professionals and the public about health risks associated with climate change;

Changing how water infrastructure and management to prevent contamination of potable supplies[164];

Undertaking steps to protect citizens from high temperatures both day and night. That may include emergency shelter for the most vulnerable citizens during times of extreme heat; and/or

[164] More than 950 communities in the U.S. now have combined sewer systems that service both sewage and storm water runoff. "During periods of heavy rainfall, expected to increase as the earth warms, these systems discharge excess wastewater directly into bodies of surface water that may be used for drinking," according to researches at Johns Hopkins University and the Centers for Disease Control and Prevention.

Remaining alert for new and better information about the impact of global warming on their communities, and translate that knowledge into local policies and practices that protect public health.

Local government can find cost savings and new revenue sources in some simple and unexpected places related to climate protection.

There is no perfect cure for the health impacts of the perfect problem. The prescription will be made up of many different actions. One of the most important, perhaps, is to educate residents and other leaders that health and climate are linked. Among the many benefits that climate action can bring to your community, none is more important than good public health.

Again, these risks to human health and ecological resources can be mitigated by lessening reliance on fossil fuels, increasing investments in energy efficiency, distributed generation and renewable energy, by building more efficient buildings, by driving more efficient vehicles, and by adopting forward-looking energy management techniques.

Regulatory Risks

City governments, utilities and utility customers also face stricter regulation coming from federal or state lawmaking bodies regarding both GHG emissions specifically and environmental protection in general. Future regulations may require decreasing the emissions of pollutants (SO2, NOx, and mercury) or reducing CO_2 emissions.

For example[165]:**All of the Northeast and Mid-Atlantic states are studying or implementing programs to reduce GHG emissions.**

- In April 2000, New Jersey adopted a statewide goal of reducing GHG emissions to 3.5% below 1990 levels by 2005.
- Similarly, the New England governors and the Eastern Canadian premiers issued a Climate Change Action Plan in August 2001, calling for the reduction of GHGs to 10% below 1990 levels by 2020.
- New York's State Energy Plan calls for the reduction of the state's CO_2 emissions to 5% below 1990 levels by 2010 and to 10% below those levels by 2020.
- In April 2001, Massachusetts established a rule requiring designated power plants to reduce CO_2 levels. Plants must meet the deadline by 2006, unless undertaking a fuel shift, in which case they may delay until October 2008.
- In May 2002, New Hampshire adopted limits on CO_2 emissions from power plants. By 2007, plants must reduce their emissions to their 1990 level.
- In summer 2003, Maine enacted a law requiring state officials to develop a climate action plan that would reduce CO_2 emissions to 1990 levels by 2010, and eventually reduce them by 80%.
- In 1998, led by Christine Todd Whitman who was then governor, New Jersey set a voluntary goal of reducing greenhouse gas emissions by 3.5% below 1990 levels by 2005. Legislation is also pending in Pennsylvania.
- The Regional Greenhouse Gas Initiative (RGGI) will assist states in New England and the Mid-Atlantic in reaching such state-specific goals. RGG1 will develop a cap-and-trade program to reduce CO_2 emissions from power plants in the participating states.
- Oregon and Washington require new power plants to offset their CO_2 emissions.
- California, in 2003, adopted legislation directing the California Air Resources Board (CARB) to achieve the maximum feasible and cost-effective reduction of greenhouse gases from California's motor vehicles. CARB has proposed a rule that would reduce emissions approximately 30%. The standard will take effect with 2009 model-year automobiles.
- Maine, Massachusetts, New York and Vermont have similar auto standards to California.

[165] From The Alliance to Save Energy provides comprehensive information on state energy programs in addition to general regulatory and technology initiatives to reduce energy consumption. www.ase.org/content/article/detail/2356, 31 July 2006.

- Connecticut, Oregon, New Jersey, Rhode Island and Washington state have announced that they also intend to follow the auto standards. Together with California, consumers in these states buy about 25% of all cars sold in the U.S.

At the time of writing, eighteen states have adopted renewable portfolio standards (RPS) that require electric power companies to use increasing percentages of electricity produced from renewable sources such as wind and sun. Those states include: Arizona, California, Colorado, Connecticut, Iowa, Maine, Maryland, Massachusetts, Minnesota, Hawaii, Nevada, New Jersey, New Mexico, New York, Pennsylvania, Rhode Island, Texas and Wisconsin. Many observers believe that the U.S. federal government will address climate change in the coming Congressional sessions, enacting legislation to cap or reduce CO_2 emissions. A diversified generation portfolio, including energy efficiency, distributed generation and renewable energy hedges against these risks. By anticipating regulatory changes, rather than waiting for these regulations to emerge, city governments pro-actively can help their citizens and local businesses prepare for forthcoming national and state policy addressing CO_2 emissions.

Risk Mitigation

CASE STUDY: Evanston, IL[166]

Evanston Township High School is located in the city of Evanston, Illinois. The school is a 1.3 million sq. ft. complex that includes 13 gymnasiums, 2 swimming pools, three auditoriums, 4 cafeterias, and 330 classrooms. The school is air conditioned, and has 2,080 tons of low-pressure steam-fired absorption cooling. A central boiler plant provides steam for heating, hot water, and absorption cooling.

In 1990-1991, in a move to cut energy costs, the school began looking at installing a combined heat and power (CHP) system.[167] By using engines with exhaust heat recovery to generate steam, the system could provide cooling, heating and power. In 1992, the school engaged LaSalle Associates of Glen Ellyn, Illinois, to design and construct a 3-engine 2,400kWe CHP system for the high school. Exhaust heat recovery was installed on the three engines to make 110-100 psig steam. The steam produced is used to heat water throughout the year and for space heating in the winter and air conditioning in the summer. The system began operation in October of 1992 and is still in operation today.

Installed at a cost of $1.5 million, the system paid for itself in approximately 4 years, and now delivers an annual savings of $354,000 per year.
Evanston's CHP system includes the following major components:

Three Caterpillar Model 3516 1,200 rpm V-16 natural gas fired engine/generator sets—rated at 800 kWe.

Three Maxim (Beaird Industries, Inc.) exhaust heat recovery silencers

Three Amercool Mfg. Inc. single fan, two speed radiators (one per engine).

Three existing Babcock & Wilcox built-in-place natural gas fired boilers (designed by Perkins & Will and installed in 1966 in the school boiler plant).

Four existing 520-ton York single-stage low-pressure steam-fired absorption chillers are located in separate rooftop mechanical rooms. The system has resulted in a 30% reduction in utility expenses for the high school, saving the school $354,000 per year.

CONTACT

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(312) 413-5448

[166] CHP Midwest Application Center Site Description, public.ornl.gov/mac/pdfs/casestudies/cs-ETHS030324.pdf, 13 September 2006.
[167] CHP Midwest Application Center, www.chpcentermw.org/, 30 October 2006.

CASE STUDY: Ft. Collins, CO[168]

Poudre School District of Ft. Collins, Colorado, reaped sizable financial savings by adopting efficiency measures. Poudre is also a model for how to take advantage of EPA's energy performance rating, from the earliest design phase through the operations phase.

The city saw the construction of an operations office building as an opportunity to apply EPA's energy-saving approach to a new structure. In the early stages, a design charrette facilitated by the architect challenged the participants to consider requirements from more than 200 stakeholders, laying the foundation for a cohesive team effort. Poudre used Target Finder, EPA's rating system for design projects, to set an energy use target and evaluate design strategies modeled by energy simulation software.

As the design progressed, they explored how key elements (building orientation, envelope, materials, systems and equipment) could affect energy performance. Over time, the design's energy performance rating remained in the 80s on EPA's 1 to 100 rating scale.

Poudre's operations building features many innovative technologies at the forefront of enhanced energy performance. For example, the building incorporates daylighting and a dimming system to provide adequate lighting with minimal electricity use, while a photovoltaic demonstration unit installed on the roof lowers electricity purchases. Heating and cooling is supplied solely by a geothermal system.

Energy performance isn't the only environmental feature of the building. Sixty-eight percent of the "typical" construction debris was recycled. The builders also used many construction components made from recycled materials; these included recycled wheat board finishing on the interior, recycled carpet backing, and roof shingles composed of metal reclaimed from gasket production. The building design also supports energy education by allowing high visibility of its energy-saving features. The glass-enclosed mechanical room provides a full view of energy systems in action, and the building's daily energy use is displayed (next day) in a kiosk at the main entrance.

Poudre School District earned an ENERGY STAR® label for the completed and occupied operations building based on 12 months of actual utility bills, joining 10 Poudre schools that had already earned the ENERGY STAR® for superior energy performance. The district also received state-level recognition when the Colorado Renewable Energy Society honored Poudre's Operations Building with its Colorado 2002 Renewable Energy in Buildings Award. EPA selected Poudre School district as the 2003 ENERGY STAR® Partner of the Year for Leadership in Energy Management because of its success in implementing ENERGY STAR® best practices.

The 8,753 square foot building was completed in May 2002. The estimated total annual energy use is 199,378 kBtu and cost and $6,101.[169]

CONTACT

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[168] ENERGY STAR® Building Design Guide, www.energystar.gov/index.cfm?c=new_bldg_design.poudreschool_cs, 13 September 2006.
[169] American Institute of Architects COTE Newsletter, www.aia.org/nwsltr_cote.cfm?pagename=cote_a_200602_epa, 13 September 2006.

How Can The Risks Be Managed?

Generally speaking, the two most important mitigation responses that communities can take to address these risks happen to be the same two most important actions communities can take to reduce their GHG emissions:

1. Adopt and encourage energy efficiency and conservation in the community and in the local utility, and
2. Increase the use of renewable energy resources, both in terms of passive design and power generation, in individual homes and buildings and on the local grid.

Within these general strategies are a number of programs that can mitigate the risk described above. These include:

Implementing thorough electricity and natural gas energy efficiency programs. By reducing demand on the system, the probability of a transformer failure is decreased. Though utilities have invested in demand-side management (DSM) resources in the past, there is still a lot of room for efficiency improvements in commercial, industrial and residential buildings. Utility deregulation slowed the rate of efficiency investments in the past five years, but higher fuel prices are starting to stimulate this activity again. City governments can direct their own utility or petition their investor-owned utility to offer more rebates and incentives for energy efficiency programs directed towards all sectors, including low-income residential Using combined heat and power resources where possible. In many industrial facilities, as well as some commercial buildings (such as hospitals and hotels), using the waste process heat to pre-heat water reduces energy costs and strain on the delivery system.[170]

Offering interruptible load programs, voluntary load curtailment, smart meters and other peak shaving programs to reduce energy use at critical peak times.[171] [172]

Deploying distributed generation resources at the customer site or around the utility service territory. These include small wind turbines, micro-turbines (combustion gas turbines), reciprocating engines, photovoltaics and emerging technologies such as fuel cells and stirling engines.[173]

Networking distributed generation assets ("networked DG") so that a utility can remotely switch on a generating resource at a customer's site and feed that power to the grid during critical peak energy demand.[174]

Greater reliance on renewable energy resources, such as wind, geothermal, biomass and solar. By diversifying the resource mix in a single service territory, the risk of failure is spread among more assets, thus mitigating the risk that any one asset could cause grid failure. Renewable energy also tends to be dispersed rather than centralized, giving it the benefits of distributed generation.[175]

Adoption of local model or green building codes for new construction and use of EPA ENERGY STAR®-rated appliances, fixtures, lighting, boilers and air conditioning for new and existing residential and commercial buildings.[176] For an example, see the case study at the end of the document.

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[170] For more information on CHP, visit WADE ("World Alliance for Decentralized Energy") at: www.localpower.org/, 30 October 2006

[171] Almost every large utility in the U.S. offers load curtailment and other demand response programs to their industrial customers, and many offer voluntary interruptible load programs to their residential customers. For more information, see "Demand Response Programs: New Considerations, Choices, and Opportunities," by Dan Merilatt, V.P. Program Development, GoodCents, January 2004, at: www.goodcents.com/Info/research.htm, 30 October 2006.

[172] For more information on utility DSM programs, visit the American Council for an Energy Efficient Economy's website at: www.aceee.org, 30 October 2006.

[173] There are numerous information sources about distributed generation. We recommend the website hosted by Resource Dynamics Corporation for more information about policy and technology trends regarding distributed generation: www.distributed-generation.com/, 30 October 2006.

[174] Ibid.

[175] For more information about renewable energy resources and technologies, visit National Renewable Energy Lab website: www.nrel.gov/, 30 October 2006.

[176] For more information on green building codes, the U.S. Green Buildings Council website, at: www.usgbc.org/DisplayPage.aspx?CMSPageID=76. For more information about the EPA's Energy-Star program, visit EPA's website at: www.energystar.gov/, 30 October 2006.

Tapping into federal and state grant moneys for weatherization programs, heating assistance and energy efficiency programs for low-income households that can help cities help their most vulnerable citizens.[177]

Many of these are best implemented in conjunction with or by the local electric utility, whether it is a municipal utility or an investor-owned utility.

Increasing energy efficiency reduces the strain on the local grid, minimizes summertime peak loads, reduces the risk of blackout or power interruptions, reduces energy costs to customers and end-users, mitigates exposure to volatile fuel prices *and* also creates jobs, increases comfort, reduces health impacts derived from combustion of fossil fuels, creates better working and living environments and reduces a community's contribution to global climate change.

Increasing reliance on renewable resources diversifies the fuel mix on which a community is dependent. By having a more diversified fuel mix, the community is less dependent on any one fuel source, thus mitigating the risk of economic loss due to volatile fuel prices for any one fuel type.

Renewable energy tends to be a distributed resource, rather than coming in large, centralized plants. Distributed energy reduces investment in transmission and distribution and increases the efficiency of power production. Conversely, large, centralized plants make communities more vulnerable to weather or sabotage-related failures.

Renewable energy has the additional benefit of steady fuel prices. While renewable energy technologies are still improving, and operating costs are still coming down over time, the cost of the wind and the sun remain constant—"free." Conversely, though the technology and operating costs of fossil fuel plants are relatively constant (there are emerging technologies, but fossil sources are generally considered mature technologies), the cost of fuel is increasing over time.

[177] A comprehensive source of information about federal and state programs can be found on the website hosted by LIHEAP (Low-Income Home Energy Assistance Program), a program of the Department of Health and Human Services, at: www.liheap.ncat.org/, 30 October 2006.

Additional Resources

Chicago Climate Exchange: To learn more about the potential to engage in carbon trading, visit: http://www.chicagoclimatex.com/

The city of Portland offers information about its climate action and many other sustainable development activities at www.sustainableportland.org

Visit the Smart Growth Network at http://www.smartgrowth.org/ for more information about alternatives to urban sprawl.

For more information about shading parking lots, see: http://www.fs.fed.us/psw/programs/cufr/products/3/cufr_151.pdf

Environmental Protection Agency: EPA maintains a section for health professionals on its global warming web site: http://yosemite.epa.gov/oar/globalwarming.nsf/content

U.S. Global Change Research Program: This government program offers hotlinks from it web sites to a number of other sites and publications on the health impacts of global warming: http://www.usgcrp.gov/usgcrp/nacc/health/default.htm

The Harvard Medical School's Center for Health and the Environment offers a variety of analyses, educational papers and Powerpoint presentations on the health impacts of climate change. See http://chge.med.harvard.edu/index.html

At the United Nations Conference on Climate Change in December 2005, more than 300 mayors from around the world endorsed the World Mayors and Municipal Leaders Declaration on Climate Change. It addresses the responsibility of municipalities to mitigate and deal with the effects of global warming, including its public health impacts. See http://www.iclei.org/index.php?id=2447

The Utah Energy Office offers good information about urban heat island effects, and sample educational and campaign materials for children. See http://www.nef1.org/ea/koolkids/overview.html

American Forests' web site offers information about urban tree planting programs, including educational activities for youth. Visit the site's information about CITYgreen is a software tool that helps people understand the value of trees to the local environment. Planners and natural resources professionals use the program to test landscape ordinances, evaluate site plans, and model development scenarios that capture the benefits of trees: http://www.americanforests.org/

For information about capturing landfill methane, visit the EPA's Landfill Methane Outreach Program at http://www.epa.gov/lmop/

Climate Change Futures (CCF) Project: Health, Ecological and Economic Dimensions (CCF) project examines the physical and health risks of climate instability. CCF is a three-year effort by the Center for Health and the Global Environment at Harvard Medical School,and is supported by Swiss Re and the United Nations Development Programme. Key findings of the study will be presented Tuesday, November 1,2005, at the American Museum of Natural History in New York, New York.

This project is unique because:

- Involves corporate stakeholders directly in the assessment process.
- Offers multi-dimensional projections and recommendations for the coming five to ten years, unlike other assessments with projections far off into the future
- Takes a broad view of health, focusing on human diseases, while including diseases and infestations affecting natural systems that can have profound economic effects via the loss of resources and the services the environmental systems provide.
- Brings together the wisdom of a multi-sectoral group of researchers (public health professionals, veterinarians, specialists in agriculture, marine biology, forestry, and climatology), and representatives from the corporate, NGO and United Nations sectors to assess the emerging pattern of risks.
- Uses climate scenarios that explore the possibility of much greater variance and the growing potential for surprises and shifts that could have the greatest overall impact on human health and well-being.
- http://www.climatechangefutures.org/

Chapter 3: **Conduct a Baseline Inventory**

DOCUMENT CONTENTS

Baseline Emissions Inventory

There are many different ways that a community can undertake to reduce its risks, save energy and contribute to climate protection. This manual suggests that you follow the approach laid out by ICLEI – Local Governments for Sustainability. This sets out five milestones that cities should meet.

The first step of ICLEI's five milestones is to establish a baseline for citywide greenhouse gas (GHG) emissions. This is an important first step for many reasons.

It creates a database of the city's emissions that can be used to track growth and change in the city. It will also create a procedure for tracking city emissions in the future.

It allows cities to hone in on sectors that emit the most GHGs within their territories. The identification of principal sources of emissions shows where reduction measures can have the most impact. This enables cities to prioritize actions to curtail emissions.

It allows cities to take first actions within their own municipal operations or to create an action plan to deal with the community as a whole. Cities do not have to choose one or the other, but by establishing a baseline for both, cities can prioritize crucial areas to address both in municipal operations and community wide.

As a city begins the process of conducting a baseline emission inventory, it should consider not only what data to collect and for what purposes, but also how to collect and evaluate the data to make them most useful.

In order to complete any baseline emission inventory, required inputs will include and not be limited to:

Energy and natural gas consumption in residential, commercial and industrial sectors

Transportation consumption, to include type of vehicle, average miles traveled per vehicle, and type and amount of fuel used

Waste generation to include waste (per/ton) sent to landfill and methane captured

Renewable Energy Credit (REC) Inputs and offsets

Agriculture emissions

Streetlighting, etc.

Consider End-Use Analysis

When doing a baseline analysis, it is most effective to break out energy usage by "end-use," rather than only by sector. For example, if a city can determine how much energy is used to provide lighting, refrigeration, cooking, electric motor power, etc. the resulting data are much more useful than if broken out by sector—residential, commercial and/or industrial. Evaluating end-use information will better prepare cities to identify which programs will have the most impact on their GHG emission reductions. The following figure is an example of the city of Arcata, California's, breakdown of GHG emissions:

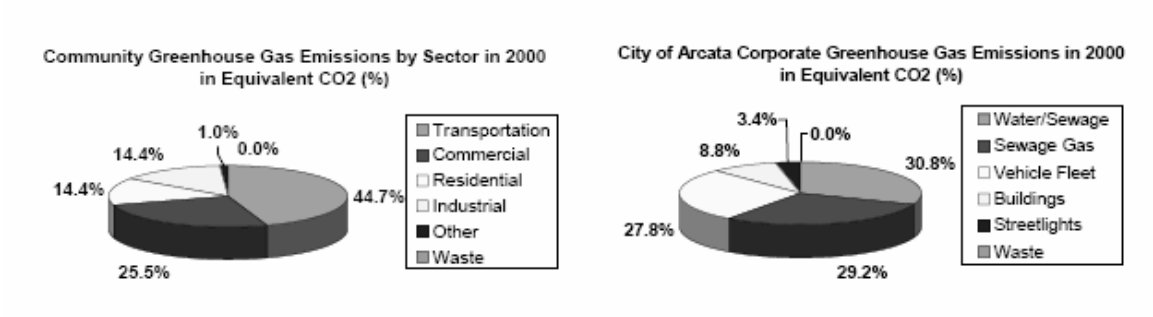

Figure: Arcata, California's GHG emission breakdown

The city of Arcata's Corporate Greenhouse Gas Emissions (Chart 2 of the above figure) makes it easier to transition to reduction goals and program initiatives. The majority of the city's emissions come from water/sewage and sewage gas. Knowing this allows the city to first focus on projects that reduce these emissions. The sector graphs (Chart 1 of the above figure) show the commercial breakdown, but it does not indicate if the main usage in the commercial sector is from electricity, lighting or if it is largely from transportation or motor usage.

Baseline Standards

Baseline emission calculators apply emission coefficients (a value determined from various studies to provide a standard way to assess greenhouse gas emissions) to energy consumption to compute greenhouse gas emissions. At least three organizations have set emissions coefficients, including the Intergovernmental Panel on Climate Change (IPCC)[178], the Energy Information Administration (EIA)[179] and the World Resources Institute/ World Business Council on Sustainable Development (WRI/WBCSD[180]). The differences between most standards are minimal.

Chicago Climate Exchange[181] (CCX)

Cities that are considering joining CCX in the future might take the CCX requirements into consideration at the data gathering stage of the Climate Action Plan. CCX is the world's first and North America's only voluntary, legally binding rules-based GHG emission reduction and trading system. CCX uses

[178] IPCC standards, www.ipcc.ch/, 14 September 2006.
[179] Energy Information Administration "Guidelines for Voluntary Reporting of Greenhouse Gases, www.pi.energy.gov/enhancingGHGregistry/technicalguidelines.html, also archived at, www.natcapsolutions.org//ClimateManual/Cities/Chapter3/TechnicalGuidelines_March2006.pdf, 30 October 2006
EIA coefficients, www.eia.doe.gov/oiaf/1605/factors.html, 21 September 2006.
[180] WRI/ WBCSD Corporate GHG reporting protocols, pubs.wri.org/pubs_description.cfm?PubID=3872, also archived at, www.natcapsolutions.org//ClimateManual/Cities/Chapter3/WRI_ghg_protocol_2004.pdf, 14 September 2006.
[181] Chicago Climate Exchange, www.chicagoclimatex.com, 14 September 2006.

World Resources Institute (WRI) coefficients, but state that converting from other standards (ie IPCC or EIA) is not difficult. CCX only considers municipal operations for a city baseline. Therefore if a city is considering joining CCX, it should make sure that the tools it uses distinguish between municipal operations and citywide emissions. For more information about CCX and the reasons to join refer to Chapter 2, and 5, Reducing Impact of Continued Emissions Section.

Tools & Resources for Baseline Inventory

There are several options to consider in deciding how to conduct a baseline emissions inventory. All will provide the information needed to move forward in developing a Local Climate Action Plan. The primary options are outlined next; but the decision will depend on city staff support, budget allocated to climate action, time available to create the baseline, etc.

ICLEI's Clean Air and Climate Protection Software

Independent Consultants

Self-Inventory, including Public Domain tools

ICLEI's Clean Air and Climate Protection Software

The first option is to use ICLEI's Clean Air and Climate Protection Software. This tool is available to members only[182]. The tool allows staff to input all information dating back to a desired baseline year. It also enables cities to create reports around future projections. ICLEI's tool looks at citywide emissions, enabling municipal operations to be separated out if desired. ICLEI provides training software to accompany the tool. Support also can be requested from ICLEI's staff. The tool requires an individual's time and expertise to submit inputs and create reports, so a city that does not have a staff member dedicated to compiling information may find this tool too time and training intensive. ICLEI provides cities the option of hiring their organization as a consultant to create a baseline report.

ICLEI's Clean Air and Climate Protection Software was developed by Torrie Smith Associates.[183] A snapshot of the software follows.

To view baseline reports generated by this software, check the cities listed next. Each has used ICLEI's tool and has made its information available to the public.

Arcata, CA, GHG Inventory report, Arcata hired a consultant to use ICLEI's tool[184]

Duluth, MN, GHG Inventory report using ICLEI tool and prepared by city staff[185]

Sommerville, MA, GHG Inventory report, done by city staff using ICLEI tool[186]

Independent Consultants

Another option is to hire one of the growing number of consultants to conduct a baseline emissions report and create a tool specifically for an individual city. Many cities have chosen this option, because it does not require as much staff involvement, and does not involve as many inputs because it matches the city's emissions by sector. The GHG inventory tool then can be used to track future emissions. For example, Boulder County used an outside consultant to create a greenhouse emission inventory tool that calculated all cities within the county.[187] The following snapshot shows how tools

[182] The benefits of ICLEI membership is posted at www.iclei.org/index.php?id=771, 19 September 2006.
[183] A demonstration of the tool is available on this website: www.torriesmith.com/.
[184] Arcata's GHG Inventory, www.arcatacityhall.org/energy/ghg_app_a.pdf, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter3/Arcata_baseline_14vii06.pdf, 21 September 2006.
[185] Duluth's GHG Inventory, www.ci.duluth.mn.us/city/information/ccp/GHGEmissions.pdf, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter3/Duluth_baseline_14vii06.pdf, 21 September 2006.
[186] Sommerville GHG Inventory, www.ci.somerville.ma.us/CoS_Content/documents/Somerville_GHG_Inventory%20Report.pdf, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter3/Somerville_baseline_14vii06.pdf, 21 September 2006.
[187] It is not the purpose of this manual to advertise for consultants. However the authors thought it was important to include an example of an individual consultant's baseline emission assessment with a city or county. Boulder County used Econergy. www.econergy.com/, 19 September 2006.

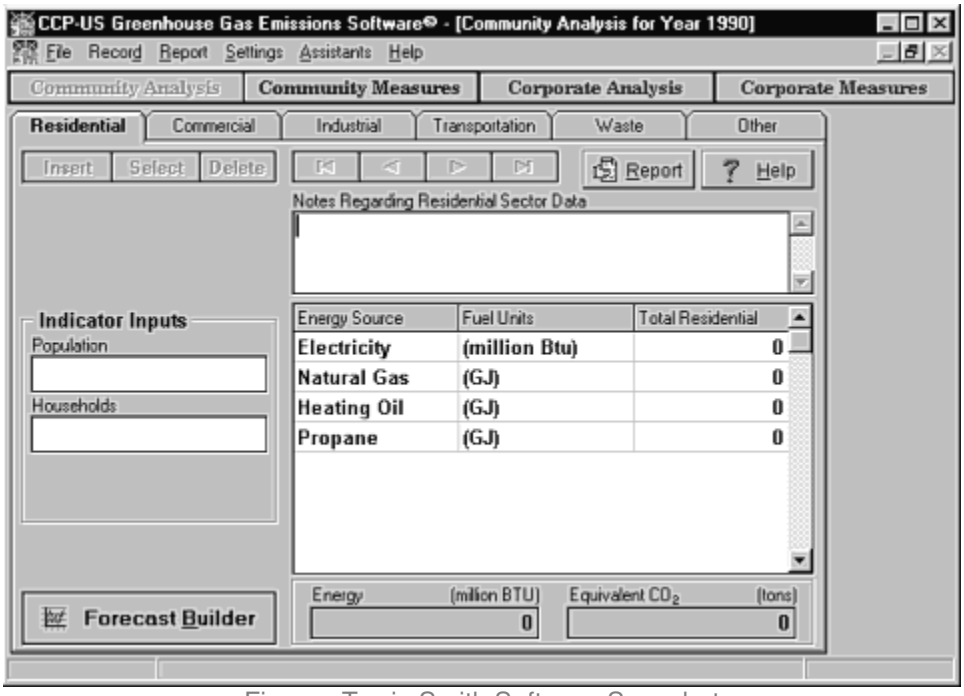

Figure: Torrie Smith Software Snapshot

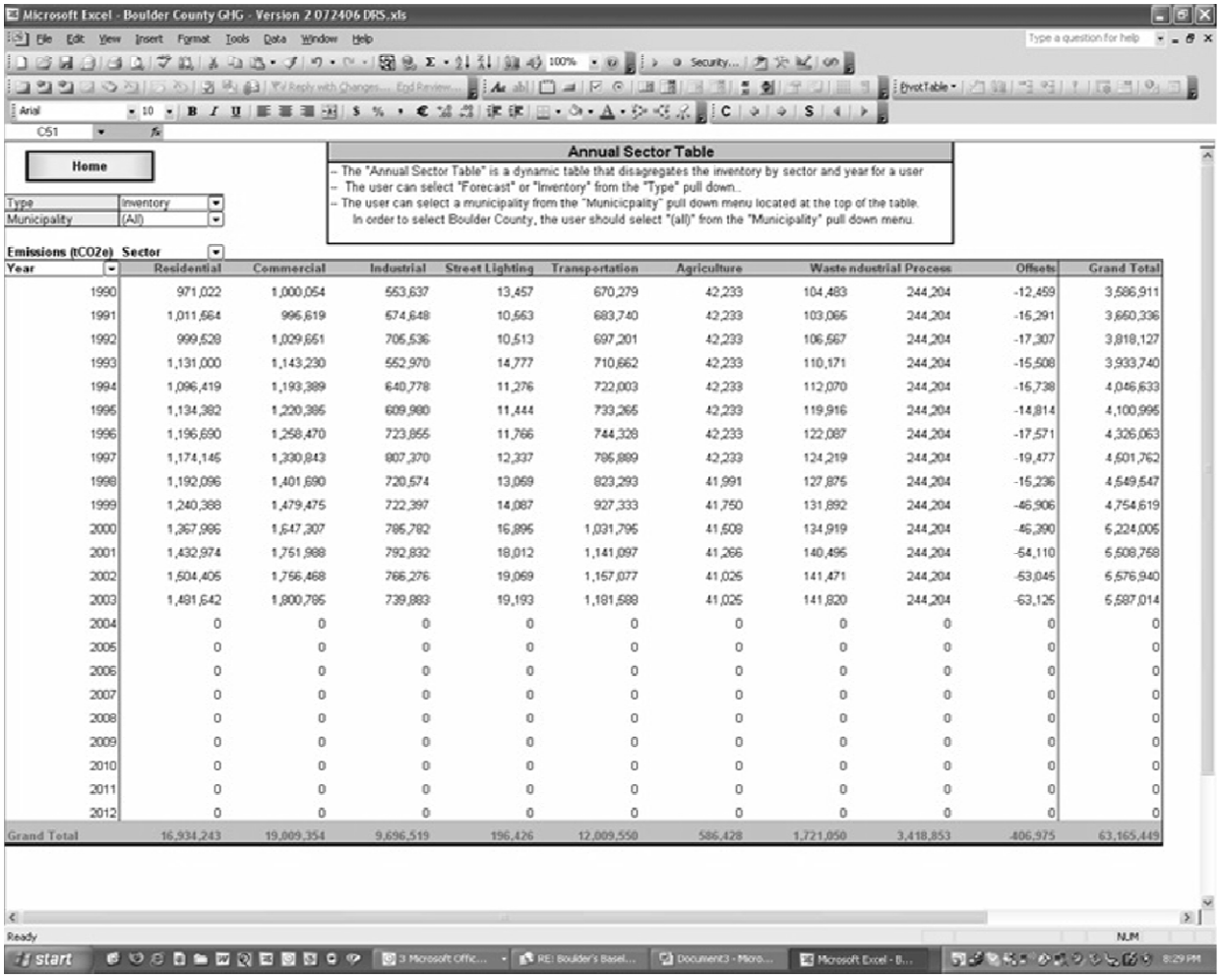

Figure: Econergy's Baseline Assessment Tool Snapshot

separate emissions by sector and source.

Other cities use consultants to create a new tool for their staff to use. This requires staff time to get the correct inputs for the emission tool, but does not require them to customize the tool. The tool is shaped to a city's own inputs and emissions, and the city staff are more involved in the development.

Self Inventory

Some cities—typically those that have large staffs—have the expertise to inventory and track their emissions on their own.

If cities choose to do a self-inventory, there are many free/open-source tools that allow companies, communities and individuals to track their own emissions. Two are listed.

1. The International City/County Management Association developed and maintains a very useful web site, www.USAEnergy.org which among other resources has links to numerous (more than 10) on-line tools[188] that assist local officials and others in assessing their baseline emissions, improving energy efficiency, harnessing renewable energy, and addressing the problems and concerns associated with climate change.

2. U.S. Environmental Protection Agency (EPA). GHG emissions calculators are available online from EPA[189]. These interactive calculators help estimate the greenhouse gas emissions of human activities, convert carbon emissions to equivalent units, and identify and compare emissions reduction options. The calculators vary greatly in complexity, scope, and intent. EPA's web site provides a brief description of each to help you choose one or more that best meet your needs.

Once a city has completed its baseline emissions inventory, it can set its reduction goals (described next in chapter 4), and develop a local action plan (chapter 5).

[188] USAEnergy, www.usaenergy.org/tools.cfm, 19 September 2006.
[189] EPA Resource Center, yosemite.epa.gov/oar/globalwarming.nsf/content/ResourceCenterToolsCalculators.html, 19 September 2006.

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WWW.NATCAPSOLUTIONS.ORG

Chapter 4: Set an Emission Reduction Goal

DOCUMENT CONTENTS

The debate is over. The science is in. The time to act is now. Global warming is a serious issue facing the world. We can protect our environment and leave California a better place without harming our economy.

-California Governor Arnold Schwarzenegger[190]

Every city that undertakes a climate protection program will need to set a target for reducing its greenhouse gas (GHG) emissions. The targets cities set should be tied to the various scientific studies that calculate the amount of reductions necessary by various dates in the future. They should be as aggressive as possible while still being achievable. Some communities are ready to move rapidly to protect the climate; others will wish to move more slowly. The goal each city adopts will depend on how quickly it is ready to move.

Examples of Emission Targets

Cities typically follow one of several approaches:

Adopting the goals set by the Kyoto Protocol:
This is not an ambitious goal, but more than 300 cities have joined the U.S. Mayors Climate Protection Agreement in committing to meet or beat them. The Kyoto Protocol goals set for the U.S. are to reduce emissions of greenhouse gases 7% below 1990 levels by 2012.[191]

Various cities and other jurisdictions have set their own goals, which may be more or less ambitious.

- The New York State Energy Plan set a goal of 5% below

[190] Schwarzenegger made this comment as he set the nation's most aggressive goal for greenhouse gas reductions a state goal of 80% reductions of carbon emissions by 2050 compared to 1990 levels.

[191] For information on the U.S. Mayors Climate Protection Agreement see: www.seattle.gov/mayor/climate/, 30 October 2006.See Kyoto Protocol to the United Nations Framework Convention on Climate Change at unfccc.int/resource/docs/convkp/kpeng.html. The Protocol calls for reductions in "aggregate anthropogenic carbon dioxide equivalent emissions of greenhouse gases". For simplicity these will be referred to in this manual as GHG or carbon reductions. Neither are technically accurate, but they are common parlance.

1990 levels by 2010 and 10% below 1990 levels by 2020.[192]

Some cities are adopting more ambitious goals and longer-range goals.

- The city of Portland and Multnomah County, Oregon, chose a level of 10% reductions below 1990 levels by 2010.[193]
- Cambridge, Massachusetts, chose 20% below 1990 levels by 2010.[194]
- Ottawa, Ontario, Canada picked 20% below 1990 levels, splitting the dates of attainment to 2007 for corporate business activities and 2012 for community emissions.[195]

Some governments and companies have adopted goals ranging from cutting emissions in half to eliminating them entirely to achieve carbon "neutrality." Examples from the public and private sectors include:

- Seattle City Light, a municipal utility, set a target of zero net emissions that was achieved in 2005 through a purchase of 300,000 tons of GHG offsets[196]
- Fort Carson Mountain Post, U.S. Army set a goal of 100% renewable energy by 2027.
- DuPont set corporate goals of 65% reduction over 1990 levels by 2010, and has already met that target for its global operations, with a savings to date of $3 billion.
- Interface Inc.'s "Mission Zero" commitment to "eliminate any negative impact our company may have on the environment by 2020" includes a goal that all fuels and electricity will be from renewable sources.[197]

An increasing number of cities are joining Chicago Climate Exchange:

- Over 200 members, including six cities and King County, Washington (as of September 2006) have committed to the legally binding requirements of the Chicago Climate Exchange (CCX). Cities that join CCX get a comprehensive carbon calculator, as well as externally verified, third party audits of their performance. CCX requires its city members to reduce emissions from municipal operations a total of 6% by 2010 from a baseline of the average emissions of 1998-2001. Annual requirements from the baseline from 2006 to 2009 are: 2007: 4.25%; 2008: 4.5%; 2009: 5%.[198]

Establishing a Time Frame

Based on the best estimates by climate scientists at the time (1996) the Kyoto Protocol set the base date of 1990 as the level of carbon emissions to reduce below. Many cities have followed this lead. However, many jurisdictions will find that they were not keeping records of their carbon emissions at that time. Depending on the results of the baseline inventory process (see Chapter 3), and the community's level of comfort with the accuracy of the baseline data of 1990 emission levels, there may be reasons to set a different point in time from which to measure carbon reductions.

Some jurisdictions have chosen goals that will reduce emissions from what they are at the time of goal setting:

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[192] New York State Energy Research and Development Authority, "Facing Energy Challenges in the 21st Century—A Three Year Strategic Outlook 2006-2009," 2006. Available at www.nyserda.org/Energy_Information/energy_state_plan.asp#dsep, 15 October 2006.

[193] City of Portland and Multnomah County, "Local Action Plan on Global Warming," 2001, available at www.portlandonline.com/shared/cfm/image.cfm?id=25050, 30 October 2006.

[194] "City of Cambridge Climate Protection Plan—Local Actions to Reduce Greenhouse Gas Emissions," available at www.cambridgema.gov/~CDD/et/env/clim_plan/clim_plan_full.pdf, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter4/CambridgeMA_clim_plan_full.pdf, 30 October 2006. The plan includes specific improvement goals for electrical use efficiency (12.5%), reduced natural gas and fuel oil use (10%), reduced electrical generation emissions (40%), green power purchases (20%), average auto fuel economy (40 MPG), reduction of vehicle miles travelled (10%), and recycling rate (60%).

[195] City of Ottawa, Air Quality and Climate Change Management Plan website: ottawa.ca/city_services/planningzoning/2020/air/, 8 October 2006.

[196] Seattle City Light news release 11/9/2005 at www.seattle.gov/news/detail.asp?id=5656&dept=40, 8 October 2006.

[197] Interface's website: www.interfacesustainability.com/renew.html, 8 October 2006 Interface is also a member of the Chicago Climate Exchange.

[198] Chicago Climate Exchange, website Program Summary, at www.chicagoclimatex.com/about/program.html. See also www.usmayors.org/uscm/wash_update/energyenvirosummit06/ChicagoClimateExchange.ppt, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter4/CCX_USMayorsConf_may06.pdf, 8 October 2006.

Salt Lake City, Utah Mayor's Executive Order requires city operations to achieve a 21% reduction from 2001 to 2006.[199]

Burlington, Vermont, pledged in 2000 to achieve a 10% reduction of 2000 emissions by 2010.

Sweden plans a 50% reduction from "present levels" (2005) by 2050.

Rather than establish 1990 or other historic baselines, cities such as Los Angeles and Berkeley, California established emission reduction goals compared to the emission levels expected from a "business as usual" projection of future emissions.

Los Angeles aims to reduce 30% of electricity purchases for city operations by 2010[200]

Berkeley aims to achieve 15% reductions below emissions that have been projected for 2010.[201]

Set Aggressive Goals

Emission reduction pledges, such as those represented by the Kyoto Protocol and embodied in the Mayors' Climate Protection Agreement are a good start. However, increasingly clear scientific evidence of the speed and severity of global warming is eliciting calls from scientists and business and political leaders throughout the world for stronger actions than those called for by the Kyoto Protocol.

In 2000, the British Royal Commission on Environmental Pollution concluded that the U.K. needed to reduce carbon emissions by 60% by 2050. It stated that such a target would be needed to "prevent excessive climate change" by keeping levels of CO_2 in the atmosphere below 550 parts per million (ppm).[202] The U.K. government formally adopted this goal. The Commission recommended a short-term goal of 20% carbon reduction by 2010. The government initially set this target, but recently scaled back to 15-18% reduction by 2010, as it struggles with the initial reluctance to change, and the difficulties of getting such a program underway.

Lacking a coherent national mechanism to limit carbon emissions, U.S. emissions increased 20% from 1990 to 2003,[203] despite the economy becoming about 20% less carbon intensive.[204] The U.S. Energy Information Administration predicts a 75% growth in global emissions from 2003 to 2030.[205] Observers around the world fear that unless the U.S. undertakes more aggressive reduction plans there will be little hope of controlling greenhouse warming.

In October 2006 a report commissioned by British Prime Minister Blair was released. Its author, the former Chief Economist of the World Bank, Sir Nicolas Stern, stated that the planet faces catastrophe unless urgent measures are taken to reduce greenhouse gas emissions.[206] The Report stated that the world has the means to avert catastrophe from global warming although it will involve the huge expense of 1% of global GDP (£0.3trn). This may seem like an untenable amount of money to spend, but the report warned that if it is not done, global warming could cost the world's economies up to 20% of their gross domestic product (GDP). The report called for "a rapid increase in research and development of low carbon technologies".[207]

The report warned that 200 million people are at risk of being driven from their homes by flood or drought by 2050. Four million square kilometres of

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[199] Mayor Rocky Anderson, "Salt Lake City Green – Climate Change and Sustainability," 2005.

[200] City of Los Angeles Climate Action Plan – Energy C.A.P., 2001, available at www.energy.ca.gov/global_climate_change/01-GGE-01_registry_guidance/documents/2001-12-14_workshop/2001-12-14_PRESENTATIONS/12-14_Climate_Action_Plan.ppt, 30 October 2006.

[201] City of Berkeley Resource Conservation and Global Warming Abatement Plan, January 1998, available at www.baaqmd.gov/pln/GlobalWarming/BerkeleyClimateActionPlan.pdf#search=%22City%20of%20Berkeley%20Resource%20Conservation%20and%20Global%20Warming%20Abatement%20Plan%22, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter4/BerkeleyClimateActionPlan1998.pdf, 18 October 2006.

[202] "The Royal Commission on Environmental Pollution's 22nd Report: Energy—The Changing Climate," available at www.rcep.org.uk/newenergy.htm, 8 October 2006

[203] United Nations Framework Convention on Climate Change, "National Greenhouse Gas Inventory Data for the Period 1990-2003 and status of reporting", 2005.

[204] U.S. Energy Information Administration, "2006 International Energy Outlook," Chapter 7, p. 4. Carbon intensity in 1990 was 701 Mt per million 2000 U.S. dollars of GDP and had declined to 562 by 2003, The OECD average in 2003 was 473. www.eia.doe.gov/oiaf/ieo/pdf/emissions.pdf, also archived at, www.climatemanual.org/Cities/Chapter4/emissions.pdf, 8 October 2006.

land, home to one-twentieth of the world's population, is threatened by floods from melting glaciers. It observed that 35,000 Europeans died in the 2003 heatwave, an event likely to become 'commonplace'.

To prevent these and worse disasters, the report found, it would be necessary to spend £200bn, or 1% of global GDP every year. Failure to take such action to limit climate change, the report warned, would force the world's economies to spend up to 20% of their GDP each year to deal with the floods, storms, fires, droughts and other catastrophes. The technology does exist to confront the challenge, the report stated, the financing public and private does exist, so it doesn't have to be a catastrophe, but it's a challenging message. In fact, the report finds reducing climate change could become one of the world's biggest growth industries, generating around £250bn of business globally by 2050.

The Stern Report reckons that such aggressive action would enable "carbon dioxide levels to "stabilize" at 550ppm. This accords with scientists' predictions that a 70-80% reduction of climate changing emissions from all sources will be needed to "stabilize" concentrations of GHGs in the atmosphere by the middle of the 21st century at approximately double pre-industrial levels of CO_2 in the atmosphere.

Some scientists, however, fear that even these levels would be too high. They point out that the word "stabilise," is misleading, however. Given the time lags in global climate, it will take at least another 50 years for the climate to stabilize at any particular level. There is intense debate between scientists about how high concentrations can rise before life as we know it cannot survive.

The level in the atmosphere of carbon dioxide, the principal greenhouse gas, stood at 280 parts per million by volume (ppm) before the Industrial Revolution, in about 1780. The level of CO_2 in the atmosphere today stands at 382 ppm.

Without an unthinkable dislocation in present energy practices, concentrations of GHGs will inevitably reach 400 ppm in 10 years. Scientists believe that this is the upper limit that can be safely maintained. At a level of 450 ppm, the world would see a 4-5 F degree increase in temperature, an interference with the climate system that essentially all climate scientists consider dangerous.

The Stern report warned:
6C is a "plausible" estimate of how much world temperatures could rise by the end of the century if greenhouse gas emissions are unchecked

40% of the world's species would face extinction if temperatures rose by 2C

4 billion people will suffer from water shortage if temperatures rise by 2C

35 per cent drop in crop yields across Africa and the Middle East is expected if temperatures rise by 3C

200 million more people could be exposed to hunger if world temperatures rise by 2C (550 million more people could be at risk of hunger if world temperatures rise by 3C).

Global warming reinforces itself, and is now occurring must faster than had been predicted. Key factors include:
Loss of ice reflection. As ice near the poles melts, incoming sunlight will reach either oceans or land rather than being reflected back into space by white ice sheets or caps. Greater absorption of solar energy by land and water will raise temperatures and higher land or ocean surface temperatures will further speed the melting of remaining ice.

Thawing of permafrost in northern latitudes. If Arctic permafrost continues to thaw, there is the potential for large releases of carbon in the form of carbon dioxide and/or

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[205] Ibid.
[206] Brown, Colin and Cornwell, Rupert "The day that changed the climate" The Independent, 31 Oct 2006, news.independent.co.uk/environment/article1943294.ece, 30 October 2006.
[207] Brown, Colin and Cornwell, Rupert "The day that changed the climate" The Independent, 31 Oct 2006, news.independent.co.uk/environment/article1943294.ece, 30 October 2006.

methane. For example, the Siberian permafrost (400,000 sq. miles) alone is estimated to have the potential to release methane equivalent to decades of human activity if it thaws.[208] Methane is a more potent GHG than CO_2

Warmer soil, especially at high latitudes, speeds up dead plant material decomposition, releasing more carbon as either CO_2 or CH_4.

Most climate scientists thus agree that the goal should be to peak at the lowest level of emissions possible and then drop from there until the world reaches levels well below pre-industrial concentrations.[209]

Examples of Aggressive Goals:

Such European Union (EU) countries as France, Germany, the Netherlands and Sweden have set long-term goals ranging from 50% to 80% reductions. Germany targeted all GHGs. Sweden set targets based on per capita emissions. The EU Environment Council has recommended that developed countries set goals of 15-30% by 2020 and 60 to 80% by 2050 below 1990 levels.[210]In 2004, the Network of European Environment and Sustainable Development Advisory Councils (EEAC) advocated political commitments to goals of a 30% GHG reduction by 2020 and 70% by 2050.[211]

In 2006, the 1,300 members of the Climate Alliance of European Cities with Indigenous Rainforest Peoples resolved to reduce CO_2 emissions 10% every five years, reaching emission levels 50% below 1990 by 2030. The resolution aims for a climate stabilization goal of 2.5 metric tons of carbon dioxide equivalent emissions per person, approximately 25% of current emissions levels in the UK and Belgium.[212]

In 2005, California Governor Schwarzenegger set a California target of 80% reduction of GHGs from 1990 levels by 2050, with an interim target to reduce emissions by 2020 to 1990 levels.[213] In September 2006, the Global Warming Solution Act, known as AB 32 passed was passed by the Legislature and signed into law by the Governor. The2020 target was adopted as a statewide "limit" for greenhouse gas emissions. The law sets a mandatory cap on carbon emissions and establishes a trading regime by which companies failing to meet the goal may face fines unless they purchase other entities excess reductions.[214]

On December 20, 2005, seven states announced an agreement to implement the Regional Greenhouse Gas Initiative, as outlined in a Memorandum of Understanding (MOU) signed by the Governors of the participating states. The states that agreed to sign the MOU are Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York, and Vermont. The MOU outlines the program in detail, including the framework for a Model Rule. Participating states would set requirements beginning in 2009 for its GHG emitters. Emitters would be

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[208] Janet Wilson, "Global Warming Threat Is Seen in Siberian Thaw," Los Angeles Times, 16 June 2006, sourced at www.commondreams.org/cgi-bin/print.cgi?file=/headlines06/0616-05.htm, 18 October 2006. According to scientific study published in *Science* magazine, the Siberian permafrost, about 80 feet deep, could contain 500 billion tons of carbon.

[209] Compiled from various studies, including the conclusion by the UK Royal Commission for Environmental Protection in 2000 that a 60% reduction from 1990 levels is needed, and a 2003 conclusion by scientist Graeme Pearman that 70% from "current emissions levels" is required (see www.ens-newswire.com/ens/aug2003/2003-08-07-01.asp, 18 October 2006).

[210] See Dr. Karsten Sach, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, "Climate Policy – the Short- and Long-term," 2006, archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter4/Sach.pdf. See also Sweden Ministry of Sustainable Development, "National Climate Policy in Global Cooperation—Fact Sheet", www.swedenabroad.com/SelectImage/51404/climatepolicysweden.pdf, 8 October 2006.

[211] EEAC, "70/30 – Towards European Targets for Greenhouse Gas Reductions", December 2004, available at www.eeac-net.org, 8 October 2006.

[212] Environment News Service, "European Cities Pledge to Slash Greenhouse Emissions," 9 May 2006.

[213] Executive Order S-3-05, California Governor Arnold Schwarzenegger. For implementation details see the March 2006 report of the California Environmental Protection Agency's Climate Action Team, available at www.climatechange.ca.gov/climate_action_team/reports/2006-04-03_FINAL_CAT_REPORT.PDF#search=%22california%20governor%20office%20schwarzenegger%2080%25%20goal%20climate%20carbon%22, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter4/2006-04-03_FINAL_CAT_REPORT.pdf, 8 October 2006.

[214] California Assembly Bill 32; this approach is nearly identical to the EU's implementation of the Kyoto Protocol. The bill directs the California EPA to establish enforcement regulations by 2011 that will establish legal limits for 2012 based on the maximum GHG reductions that are "technologically feasible and cost-effective."

required to reduce emissions by 2012 or face fines[215]

The American Institute of Architects and the U.S. Conference of Mayors have endorsed a minimum 50% reduction in fossil fuel consumption in building construction and operation by 2010, with further reductions of 10% annually for five years. Their long-term goal is carbon neutrality for all new and renovated buildings by 2035.[216]

Recommended Process

The following process lays out a 15-step approach that cities may follow to undertake an initial goal-setting process.

1. Establish the timeframe for which to set goals.
   The timeframe should give a community enough time to implement a reasonable program, but should include periodic benchmarks so that the climate protection effort is not just passed on to a future administration. It is worth building in the ability to revisit the goals, in case the science or local circumstances dictate strengthening or altering the goals as time goes by.

2. Set the most aggressive goal that the political climate will allow. U.S. communities, being among the world's largest emitters of GHGs, should set the strongest goals possible unless compelling evidence demonstrates that they would face severe economic and/or human health consequences.[217] In the wake of the Stern report, British Ministers were drawing up a Climate Change Bill, which would enshrine in law the long-term target of reducing carbon emissions by 60% by 2050.

3. Determine whether there is sufficient political will to simply set a goal or whether greater community support must be obtained before such a goal can be established. ICLEI suggests that mayors pass a resolution setting the goal to ensure longevity of the climate protection program.

4. Establish the implementation plan that the city will follow to ensure adherence with the stated goal. Many communities form citizen task forces to help determine appropriate actions for their communities.

5. n the event that the Mayor cannot simply declare a goal by Executive Order, outline the strategy needed to produce the necessary support.

6. Determine whether it will be necessary to establish legal findings to support inclusion of adopted goals into decision-making procedures of the city, including land use regulations, which require legally defensible findings.

7. Determine the best way to obtain the information necessary to enable officials to set a goal. At a minimum, it will be necessary to calculate the city's emissions at present, set the baseline date against which the target will be measured, and establish the ability to calculate emissions going forward.

   Some cities hire consultants to obtain the necessary data.[218] Denver used local university students supervised by a professor.[219] Some cities have an environmental department with sufficient staff to undertake the analysis.

   The use of local and non-local scientific and technological expertise brings up a strategic choice. Local experts and examples of sustainable behavior can be much more powerful motivators for local businesses than consultants or examples from afar. On the other hand, non-local experts can legitimize sustainability

[215] Regional Greenhouse Gas Initiative, www.rggi.org, 8 October 2006.
[216] AIA newsletter 22 May 2006 at www.aia.org/angle_nwsltr_20060522, 18 October 2006.
[217] This suggestion is akin to the "precautionary principle" that is advocated for governance of human-derived chemical compounds. Communities can investigate the pros and cons and established protocols of this concept through the UK Interdepartmental Liaison Group on Risk Assessment website at www.hse.gov.uk/aboutus/meetings/ilgra/pppa.htm, 18 October 2006. Also see the Institute of Science and Society's Report "The Precautionary Principle is Science Based," 2003, at www.i-sis.org.uk/sapp.php, 18 October 2006.
[218] It is not the intention of this manual to advertise, but an example is Boulder, CO. They hired the consulting firm, Econergy, www.econergy.com, 8 October 2006.
[219] Denver Greenprint Report, 7.12.06, available at www.greenprintdenver.org, 8 October 2006.

and/or climate change efforts as being on the global cutting edge.

Consider whether to partner with other cities in the region or state to obtain information that might apply to more than one community in order to reduce costs.
Examine the climate change goals of other communities (particularly those in the region and/or state) and determine the implications of such goal choices (i.e. are there synergies to be achieved through goal consistency on a regional or state basis).

8. Consider the creation of a Citizen Advisory Commission.

- If a citizen advisory commission for either climate change or general sustainability has not yet been established, determine whether this would enhance climate protection efforts. Be sure to create a Commission with sufficient diversity and resources to be credible and balanced in its development of climate strategies. Ensure sufficient business community involvement to give the commission's work a strong economic development component.

A citizen commission can also be useful in developing a local action plan. Leading examples include:

- Boulder County Sustainability Task Force, Boulder County, CO[220]Denver Greenprint Council[221]
- Aspen Global Warming Alliance, Aspen CO[222]
- Portland/ Multnomah County Sustainable Development Commission, Portland OR[223]
- Alliance for Climate Action, Burlington VT[224]
- Green Ribbon Commission on Climate Protection, Seattle WA[225]

9. Consider whether the climate goals should be integrated with existing plans and progress indicators.
Most of the actions a community will take to address climate change will make local companies more profitable. Similarly, a good climate protection program can increase the effectiveness of city and other local government operations. Often, however, existing policies, plans and regulations form barriers that will impede cost-effective climate change actions by municipal and community members.

The analysis should examine opportunities to help the local economy and improve quality of life through climate change revisions. This process should conduct a review of land use and development policies and other goals of the city's comprehensive plans. Leading examples include:Aspen Climate Impact Assessment, Aspen Colorado[226]

- Economic and Technology Advancement Advisory Committee, State of California (to assist with regulatory development)[227]

10. Consider whether to undertake a local/regional climate change risk analysis. It may be useful to conduct a science-based analysis of the likely local physical effects that are expected to result from climate change. Such an analysis will bring climate concerns home and build greater stakeholder support. Stakeholder education efforts can then include what can be forecast about climate change risks to your ecology and economy. This analysis will also help citizens, businesses and governments plan for what is coming.[228] Leading examples include:

[220] Boulder County Board of County Commissioners, Resolution 2005-137, "Adopting a Sustainable Energy Path for Boulder County," available at: www.co.boulder.co.us/bocc/images/Energy_Res_2005-137.pdf, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter4/Boulder_Energy_Res_2005-137.pdf, 8 October 2006.
[221] Denver Greenprint website, www.greenprintdenver.org, 8 October 2006.
[222] City of Aspen Canary Initiative, www.aspenglobalwarming.com, 8 October 2006.
[223] Portland/Multnomah County Sustainable Development Commission, www.portlandonline.com/osd/index.cfm?c=41485, 8 October 2006.
[224] Burlington Electric, Alliance for Climate Action, www.burlingtonelectric.com/SpecialTopics/climate.htm, 8 October 2006.
[225] Seattle Climate Action Plan homepage, www.cityofseattle.net/climate/, 8 October 2006.
[226] Aspen Canary Initiative, Western Colorado Climate Data, aspenglobalwarming.com/westerncoloradodata.cfm, 8 October 2006.
[227] This Committee is to be set up under California's Global Warming Solutions Act of 2006—see Part 7, section 38591.
[228] EPA State Climate Change Impacts information sheets, yosemite.epa.gov/OAR%5Cglobalwarming.nsf/content/ImpactsStateImpacts.html, 30 October 2006.

- University of Washington Climate Impacts Report (for Pacific Northwest)[229]
- City of Santa Monica Solar Potential Study (1997) and Community Energy Independence Initiative (2006), Santa Monica California[230]
- The European project AMICA has developed a methodology for cities to use in development of a climate-change sensitive regional development strategy.[231]
- Climate Alliance of European Cities, which offers a model set of progress indicators towards climate stabilization.[232]

11. Scan Carbon Trading Opportunities**.**
    The economics of achieving GHG reduction goals have changed with the advent of the Chicago Climate Exchange (CCX). Such major metropolitan areas as Chicago, Portland, Berkeley, Oakland, Boulder and others have determined that the procedures that CCX uses to establish the city's baseline, the third-party verification that CCX provides, and the potential for greater returns from selling reductions in GHGs made it worthwhile to make the legally binding commitment to reduce their emissions by becoming CCX members.

12. It is worth conducting a scan of the trading opportunities that CCX offers and how they may affect the economics of reaching your climate change goals.

    Bring the results of the assessments together as quickly as possible, preferably within six months, in order to keep momentum up. The findings will inform adoption of goals, and will support work to develop a Climate Action Plan (Chapter 5). If there is a desire to move more quickly, develop a local action plan at the same time as the goal-setting process. It should be possible to develop both strong short- and long-term goals and a Climate Action Plan in under a year.

13. Align community regulations and resources to maximize GHG reductions to the extent technologically feasible and cost-effective (as per California's Global Warming Solutions Act of 2006).

14. Establish enforceable short- and long-term total emissions goals that estimate the implementation of maximum feasible and cost-effective reductions.
    - Define "cost-effective" as any investment with up to a ten-year payback (as per the energy efficiency strategy of the U.S. Department of Defense).
    - Include a per-capita goal that psychologically reinforces the duty of every citizen to adjust their own life choices to play their part – such as the Swedish goal described below.

15. Revise the goals at least every five years.

If the process outlined above seems too ambitious at first, consider starting with the simpler steps, and then undertake the more complicated steps as you develop expertise and political will.

Factors to Consider in Choosing a Goal

In addition to the variables described above, there are other factors to consider in setting a target for climate protection. These include:

Which basis of measurement to use:

- Total GHG emissions vs. per capita GHG emissions vs. carbon/GHG intensity
- Gross emissions vs. net (aggregate) emissions
- Carbon only vs. all GHGs

[229] "Uncertain Future: Climate Change and its Effect on Puget Sound," at: www.cses.washington.edu/cig/outreach/files/psat1005.shtml, 8 October 2006.
[230] Community Energy Independence Initiative proceedings and information about the Solar Potential Study are available at: santa-monica.org/cityclerk/council/agendas/2006/20060912/s2006091201-G.htm, 8 October 2006.
[231] Amica Integrate Climate Policy Approach, www.amica-climate.net, 8 October 2006.
[232] Climate Alliance Municipal Fields of Action, www.klimabuendnis.org/english/municipal/frameset.htm, 8 October 2006.

Outcome-based goals:

- Climate stabilization (long-term)
- Economic development

Measurement

Three fundamental choices exist regarding how to measure greenhouse or climate change goals:

1. primary measurement strategies;
2. gross or net measurement; and
3. carbon only versus all GHGs.

Primary Measurement Strategies

All climate change goals will interact with population growth, economic development and emissions rates. A simple formula is:

(Population) X (Per capita GDP) X (GHG intensity*) = total GHG emissions.[233]

* GHG intensity is defined as GHG emissions per dollar of GDP generated in a given time period

Total emissions caps set the total amount of GHGs that can be emitted; the most meaningful measure is actual GHGs being put into the atmosphere. A goal or limit of total emissions can be achieved by reducing any or all of the three variables in the equation above. As described above, most cities and nations have adopted goals like the Kyoto Protocol that would limit total emissions. Total emissions goals are stronger than goals based on limits to carbon intensity or per capita limits.

Examples of total emissions limitation goals include:

California's "Global Warming Solutions Act 2006" sets a statewide "limit" of no more than the 1990 level of emissions in 2020. The Act mandates development of regulations and programs that will promote the maximum implementation of "technologically feasible and cost-effective reductions."[234]

Kyoto Protocol implementation by the EU has set limits for the industrial sector, for each country as well as sector-by-sector. This approach means that limits are set for all major GHG producers. The limits are calibrated to achieve the EU's commitment of 8% total reductions from 1990 levels by 2008-12.

Total emission reduction goals can be stated on a per capita basis. Sweden translated its overall emissions goal of 50% reduction from 2005 to 2050 into a per capita goal of achieving 4.5 million tons of CO_2 emitted per person. Its emissions at the time were 8 million tons per capita.[235]

To achieve its total emissions reduction goals, Sweden's population will have to remain constant.

The U.S. government (as per policy statement by President Bush in 2002, not enacted into law) is aiming for an 18% reduction in carbon intensity from 2002-2012. According to the U.S. Department of Energy, the U.S. economy has been steadily reducing its carbon intensity for the past two decades through energy efficiency, and through the steady transition of the U.S. economy from energy-intensive heavy manufacturing and light manufacturing to services during the past three decades.[236]

Per capita goals or intensity goals leave room for total GHG emissions to increase if the population or per capita GDP increase faster than the reduction of emissions per capita or GHG intensity.[237]

A decrease in intensity does not necessary mean a decrease in actual GHG emissions. As a measure of progress, carbon intensity must be used with caution. The Energy Information Administration (EIA) chart below illustrates that while U.S. carbon intensity is decreasing, actual GHG emissions are projected by EIA to rise significantly by 2030.

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[233] John E. Blodgett and Larry Parker, US Congressional Research Service (CRS), "Greenhouse Gases and Economic Development: An Empirical Approach to Defining Goals," published by the CRS, Library of Congress, 4 February 2005.
[234] State of California Assembly Bill 32, "Global Warming Solutions Act 2006."
[235] Sweden Ministry of Sustainable Development, "National Climate Policy in Global Cooperation," Fact Sheet, May 2006, www.sweden.gov.se/content/1/c6/06/47/24/ccbef4cd.pdf, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter4/Sweden_natlClimatePolicy.pdf, 8 October 2006.
[236] The U.S. Department of Labor projects that 18.7 million of 18.9 million net new jobs from 2004 to 2014 will be in service-related industries, whereas employment in "goods-producing" industries is expected to decline. US Department of Labor, Bureau of Labor Statistics, "Tomorrow's Jobs," available at www.bls.gov/oco/oco2003.htm, 20 December 2005.

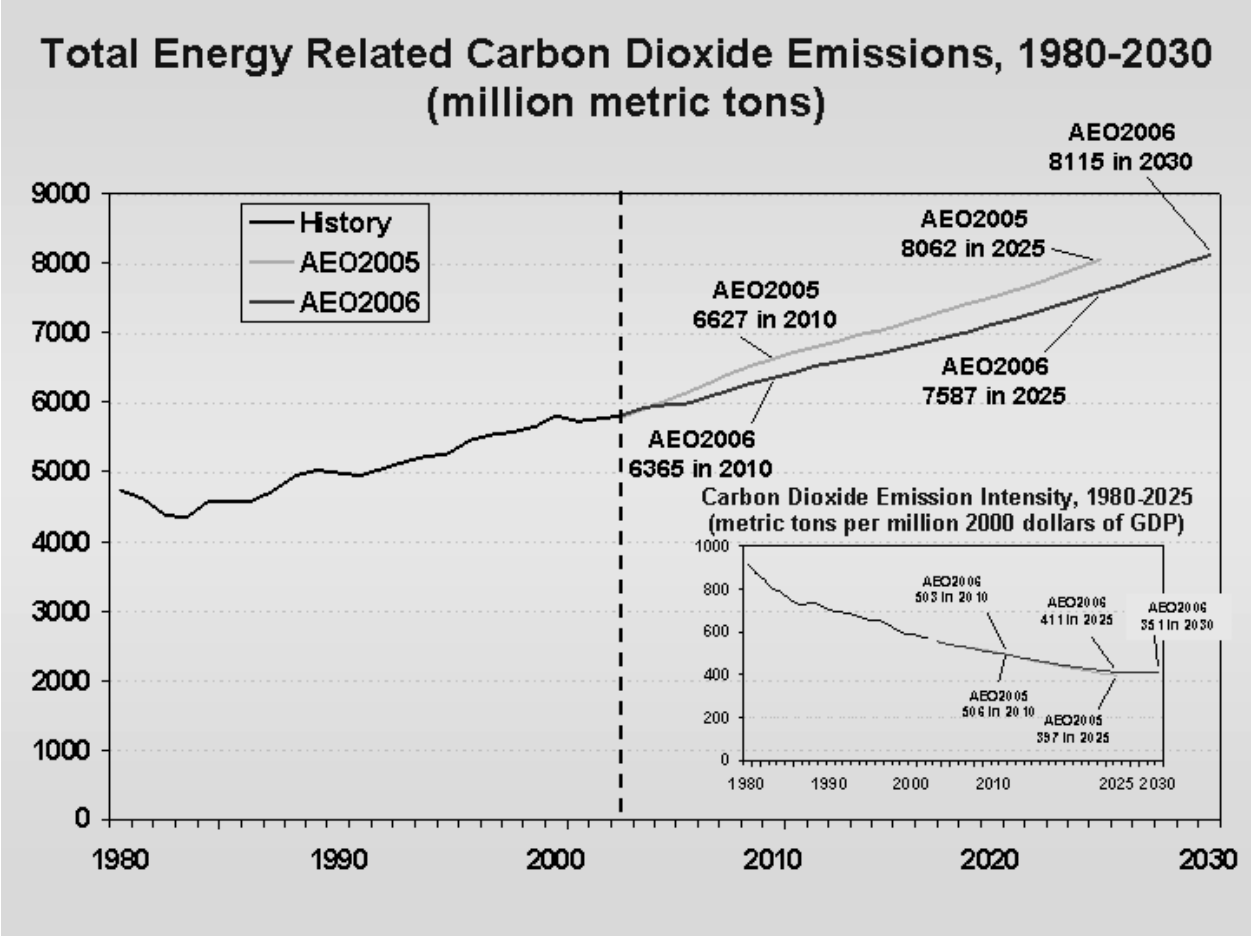

Figure: Energy Information Administration

Gross Emissions vs. Net or Aggregate Emissions

Though U.S. cities have generally chosen to set gross emissions goals (i.e. without subtracting for carbon absorption), the international reporting system established by the Intergovernmental Panel on Climate Change for the Kyoto Protocol recognizes an "aggregate" emissions reporting basis in which gross emissions are offset by credits for potential emissions absorption, for example, from tree planting. The U.S. Mayors Climate Protection Agreement and the Kyoto Protocol, upon which it is based, are aggregate emissions commitments.[238]

Carbon Only vs. All GHGs

The Kyoto Protocol recognizes and regulates six GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). The U.S. Mayors Climate Protection Agreement represents a goal for "global warming pollutants," meaning the six Kyoto GHGs. The reporting requirements of the Chicago Climate Exchange also include all GHGs converted to CO_2 equivalents. These and most GHG reporting and goals call for the reduction of all GHGs; however, they convert measurements of the other gases to metric tons of carbon dioxide equivalents ($MtCO_2e$) in which the other five GHG emissions are

[237] For more on the pros and cons of carbon intensity goals, see William Pizer, "The Case for Intensity Targets," 2005, available from Resources for the Future, www.rff.org, 18 October 2006. Pizer believes that intensity goals can be useful for easing carbon goals into the economy without political opposition based on limiting economic growth – a useful short-term strategy.

[238] See Kyoto Protocol to the United Nations Framework Convention on Climate Change, available at unfccc.int/resource/docs/convkp/kpeng.html, 8 October 2006.

converted to the equivalent amounts of CO_2. This is a good practice. Capturing all GHGs is important because all the other GHGs have more warming potential of CO_2. Thus, even smaller releases of these gases can have dangerous impacts on the climate. Doing this, however, requires more sophisticated measures of sources of emissions than just tracking fossil energy use.

Outcome-based Goals

Local and regional governments have increasingly been held accountable to specific outcomes, particularly with regard to environmental and health regulations. Stakeholder efforts since the early 1990s to create "progress," "sustainability" or other quality of life indicators are based on the concept of identifying specific outcomes that the community wishes to achieve, and implementing management systems to ensure these outcomes. Climate change outcomes are no different. Good goals, policies and activities should be tied to consensus outcomes that are measurable and that contribute towards all of the positive outcomes the community desires. Climate stabilization and economic development are two primary goals that should drive your climate protection program.

Climate Stabilization: The Wedge Strategy

Allowing emissions of GHGs to rise is risking the ability of the Earth to support life as we have known it. GHG levels now present in the atmosphere are unprecedented in human history and are increasing every day.[239] Given that our GHG emissions to date already have created climate instability, stabilizing emissions at approximately double the preindustrial level of GHGs in the atmosphere is likely to mean accepting a very different climate than we experience today, one about 4 to 5 degrees F warmer than in the year 2000. As stated in the science primer at the beginning of this chapter, that will result in enormous dislocations around the globe.

Even so, stabilization at some relatively safe level is widely agreed by scientists to be preferable to allowing a continued rise in atmospheric levels of GHGs that would mean temperature increases more than twice this great and the much greater instability this would bring.

Achieving stabilization may require setting far more aggressive goals than cities have done to date. It is better to start somewhere, even if it is an inadequate goal, than to set no goals at all. However, city leaders should prepare themselves and their citizens for the likelihood that far tougher standards will be necessary.

The Carbon Mitigation Initiative at Princeton University approaches the climate change challenge as a choice between two scenarios. A business-as-usual (or do-nothing) scenario of continuing the historic growth of GHG emissions since 1976 to 2056, would lead to a tripling of atmospheric carbon from pre-industrial levels, with 14 billion tons of carbon added annually. The second strategy would hold annual carbon emissions at seven billion tons until 2056, then cut emissions in half for the following century to avoid doubling atmospheric carbon from pre-industrial levels.

The Princeton Carbon Mitigation Initiative[240] outlines 16 basic strategies (below) to achieve the stabilization strategy. Each of the strategies would result in the reduction of about a billion tons of carbon a year. To hold emissions at 7 billion tons annually the world would need to implement seven of the measures below. Reducing emissions further could be achieved by implementing more measures:[241]

End-user efficiency and conservation

1. Increase fuel economy of two billion autos from 30 to 60 MPG
2. Cut average use of two billion autos (at 30 miles per gallon (MPG)) from 10,000 miles/year to 5,000.
3. Cut electricity use in buildings 25%

[239] A useful metaphor for this situation is a comparison to the hormones in our bodies – how would we react to a situation in which one of our key hormones had risen 35% more than normal levels and was growing further from normal every year. Even if medical science was not certain of the eventual outcome, any sane doctor would urge immediate changes to return the levels to normal.
[240] Robert H. Socolow and Stephen W. Pacala, "A Plan to Keep Carbon in Check," *Scientific American* magazine, September 2006.
[241] The Princeton Initiative is useful because it describes an example of how to set a plan, but its calculations are based on GHG reduction goals that are less ambitious than what will likely be needed. www.princeton.edu/~cmi, 30 October 2006.

Fuel switching ("power generation" and "alternative energy sources")

4. Drive two billion autos (at 60 MPG) on ethanol instead of gasoline
5. Improve power generation efficiency at 1,600 large (1,000 MW) coal-fired electric powerplants from 40 to 60%
6. Replace 1,400 large coal-fired plants with gas-fired plants
7. Increase wind-generated electricity 80-fold to make hydrogen for autos
8. Increase solar-generated electricity 700-fold to displace coal-fired power plants
9. Increase wind-generated electricity 40-fold to displace coal-fired power plants
10. Double nuclear power plant output to displace coal-fired power plants (or increase nuclear power plant output by a factor of five to displace all coal plants—achieving more than double the effect)

Carbon capture and storage

11. Expand conservation tillage to 100% of cropland
12. Stop all deforestation
13. Curtail emissions of methane (primarily from agricultural sources)
14. Install Carbon Capture & Storage systems at all coal-to-syngas plants (that make enough syngas to replace 1/3 of today's oil production)
15. Install Carbon Capture & Storage systems at coal-fired power plants that make hydrogen for 1.5 billion vehicles
- Install Carbon Capture & Storage systems at 800 large coal-fired power plants

Authors Socolow and Pacala[242] note that setting a price for carbon emissions between $100 and $200 per ton—enough to make it cheaper for owners of coal plants to sequester carbon rather than vent it—is required to "jump-start" the needed transition. The current price (as of January, 2007) on both the Chicago Climate Exchange and the European Exchange is running between $4 and $5. They also note that holding global population to eight billion rather than the projected nine billion would also be the equivalent of reducing emissions by one billion tons over forecasts, and would thus count as one of the seven strategies required.

Goals must also consider local and global issues of carbon equity (or environmental justice). These sorts of issues have been central to international climate change negotiations:

Do nations that are now more carbon / GHG intensive (like the U.S.) need to adopt more aggressive goals in order to make room for carbon-based economic development of less developed nations, at least in the short-term?[243]

Do carbon-intensive personal lifestyles (motor sports, and long distance air travel) need to be more aggressively regulated in order to allow some growth of carbon-usage by the community's underprivileged?

These are thorny issues that frequently derail efforts to reach international agreement on carbon / GHG reductions. It is unlikely that individual cities will be able to resolve them, but awareness of them is important.

Economic Development

Since the 1970s, advocates for environmental health have demonstrated that well-designed environmental protection measures increase economic competitiveness.[244] Yet the climate change debates in the U.S. have featured unfortunate and acrimonious claims that economic competitiveness and growth would be unacceptably diminished by climate change efforts. The discussion in Chapter 2 of this manual shows that there is actually a strong business case for aggressively reducing emissions of GHGs. Based on reading the report on which Chapter 2 of this manual is based, the Chamber of Commerce of Boulder, Colorado switched from opposing a proposed municipal carbon tax to supporting it.

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[242] Ibid.

[243] As noted by the World Bank, "Assume, for the sake of fairness, that every person on earth has an equal right to the atmosphere as a resource. In that case carbon dioxide emission quotas for counties would be determined by population size. Low-income countries would not yet have reached their quotes and would have the right to continue emitting carbon dioxide. But middle and high income countries would already have exceeded their quota." Tatyana P. Soubbotina, World Bank, *Beyond Economic Growth – Meeting the Challenges of Global Development*, 2000, Chapter 14.

[244] See Florida, Richard L., *The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community and Everyday Life,* showing that regions that protect their environment economically outperform those that do not. Basic Books, 2004.

A city's discussions must examine all sides of the issue: the economic consequences of runaway climate change as well as the potential costs or benefits of responsibly addressing it. As the Stern Report in the UK found, the costs of doing nothing may far exceed any costs of action. The California Global Warming Solutions Act leads with a warning for other U.S. states and regions:

> Global warming poses a serious threat to the economic well-being, public health, natural resources, and the environment of California. Global warming will have detrimental effects on some of California's largest industries, including agriculture, wine, tourism, skiing, recreational and commercial fishing and forestry.[245]

Predictions that climate change strategies would diminish economic health are largely based on the unexamined expectation that the only way to elicit reductions of energy use would be to require higher energy costs for businesses and consumers. However, as described by economic analysts at the non-profit research center, Redefining Progress:

> …credible economic models estimate that controlling U.S. emissions of greenhouse gases would result in less than a 0.5% one-time loss of Gross Domestic Product (GDP). Public policies with significant impacts are usually phased in over time. Assuming a ten-year transition period, this approach would amount to reduced growth of GDP and real income of less than one tenth of 1% per year. Pessimistic studies estimate that real GDP per employee will grow from $54,000 in 1995 to $61,000 in 2010 under Kyoto Protocol commitments.[246]

Similar projections supported the U.K. government's commitment to a 60% reduction goal by 2050.[247]

Nearly all climate change investments by the private sector (and public sector organizations through management of their own operations) actually achieve strong rates of return—far beyond the cost of money (the bottom-line of investment returns). These rates of return are amplified if fossil fuel energy prices increase faster than the rate of inflation. Unless a government is prepared to make the case that fossil fuel energy will decrease in real dollar costs (a very difficult case to make in a time of diminishing U.S. production and global reserves, increasing global demand and increasing availability of cost-effective substitutes), community policies that support reduced fossil fuel dependence will enhance your community's economic competitiveness.[248]

Climate protection programs also confer economic development benefits. These include quality of life improvements and reduction of indirect costs (such as costs of traffic congestion) as well as increased job creation.

The U.S. Mayors Climate Protection Agreement states:

> "…many cities throughout the nation, both large and small, are reducing global warming pollutants through programs that provide economic and quality of life benefits such as reduced energy bills, green space preservation, air quality improvements, reduced traffic congestion, improved transportation choices, and economic development and job creation through energy conservation and new energy technologies…"[249]

The economic development case was important to the Seattle Green Ribbon Commission's 2006 findings and recommendations:

> One of the primary obstacles to responsible climate policy is the perception that reducing fossil fuel use will be economically costly. We

[245] State of California Assembly Bill 32, "Global Warming Solutions Act 2006," 38501 sections (a) and (b).
[246] Gary Wolff and Gautam Sethi, Redefining Progress, "What's Fair: Workers, Investors and Climate Change," 2000. Available at: www.rprogress.org/newpubs/2000/wf_work_invest.pdf, 19 October 2006.
[247] "The Royal Commission on Environmental Pollution's 22nd Report: Energy—The Changing Climate," available at www.rcep.org.uk/newenergy.htm, 8 October 2006.
[248] See J. Andrew Hoerner, Redefining Progress, "A Golden Opportunity: Strengthening California's Economy Through Climate Policy," 2006, www.rprogress.org/newpubs/2006/goldenopp0106.pdf , also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter4/RedefiningProgress_goldenopp.pdf, 19 October 2006.
[249] Seattle's Letter Calling Mayors to Action, www.seattle.gov/mayor/climate/PDF/USCM_6-page_Climate_Mailing_ALL.pdf, also archived at, www.natcapsolutions.org/ClimateManual/ Cities/Chapter4/USCM_6-page_Climate_Mailing_ALL.pdf, 19 October 2006.

believe the opposite is true. The road to a more climate-friendly community is paved with economic opportunities ranging from cost-savings for families to new business development for companies. For example, the state's new "clean car" standards are projected to save drivers $2,500-$3,000 in fuel costs over the life of the vehicle, while reducing global warming pollution by 25-30% per vehicle. Similarly, investing in more energy efficient homes and businesses creates local jobs. And, here in Seattle, new jobs already are being created by climate-friendly businesses engaged in sustainable building design and biodiesel production.[250]

Other examples of governments including economic development goals in their climate change efforts are:

Boulder, Colorado Climate Action Plan[251];

New York State Energy Strategy 2006[252];

Economic development goals are included in the sustainability indicators of Santa Monica, California[253] ;

and the recommended indicators of the Pikes Peak Sustainability Indicators Project, Colorado.[254]

[250] Seattle Green Ribbon Commission, "Seattle, a Climate of Change: Meeting the Kyoto Challenge," 2006, available at www.seattle.gov/climate/PDF/SeattleaClimateReport.pdf, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter4/SeattleaClimateReport.pdf 18 October 2006.

[251] See Boulder Climate Action portal, www.ci.boulder.co.us/index.php? option=com_content&task=view&id=1058&Itemid=396, 30 October 2006.

[252] New York State Energy Research and Development Authority, "Facing Energy Challenges in the 21st Century: A Three-year Strategic Outlook 2006-2009," 2006. It notes that "Assessing how and when we use energy, while ensuring that our energy use is efficient and effective, will play an important role in our economic well-being." Available at: www.nyserda.org/publications/strategicplan.pdf, also archived at www.natcapsolutions.org/ClimateManual/Cities/Chapter4/NYSERDA_jun06.pdf, 30 October 2006.

[253] City of Santa Monica, "Santa Monica Sustainable City Plan," 2006, available at santa-monica.org/epd/scp/pdf/SCP_2006_Adopted_Plan.pdf, Also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter4/SCP_2006_Adopted_Plan.pdf, 30 October 2006.

[254] The Pikes Peak Sustainability Indicators Project is a collaboration of local governments and Fort Carson Mountain Post. Summary report available from Pikes Peak Area Council of Governments website: www.ppacg.org/Envir/PPSIProject.pdf#search=%22PPSIP%22, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter4/PikesPeakSustainabilityIndicatorProject.pdf, 30 October 2006.

Additional Resources

Why Science Compels Strong Action, Physical basics: how and why GHGs affect climate

- World Resources Institute[255]
- Intergovernmental Panel on Climate Change, a project of the United Nations Environment Programme and the WMO, especially "Climate Change 2001: The Scientific Basis".[256]
- Tim Flannery, *The Weathermakers*, Atlantic Monthly Press, 2006.
- Al Gore, An Inconvenient Truth, http://www.climatecrisis.net

Science's predictions of global physical effects

- "The Scientific Consensus on Climate Change," Essays Beyond the Ivory Tower, 2004.[257]
- The Climate Group's "About Climate Change" Case studies of companies and governments[258]
- ClimateArk's Climate Change and Global Warming Portal and its Climate Change Overview.[259]
- Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change", US Global Change Research Program, Cambridge University Press 2000.[260]

Science's predictions of local physical effects

- "Climate Change Impacts on the United States – the Potential Consequences of Climate Variability and Change," prepared by US Global Change Research Program, 2000.[261]

Goal-setting Considerations

- Technology and Innovation Opportunities: US Government National Climate Change Technology Initiative.[262]
- Daniel R. Abbasi, "Americans and Climate Change: Closing the Gap Between Science and Action – A Synthesis of Insights and Recommendations from the 2005 Yale F&ES Conference on Climate Change," 2006.[263]

Evangelical Climate Initiative Call to Action, U.S., 2006.[264]

Pew Climate Center, especially corporate commitments made through the Business Environmental Leadership Council program.[265]

The Carbon Disclosure Project supports progress towards corporate reporting of climate change impacts.[266]

DriveNeutral, a project of the Presidio School of Management, provides a system for people to offset the climate impacts of their driving.[267]

The European Climate Forum includes recent information developed by the EU. [268]

ICLEI Cities for Climate Protection Campaign.[269]

City of Seattle, Green Ribbon Commission – Resources for Local Governments web page.[270]

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[255] World Resource Insitute, Climate, Energy & Transport, www.wri.org/climate/, 15 October 2006.
[256] Intergovernmental Panel on Climate Change, www.ipcc.ch, 8 October 2006.
[257] Author: Naomi Oreskes. Available through Aspen Canary Initiative website: aspenglobalwarming.com/pdf/Science_Consensus_Essay.pdf, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter4/Science_Consensus_Essay.pdf, 8 October 2006.
[258] The Climate Group Case Studies, www.theclimategroup.org/index.php?pid=430, 8 October 2006
The Climate Group's report "Low Carbon Leader: Canada Dec. 2005" at www.theclimategroup.org/assets/TCG_LCL_Canada_01.pdf, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter4/TCG_LCL_Canada_2005.pdf, 8 October 2006.
[259] Climate Ark, www.climateark.org/overview, 8 October 2006.
[260] "Climate Change Impacts of the United States: The Potential Consequences of Climate Variability and Change" www.gcrio.org/NationalAssessment/index.htm, 8 October 2006.
[261] Available through Aspen Canary Initiative website: aspenglobalwarming.com/pdf/natl_assess_key_findings.pdf, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter4/Natl_assess_key_findings.pdf, 8 October 2006.
[262] The National Climate Change Technology Initiative, www.climatescience.gov/about/nccti.htm, 8 October 2006.
[263] Available at environment.yale.edu/climate/americans_and_climate_change.pdf, 8 October 2006.
[264] Evangelical Climate Initiative, www.christiansandclimate.org, 8 October 2006.
[265] Pew Center on Global Climate Change, www.pewclimate.org/, 8 October 2006.
[266] Carbon Disclosure Project, www.cdproject.net. Also see summary of 2006 report at GreenBiz.com: www.greenbiz.com/news/news_third.cfm?NewsID=34028, 8 October 2006.
[267] Drive Neutral, www.driveneutral.org, 8 October 2006.
[268] European Climate Forum, www.european-climate-forum.net/, 8 October 2006.

The Heat is On, Economist Article, Sept 7, 2006. The many issues surrounding climate change are explained clearly and succinctly in this article with a focus on economics and politics. http://www.economist.com/opinion/displaystory.cfm?story_id=7884738

The Stern Report
The report applies the science of global warming to an analysis of the future of the world's economy. His conclusion is that, left unchecked, global warming will generate an unprecedented economic catastrophe. http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm

Amica, a collaborative in EU trying to establish a regional development methodology with climate change considered http://www.amica-climate.net/home1.html

Too Hot Not To Handle. HBO cautionary documentary offers a guide to the effects of global warming in the United States. http://www.hbo.com/docs/programs/toohot/

[269] ICLEI, www.iclei.org/index.php?id=1118, 8 October 2006.
[270] Resources for Local Governments on Seattle website, www.seattle.gov/climate/govResources.htm, 8 October 2006.

Chapter 5: **Develop a Local Action Plan**

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In a democracy, four groups (local governments including their city staff, community members, organizations and activists, business leaders and citizens) will have a stake in any program to protect the climate, and should be involved in the creation of the plan. Whether your city has decided to engage stakeholders in the goal setting process or has decided to announce a climate protection agreement as an executive action, learning how to engage the various people in your community who will be interested is an important step in developing and following through with Climate Action Plan programs. Many of the programs described in this manual can only be done with the support and enthusiasm of the community.

Government Leaders and Municipal Staff

If you are reading this manual it is likely that you are already engaged in Climate Protection. To ensure that your town makes climate protection a priority, it will be necessary to involve city officials and staff.

Mayors who sign the Mayor's Climate Protection Agreement (MCPA)[271] commit themselves to reduce GHG emissions. In most cities, however, programs to achieve reductions will be implemented by city staff. These individuals will oversee programs to save energy, to educate the public, and to work with the community. They will measure the impacts of programs, and will make adjustments as the programs unfold. Staff members may know little at first about global warming or the science behind it. An internal education program to bring city staff up to speed on the issue is important. With support of local non-profits, such educational materials as this manual, trainings, and attendance at conferences and workshops, staff can get the support they will need to implement a successful Climate Action Plan. Resources for city staff are listed at the end of this chapter.

A good first step is to determine whether your community has signed the MCPA. If not, consider whether your Mayor might be interested in joining the over 355 mayors around the country who have.

Research has shown that even in many of the cities in which the mayor signed the MCPA, city staff members were unaware of this and uncertain how to proceed.[272] Remember that in any entity as large as a city government, there are differences of opinion, and a whole array of historical vested interests. Often climate protection programs originate in an environmental office, or an executive office. Officials in public works, utility services, vehicle operations and other departments may not view proposed changes as enthusiastically. It will be important to ensure that these people are given a way to get involved, that their opinions are heard and their expertise solicited.

Even if a mayor has signed the Agreement, city staff may be unsure which steps to take next. One of the first actions to consider is to embody the commitment in a formal resolution of the city government.[273] Passing such a resolution not only highlights the importance of climate change to elected officials. It also offers an opportunity to educate the public and the local government staff while laying out a plan of action and implementation. Some cities have proceeded without such a resolution, but going through the political process to make the Agreement official will help give it legitimacy and longevity.

Resolutions that cities have passed may be helpful models for government staff:

For a sample resolution outlining a city's commitment, view the city of Seattle Resolution.[274]

View a sample resolution[275] from a city participating in ICLEI's Cities for Climate Protection Campaign.

The sample above can be modified to include language specific to a particular community. See how the city of Carbondale, Colorado[276] has personalized its resolution.

City staff has the power to place climate protection as a high priority, or to undermine efforts even if the mayor believes this should be a focus. Helping staff

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[271] Seattle U.S. Mayor's Climate Protection Agreement website, www.seattle.gov/mayor/climate/, 8 October 2006.
[272] Natural Capitalism Solutions called every city that had signed the MCPA as of November 2005. At least 75% of officials surveyed were unaware that their city was officially a member. Most of the rest were unsure what if any programs were being undertaken.
[273] ICLEI's first responder handbook.
[274] Seattle 's Resolution,clerk.ci.seattle.wa.us/%7Escripts/nph-brs.exe?s1=&s2=&s3=30316&s4=&Sect4=AND&l=20&Sect1=IMAGE&Sect2=THESON&Sect3=PLURON&Sect5=RESN1&Sect6=HITOFF&d=RESN&p=1&u=/%7Epublic/resn1.htm&r=1&f=G, 20 October 2006.
[275] ICLEI Sample Resolution, www.iclei.org/documents/USA/resolution.pdf, www.climatemanual.org/Cities/Chapter5/ICLEI_SampleResolution.pdf, 20 October 2006.
[276] Carbondale Resolution to Participate in Cities Climate Protection Campaign, www.carbondalegov.org/vertical/Sites/%7BE239F6F5-CCA3-4F3A-8B27-95E8145FD79A%7D/uploads/%7B736D98B2-4F2F-404F-B554-B024DA1CDAA8%7D.PDF#search=%22carbondale%20colorado%20ccp%22, also archived at, www.climatemanual.org/Cities/Chapter5/Carbondale_CCP_resolution.pdf, 20 October 2006.

to understand the importance of the issue, their role in achieving climate protection and how this can improve their work on behalf of their community can dramatically strengthen a program.

Non- profit Organizations and Local Activists

Many non-profit organizations work on climate protection, from the local level to the national stage. Some groups bring pressure for change, while others provide excellent information. Some can even provide financial support for carbon reduction programs. For example, the information in this manual is available due to the partnership between Natural Capitalism Solutions a non-profit, and Paradigm Nouveau, a L.L.C., for-profit company. The city of Ballard, Washington's 'carbon neutral' goals are being put forth and implemented by the local non-profit, Net Green. Many NGOs, local and national non-profits can bring specialized resources to help stakeholder groups in planning and implementation. The city of Denver, Colorado conducted its carbon baseline by using local university students, supervised by a professor working with city staff. Many houses of worship have made climate protection a priority, reducing the energy that they use, holding educational programs for their members and speaking out on the issue

Program planning efforts will benefit from inviting all interested elements of civil society to be involved at the earliest possible stage.

Business Leaders

Business and community leaders should be invited to participate in a climate protection program at the earliest possible moment. Often business leaders are ignored as such programs are developed, and may feel that proposed changes will negatively impact their businesses. In fact, many carbon reduction programs will save businesses money and will strengthen the entire economy, but unless the business case is explained, the commercial sector may react negatively. The Business Case for Climate Protection section in the Why Act Now chapter of this manual contains information that can be provided to members of the business community. The early participation of business and community leaders will significantly improve chances for success.

Community Members

Finally, even the most aggressive program will fail unless citizens understand and give it legitimacy. It is crucially important to educate and involve citizens at every step of a climate protection process. Many mayors have taken a leadership role by signing the Climate Protection Agreement. But achieving reductions, especially significant ones will depend on the willingness of the public to participate.

Like business leaders, many citizens may feel that protecting the climate will cost them money, require higher taxes, stifle their quality of life and otherwise bring changes that they will not like. It is important to explain how reducing the use of energy saves money, increases community security, strengthens the economy and can be achieved with a minimum of disruption. It is also worth helping the community to understand the significant disruption that will come from allowing global warming to continue. An educated citizenry is one of the best assets that any community can have.

Stakeholder Engagement Strategies

Cities can take many approaches to engage its stakeholders. This manual presents several strategies so that you can determine which one works best for you. The following three strategies: LASER, Tools of Change and Businesses for Social Responsibility lay out specific steps organizations can follow to engage their stakeholders. Each have a different audience and purpose, but follow similar processes.

LASER, Local Action for Sustainable Economic Renewal, created by Global Community Initiatives[277] and Natural Capitalism Solutions[278] was developed for use in communities interested in economic renewal and in developing sustainability programs. This free tool offers an array of best practices, tools and templates that communities throughout the world can use. You can download it for free through an interactive web site.[279] In the first chapter, LASER describes the stakeholder recruitment process and the importance of creating a community vision to bring the community together and motivate it to achieve its goal.

Tools of Change[280] is founded on the principles of community-based social marketing, The web site offers specific tools, case studies, and a planning guide to help people take actions and adopt habits that promote health and/or are more environmentally-friendly. The web site includes the best practices of many other programs - practices that have already been successful in changing people's behavior. The planning guide describes the step-by-step processes necessary to change a community's behaviors. This site also provides information on clear tools to use in addressing different audiences.

Business for Social Responsibility[281] (BSR) is a non-profit organization that provides information, tools, training and advisory services to make corporate social responsibility an integral part of a business' operations and strategies. BSR describes the importance of engaging the business community, beyond just "touching base." It provides clear implementation steps to achieve success. It is especially important to present the business case for climate protection (see Chapter 2 of this manual for how to present this). Showing how the climate change programs described in this manual make business and financial sense is an important message. A strong program is much easier to deliver to local businesses, residents and city planners if it makes economic as well as environmental sense.

LASER Stakeholder Recruitment

The following is adapted from LASER's Stakeholder Recruitment and Community Visioning Process.[282] Although LASER was written with a focus on community sustainability and economic renewal, not specifically climate protection, the stakeholder engagement process has proven successful in communities around the world.

The first step in the process of developing necessary leadership is to identify and recruit the stakeholders from the community who have an active interest in a sustainable future. The legitimacy of the process will depend, in part, on who is doing the recruiting and how the Stakeholder Group derives its legitimacy. No matter who you are—mayor, municipal employee, business leader, community activist—you need allies to enable a major carbon reduction effort to succeed.

Step One: Gather a Core Team

The Core Team could be as small as three people, but should not be much larger than seven to ten. It should include people who have credibility within the community. Ideally, it will reflect experience from such sectors as business, government and civil society. The Core Team should agree on the general direction of the project and work to become a functional unit before reaching out to the rest of the community. At a minimum, those you select for your Core Team should have thoughtful and optimistic personalities, good interpersonal skills and a capacity to have fun together while getting hard work done.

[277] Global Community Initiatives, www.global-community.org/, 15 October 2006.
[278] Natural Capitalism Solutions, www.natcapsolutions.org, 15 October 2006.
[279] LASER Interactive Site, www.global-laser.org/, 15 October 2006.
[280] Tools of Change, www.toolsofchange.com/English/planningguide.asp, 15 October 2006.
[281] Business for Social Responsibility, www.bsr.org/Meta/About/index.cfm, 15 October 2006.
[282] Chapter One of LASER, www.global-laser.org/workbook/LASER_guide_Ch1.pdf, 30 October 2006.

Consider the following sources of potential candidates:

Local activists within or outside local government

Members of governmental boards or commissions

Leaders of organizations dedicated to community improvement

Leaders of organizations working on environmental issues

Local Service Clubs: Rotary, Lions, etc.

Local youth leaders

Businesses that benefit most from a healthy community

Leaders of Faith Communities

The initial responsibilities of the Core Team include:

Identifying the scope of the project

Developing a budget and planning schedule

Recruiting a Stakeholder Group

Identifying the other plans and processes that need to be integrated

Preparing the materials and presentations that will be used to invite others to participate.

Step Two: Gather Stakeholder Group[283]

A Stakeholder Group gathers a representative number of interested parties together. A group of 30-40 people is an effective size, but it can be as many as a couple hundred, depending on the needs of the community. This group will provide the leadership in creating a shared vision and plan for local climate protection. In addition to a broad cross-section of the community, the Stakeholder Group can include all the various town leaders—department heads, for example, and the heads of significant local institutions. They all will benefit when others see the links between what they do and the value they add to the community as a whole.

Different Businesses	Organized civil society groups
• Small, medium and large businesses • CO_2 intensive and non-intensive businesses • Businesses with old and new technology that addresses climate	• Schools and universities • Service organizations • Churches • Environmental Groups

Figure: Stakeholder Organizations to Take Into Consideration

To recruit business leaders to the process, it is important to understand what will motivate them. For example businesses may be more motivated by other business leaders than government or community organizations, so recruiting a prominent business person early on increases the likelihood of others becoming involved. Giving the business people credit and publicity for their involvement will appeal to their interests. Be prepared to take. some additional time and effort to meet with different business people, get their feedback and suggestions for how the process should work, and help them understand all the benefits of a more vibrant local economy

You may want to set up special meetings initially for various stakeholder groups, to help them feel at home in the process and have a voice in the way it is structured. This may mean meeting for breakfast instead of in the evenings, for example and having very specific and short agendas with clear outcomes. Empowerment—the clear connection between what people suggest and decide and the way a pubic process works—is one of the most successful ways to engage people and keep them engaged. Disempowerment—overriding decisions that don't fit with the style of city leadership

[283] Additional Stakeholder Recruitment Tool from LASER, www.global-laser.org/resources/stakeholder_recruitment.pdf, 20 October 2006.

or reversing course midstream without consultation—is an equally sure way to make people drop out of processes like this.

Step Three: Develop Group Process Skills

Once the Stakeholder Group has been convened, it is important that they develop a shared idea about how they will work together, how meetings will be conducted, what the planning schedule will be and how conflict will be resolved.

Step Four: Learn to Manage Conflict and Make Decisions[284]

All teams must recognize the need for non-violent approaches to relationships, both within their groups and in the community at large. Moreover, the members of these groups will need to accept a responsibility for helping community members to communicate peacefully, no matter how impassioned they may be.

It is also helpful to have decision-making structures articulated in advance, so conflict will not emerge simply because the decision-making process is unclear or ineffective. The exact form that conflict resolution and decision-making procedures will take can vary depending on the group involved and its particular constraints. Part of any conflict management procedure should be a clear articulation of the Vision Statement, Mission and conflict resolution criteria. Achieving agreement on these matters in advance makes it possible to guide decisions through any later conflict that may arise.

Participatory Visioning

It is important to first create a shared vision for the community as a whole, one that looks into the future and captures the collective aspirations of the people. To achieve the goal of a democratically-created local vision, you will need to inspire and motivate your fellow citizens—not only to support the vision, but to take an active role in defining it.

A vision is a positive forecast of the way we want the world to be, an affirmation of values and hopes, an image of the destination to guide our journey. The language of the Vision must be simple enough so anybody can understand and get excited about it. It must reflect shared values and convincingly depict a community changed for the better. The process of defining your Vision should be future oriented, and allow people to bring their imagination, their creativity and their hearts.

When visioning processes work, they motivate people to conceive new ventures and new activities, to create unexpected opportunities that would not have arisen if it weren't for the collective creativity put to work and the new connections made. Visions that reflect the community's aspirations can generate goals that people will want to work for, and make it easier to develop practical strategies and targets.

How is it possible to articulate a shared vision for an entire community? This is a huge task, and one that can easily fail if you don't take the time to engage the whole community in the process.

Not only must a vision reflect the core values of the people, it must come from the people. A vision statement drafted by a few people in leadership—even with the best intentions—will never engender the sense of ownership and common purpose that comes from full community participation. That is why it is important to work through the public participation process.

Depending on the size of your community, recruiting participation can be done by asking the community to submit vision statements through the media, or holding a community meeting where individuals can voice their opinions, etc.

The public participation process can generate an enormous amount of information about what people want to see in the future. In the city of Calgary, over 18,000 people answered the questions the Stakeholder Group asked the community—online, at festivals, in schools, during meetings, on the street, in their workplaces, in their utility bills and in the newspapers. Your Stakeholder Group will have to find a way to compile and digest all the information that is collected. The more successful the public participation activities have been, the more daunting this project will be.

[284] LASER provides an example of the decision making process, www.global-laser.org/resources/decision-making_sample.pdf, 20 October 2006.

The Stakeholder Group might want to set up a subcommittee to read all the information and prepare a report. This subcommittee could also take responsibility for preparing the first draft of a vision statement.

Even if the vision is properly developed, truly reflecting the hopes and aspirations of the community, it can still fail in its purpose if the leaders don't "get it"—if they see it only as words on paper. A leadership that shares the vision will respond to its community with excitement and a sense of possibility. Among citizens, likewise, an inspiring vision statement can create a wellspring of energy and commitment.

Creating Excitement and Momentum

The basic premise of this approach is that genuine community transformation is built on vision, imagination, courage and other human qualities that unite us across our differences. People do not necessarily get excited about a meeting to discuss new types of loan funds, but they do care about preserving what is special about their home towns. They care about their own ideas being heard in the process. In every stage of your activities, from initial surveying to the final adoption of the plan, you can draw on the creative and spiritual resources of your community through the arts, celebrations, challenges, friendly competition and even humor.

Asking the Right Questions

One of the first tasks a Stakeholder Group can take on is to develop a set of questions to elicit meaningful feedback from the community about the future in general. This is not so much to gather data as it is to identify hopes and dreams (the data will come later). The questions should be broad in nature, but can also touch on specific issues. The important thing is to keep the questions open-ended and positive. In this way, even comments about problems can contain the seeds of their own solutions. The following visioning questions were used successfully by the city of Calgary's imagine Calgary Project:

What do you care about in Calgary that you want to pass on to future generations?

What is it like for you to live here?

What changes would you most like to see?

What are your hopes and dreams for Calgary in 100 years?

How could you make this happen?

Examples of Climate Related Questions that would work well:

How could climate change influence our community?

How can you reduce the use of energy?

What are ways our community could benefit from energy efficiency, renewable fuels, or less traffic?

How could you contribute to protecting our climate?

Notice how the questions are positive, action oriented and personal. This is the type of inquiry that will elicit the most useful information.

Establishing a campaign theme can help to galvanize public interest in creating a Vision. Seattle Washington, for example, named their initiative "Sustainable Seattle." Many communities pick a year on the horizon—maybe 20 or 30 years in the future—and incorporate that. Hamilton, Ontario calls their effort "VISION 2020." All your efforts at this stage will emphasize the future of the community.

Ideas for Public Participation

As noted earlier, your planning project will gain real political support if the broader public understands and supports it. The Stakeholder Group should identify messages they want each member to convey to his or her own constituency, from business to labor to youth to neighborhood interests.

Beyond this targeted approach, broad community involvement is also essential. To create this, you need to make creative use of a variety of resources, including mainstream and community media, publicity efforts, events, and visuals. This public participation campaign will establish the spirit of genuine two-way communication. The trick is to create a buzz and find new ways to listen to people at the same time.

Here are some examples to improve community involvement:

Invite ideas:
Put up a big suggestion box in front of town hall, and ask a popular radio commentator to read a suggestion each week. Have an essay contest on topics related to global warming—what are the risks of the future in the community, or how your community could be the "Climate Protection Capital of the World." Create contests for ideas or change within school systems.

Create an online buzz:
Start a community-wide Internet listserv. Develop a web page on which anyone can contribute his or her thoughts, events and community building ideas. Do training with local high school students on using interactive software and ask them to help their parents get involved.

Town Hall Meetings:
Facilitate the organization of citizen-led meetings to mobilize public participation in identifying community priorities. Elect representative community development groups to plan local initiatives and build dialogue and cooperation with local governments.

Good news:
Start sending press releases to local papers, telling them about good things that have happened and people who have made a difference—from the students who are turning out lights in classrooms to the elders who are switching to compact fluorescent light bulbs downtown. As your climate protection initiative generates ideas and makes people aware of the good work already going on, this can become a steady source of good news. Follow up with reporters and editors and keep your eyes open for advertising sponsors to underwrite their coverage.

Art:
Pull together the artists in your community for a public art event to create the future. Find a big canvas that everyone can draw on. Make musical instruments available for improvisation. Bring recycled materials for people to make sculptures. Have lots of food and activities for young children.

Celebration of Assets:
Every single community has something it can celebrate. Find an excuse for a party, line up some local sponsors, and celebrate what the community will look like in 5, 10, or 20 years. A futuristic birthday party. Have a parade. Invite politicians to dress like they'll look in 15 years. Invite young people to be the politicians for a day. Make a huge paper maché statue in the middle of town to commemorate the celebration.

Challenge:
People like a challenge. They like friendly competition, and demonstrating what they do well. Sponsor a prize for the local business with the highest score on energy efficiency. Give awards to people who have made the world safe for our grandchildren.

Humor:
Find ways to make people laugh, from street theatre to standup comedy. The tough issues facing communities may not be funny, but our mistakes dealing with them usually are.

Climate activists have been preaching environmental disaster as a sole motivator for far too long. People are not motivated by fear and guilt as effectively as they are by hope and novelty.

The main message about engaging all sorts of different groups that can be considered "the public" is to go to them and meet them on their terms, rather than having them come to you. Ask to be put on the agenda for their regular meetings; attend the festivals and functions; get invited to speak at their clubs, churches, synagogues, mosques and community suppers—all of these are as important as holding meetings at city hall.

Within the business community it is important to appeal to the things that businesses find important. Find ways to promote those businesses that are participating in your project, such that other businesses want to get on the bandwagon. Full page ads with business logos, news stories about how a particular business is cutting its emissions, awards to businesses for innovation, future thinking, community service—all of these techniques will help you win credibility and participation from a group that is often slow to get involved. Portland, Oregon does this by awarding the BEST (Businesses for Environmentally Sustainable Tomorrow) award each year to seven different companies demonstrating excellence in business practices that promote economic growth and environmental benefits.

They post the winners on their web site and hold an award ceremony to present the award to each winning organization.[285]

Completing the Vision

Once the stakeholders have come up with a draft vision statement, bring it back to the community to discover whether it captures their ideas adequately. Publishing it in the paper with an easy way to respond, discussing it at city council meetings, holding meetings with many of the same groups that contributed at the outset—all of these techniques can help the Stakeholder Group determine if what they have drafted successfully reflects the aspirations of the community.

The Vision should be a short, inspirational, compelling statement about what the community wants for the future. Ideally, it will reflect all the different aspects of community life, not just economic goals. This is because a climate protection effort will find its most promising initiatives in things that meet the broad spectrum of human needs.

The following excerpt for Cambridge, Massachusetts' Climate Protection Plan[286] is a good example of how a vision statement around climate protection can be worded.

> **Vision Statement**[287]
> *In 2025, we see our world and city doing things better and smarter. We live and work in "energy smart" buildings that use readily available technology to maximize energy efficiency. Computerized controls on heating, cooling, and lighting systems automatically adjust for daylight levels and turn off when rooms are vacated. Appliances and office equipment use much less energy for the tasks they perform. Geothermal heat pumps eliminate the need for furnaces and boilers in many buildings. The demand for energy conservation services has created a bustling industry with well-paying jobs. Compared to 1990, citywide energy use is down by 50%.*
>
> *Cambridge also has dramatically reduced its reliance on centralized electricity systems. Buildings do not just consume electricity; they also produce power. Some have fuel cells that provide the energy reliability important to Internet businesses, biotech laboratories, and public safety operations. Solar photovoltaic panels and roof tiles are common; any excess power they produce is sold into the regional electricity grid, allowing the building owners to run their meters backwards.*
>
> *Solar thermal systems are installed to heat air and to produce hot water, reducing the need for fuel and electricity. Where electricity from the regional grid is still needed, users have negotiated contracts with suppliers, often through group buying programs, to buy electricity from renewable sources. Consumer demand is driving the installation of wind power turbines in the Berkshires and offshore, large-scale fuel cell facilities are running on hydrogen, and landfill gas is being recovered to generate electricity. Where renewable energy supply is insufficient, natural gas fuels clean-burning combined cycle generators.*
>
> *Rooftop gardens and green roofs are routinely installed on buildings of all types to reduce the need for air conditioners in the summer and to reduce storm water runoff to the Charles and Mystic rivers. The city's tree canopy has expanded as a result of aggressive planting and maintenance, reducing energy needs for adjacent buildings and increasing shading to offset the urban heat island effect. There is enough quantity and variety of vegetation to support songbirds, and the shaded sidewalks and pleasant open space encourage people to enjoy the city in summer instead of fleeing the heat.*
>
> *Fewer cars with single occupants are seen on the road. The regional transit system has expanded in response to demand for more and better service. Vehicles*

[285] Portland BEST Awards, www.portlandonline.com/osd/index.cfm?c=41891, 22 September 2006.
[286] City of Cambridge Climate Protection Plan, www.ci.cambridge.ma.us/CDD/et/env/clim_plan/clim_plan_full.pdf, 30 October 2006, also archived at, www.climatemanual.org/Cities/Chapter5/Cambridge_ClimatePlan.pdf, 30 October 2006.
[287] Cambridge Vision Statement, www.ci.cambridge.ma.us/CDD/et/env/clim_plan/clim_plan_3.pdf, 30 October 2006, also archived at, www.climatemanual.org/Cities/Chapter5/Cambridge_visionstatement.pdf, 30 October 2006.

running on alternative fuels, hybrid technology, and fuel cells have replaced diesel buses. Cyclists and pedestrians dominate the street instead of automobiles, since mixed use neighborhoods mean many destinations are within walking or biking distance. With so many people on the street, crime is significantly lower; with so many fewer cars, the streets are safer for everyone.

Very little material is thrown away. Products are increasingly made out of recycled materials. Manufacturers and retailers take back old products for refurbishing or recycling. The city provides a welcome home for diverse communities with its clean air, safe neighborhoods, and easy access to jobs, services, and recreation. Children have a sense that they are partners with adults as community stewards, and the city is safe for them to explore.

As a result of all these changes, the buildup of greenhouse gases in the atmosphere is abating and the threat of climate change is diminishing. While past emissions have caused the climate to shift, changing precipitation patterns, average temperatures, and sea level, scientists have lowered their concern about the scale of the impacts. This has happened because the previous generation recognized the problem and chose to modify their ways to protect future generations.

LASER provides a database of communities both throughout the workbook and as additional resources on its web site.[288]

Tools of Change: Social Marketing to Engage Stakeholders

The following information comes from the Tools of Change web site. Their planning guide is designed to help organizations plan, by providing space on the web site to insert their own plans and programs. The planning Stages for any program to engage community members[289] process is broken down into the seven sections below. More detail on each section is available on the web site.

1. Setting Objectives
2. Developing Partners
3. Getting Informed
4. Targeting the Audience
5. Choosing Tools of Change
6. Financing the Program
7. Measuring Achievement

Setting Objectives

In this stage you will work to identify the objectives you aim to achieve. This should be done through first evaluating the current situation, then setting the specific actions you want your stakeholders to undertake. You must also determine measurable objectives and how you are going to measure the success of meeting those objectives.

Developing Partners

Determine what/if any organizations you would like to partner with to achieve your objectives. Make sure to assess the pros and cons of partnering with each organization, what can you benefit from in particular from working with each organization.

Getting Informed

It is important to gather as much information around the subject prior to engaging your stakeholders. This means doing literature reviews, speaking with area experts, contacting other cities with similar programs, and getting a sense of your communities existing opinions and behaviors.

Targeting the Audience

Determine what group of people you most want to reach through your program. Who will have the greatest opportunity to change their behavior and reduce GHG emissions? What group of people are already interested, but do not have the information to act?

Choosing Tools of Change

You must decide now how to best motivate action in your target audience. What tools will engage individuals to make changes, continue the momentum of programs, spread the education, and remind individuals to act. This will also involve creating an effective marketing mix with a variety of messages and language.

[288] LASER Database, www.global-laser.org/cgi/laser/advancedsearch.html?id=o2Yco9Qc, 15 October 2006.
[289] Tools of Change, www.toolsofchange.com/English/planningguide.asp, 15 October 2006.

Important strategies to engage community members are:[290]

- Building Motivation Over Time
- Feedback
- Financial Incentives and Disincentives
- Norm Appeals
- Obtaining a Commitment
- Overcoming Specific Barriers
- Prompts
- Vivid, Personalized Communication
- Home Visits Mass Media
- Neighborhood Coaches and Block Leaders
- Peer Support Groups
- School Programs that Involve the Family
- Word-of-mouth
- Work Programs that Influence the Home

Financing the Program

The best way to ensure a program will continue over time is to design it to pay for itself. To achieve this goal it is important to:

Assess the value of and charge for the promotional opportunities you provide (coupons, demonstrations, referrals, advertising, public relations opportunities). What other promotional opportunities could you offer?

Assess the value of and charge for the products and services you provide. What other products and services would add value for your participants?

Choose low cost/low maintenance/high impact program activities

- These programs are highlighted in the Best Bets Section of Chapter 5.

Obtain funding from partners who benefit from your program or who want to encourage what you are doing.

Tie program activities to ones already being carried out by your organization and its partners

- City of Boulder is working with its utility, Xcel, to assess carbon fees (based on a successful 2006 Ballot Measure) on Boulder's residents and businesses.[291]

Establish partnerships with program delivery organizations, such as service clubs and community associations, who can offer volunteer labor on an ongoing basis

Measuring Achievement

It is important for any program to decide what measures to monitor frequently or at major milestones. For programs designed to educate, it might make sense to have a control group. Measuring and reporting performance is discussed later in this manual, Chapter 7: Monitor and Verify Results.

Tools of Change provides numerous case studies about organizations and the specific programs and social marketing tools they used to be successful.[292]

Business for Social Responsibility: Organizational Stakeholder Engagement[293]

Steps that businesses can use to engage their stakeholders are very similar to the measures city officials can use to involve the community in Climate Protection:

Business for Social Responsibility (BSR) is a leading global resource for the business community and thought leaders around the world. BSR equips its member companies with the expertise to design and implement successful, socially responsible business policies, practices and processes.

According to BSR, company approaches to developing stakeholder engagement are as many and varied as the types of engagement and the companies' motivations behind them, which range from crisis management to business strategy development. Regardless of the type of engagement, these key issues should be considered:

Build the Business Case

This is the first and most important step before entering into stakeholder engagements. Determine the specific goals being addressed and how the stakeholder relationship will help meet those goals. Whatever the goal, it should be articulated as specifically as possible. Among other things, this will help "sell" the benefits of the stakeholder relationship to and help stakeholders understand why the

[290] Tools of Change, www.toolsofchange.com/English/toolsofchange.asp, 15 October 2006.
[291] The Climate Action Plan Tax (CAP-T), Measure 202 on Fall 2006 ballot, is a tax on electricity bills. www.climatesmartboulder.org/how.html, 15 October 2006.
[292] Tools of Change Case Studies, www.toolsofchange.com/English/casestudies.asp, 15 October 2006.

parties are entering into this relationship.

Examine Costs, Opportunities and Risks

Part of the business case should include a rough cost-benefit assessment of the actions proposed. Costs can include the time, personnel, and resources that need to be committed to the relationship, the potential loss of market share or reputation that could result if things go poorly, and potential negative reaction among shareholders. It also is important to consider the risks associated with not acting at all. At the same time, take stock of the potential opportunities, including improved access to new markets, increased sales, greater public support (which could translate into tolerance of future mistakes or mishaps), improved morale, and enhanced satisfaction.

Do Your Homework

Identify potential stakeholder organizations with which to partner or engage, and conduct due diligence before contacting them. Use leaders of stakeholder groups to identify other individuals or groups who should be involved. Each stakeholder group has unique issues, interests, and willingness to engage in a partnership or dialogue. Learn about organizations with which you share vision or values, and, when appropriate, be willing to engage even your toughest critics. Find out each organization's motivations for partnering with you. Check a potential partner's reputation, read its publications, scan its web site, and research media clips about the group. Check references: Was the group open-minded, fair, and positive? Did it keep its promises?

Understand Expectations

Important factors to consider before actual engagement are the expectations of stakeholders from engagement. What are the respective drivers for stakeholder engagement and how will they influence the initial basis for understanding? Are there issues of language, jargon or technical knowledge that will hinder communication and understanding? Has it been a conflict situation where the different parties are sitting at the same table for the first time, or is it a multi-sector working partnership, where each party has different perspectives on successful outcomes.

Get to Know Each Other

"Walk a mile in each other's shoes," is the advice of one stakeholder engagement expert. Whether using one-on-one meetings, group interviews, focus groups, workshops, seminars, public meetings, questionnaires, web-based discussion forums or stakeholder panels, work to understand each other's viewpoints. Be as open and candid as possible in answering questions. Be willing to ask and be asked candid questions. Become as comfortable as possible with the specific individuals with whom you will be partnering. Keep in mind that partnerships are formed among organizations but succeed because of individuals.

Clarify the Agenda

A partnership between stakeholder groups should have a specific agenda, timetable, and goals—ideally, created and agreed upon by all parties. Determine what the deliverables will be, and who will deliver them. Ensure that the goals are both aggressive and manageable. Most experts say that such relationships should have a fixed duration so that projects don't drag on. Even if a stakeholder relationship succeeds it may be good to disengage for a while to gain perspective on the relationship and the value—or lack thereof—it has brought.

Agree on the Ground Rules

Find ways both parties can benefit and further their objectives, and ensure that the risks and benefits to both sides are equitable. There are a myriad of ground rules to consider. How much of the project will be publicly disclosed -- and by which parties, when, and under whose control? If there will be costs involved, who will bear them? Be careful where money is involved. Make sure it is well understood by all parties what, if anything, is expected for the money.

Get Top-Level Support

To give weight and credibility to the relationship, it should involve those high up in all the participating organizations appropriately from the onset of the relationship. This lets a partnership operate easily within the rest of the organizations and displays each organization's commitment to other partners.

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[293] Business for Social Responsibility Stakeholder Engagement, www.bsr.org/CSRResources/IssueBriefDetail.cfm?DocumentID=48813#external, 15 October 2006.

Lack of top-level support can greatly undermine a partnership's chances of success.

Speak with One Voice

Designate someone as the principal contact for the project or relationship. As much as possible, flow communication with the stakeholder group(s) through that individual to avoid conflicting information and to ensure that you are communicating a consistent message.

Harness Proven Tools and Techniques

Although stakeholder engagement may appear to be outside the normal realm of daily management, it can benefit from the application of some of the business tools and resources existing within companies. Examples include professional meeting facilitation, the use of indicators and goals to measure metrics and milestones, and information management systems to compile, track, and communicate information.

Respond

It is not enough for a government to listen to its stakeholders, or use the process to legitimize decisions without the possibility of change or influence. Ask: "Are we doing this because we genuinely feel stakeholders have something to contribute or is it because we feel we should and think it will be good for our image?" That is not to say that communities should (or could) meet all the demands of all their stakeholders.

Analyze and Report the Results

The value of stakeholder engagement will be enhanced if a community uses a variety of metrics and indicators and analyzes and reports on them during and after the relationship to determine whether and how the project met its goals. Stakeholder-related indicators typically cover such things as the specific, measurable results of the relationship, third-party facilitation, and the direct and indirect costs of managing the process. Periodic reports of the progress of the relationship are valuable to all involved. At the conclusion of the process, many communities issue a public report describing the relationship, including the process and the tangible results.

Understand the "Who, What, Where, When & How"

In summary consider the following:

Who is involved it the engagement? Engagement may focus on one or more groups. It may attempt to survey all individuals within a group or to identify a sample that is either representative or able to provide information of particular value.

What is the subject of engagement? Engagement may focus on a particular issue, or may be linked to a particular part of an organization's decision-making process. In some cases, there may be no clearly formed subject of engagement - the point is to allow the stakeholders to understand each other better and to allow important issues to arise unforced.

Where does the engagement take place? This may be driven by the use of a particular technique, for example the use of the Internet or postal questionnaire.

When is the engagement undertaken? The engagement may be a one-off process either to begin a process of debate or to close off a decision.

How does the organization engage with stakeholders - which methodologies and techniques does it use? A variety of techniques can be used to engage with stakeholders, including workshops, telephone hotlines, etc.

Additional Resources

Clean Air-Cool Planet – Community Toolkit
Clean Air-Cool Planet, with assistance from Jeffrey H. Taylor and Associates, have created this Toolkit to assist communities in implementing sustainable policies and projects. This web-based "how-to" guide for municipal staff and elected or appointed representatives provides:

- Step-by-step project guides
- Important contacts
- Financing mechanisms
- Cost implications
- Model ordinances

The Toolkit offers projects focused on energy, transportation, waste and land use.

Federal House in Order Initiative, Government of Canada: Staff Awareness & Training
http://www.fhio-ifppe.gc.ca/Default.asp?lang=En&n=C4F1C34D-1 Employee awareness is defined as the process of informing, training and involving your employees in any specific issue important to your organization, whether it be health and safety, waste reduction, or in the case of Federal House in Order, climate change. Employee awareness activities in the area of climate change can include, but are not limited to:

- Distributing climate change information to employees via emails, newsletters, websites or other communication mediums;
- Conducting employee awareness and orientation workshops, which include climate change topics such as the science of climate change and actions to reduce GHG emissions and improve energy efficiency;
- Establishing employee awareness teams and holding regular meetings to address climate change activities, while assessing new awareness and training opportunities within the organization, and
- Including climate change as a topic at staff meetings.

This section provides details on how to develop and implement an employee awareness program, information on existing awareness programs and employee awareness tools/resources.

Global Green USA – Local Government Green Building Initiative
http://globalgreen.org/greenbuilding/localGov.html Global Green USA works in partnership with local governments and other public entities to demonstrate the benefits of green building, outline options for establishing green building programs that protect local quality of life and the environment, provide training for staff and constituents, and encourage the development of incentives for green building projects. Current and past partners include San Mateo County and the Cities of San Francisco, San Jose, Los Angeles, Santa Monica, West Hollywood, Santa Clarita, and Irvine.

U.S. Environmental Protection Agency – Climate Change: State and Local Governments
http://www.epa.gov/climatechange/wycd/stateandlocalgov/index.html
The website provides details on actions by states and efforts by local agencies to address climate change, along with links to relevant EPA voluntary programs that can help states and localities meet their goals. It also provides a directory of tools that can help state and local governments inventory their greenhouse gas emissions, analyze greenhouse gas reduction opportunities and quantify the energy, environmental and economic benefits of lowering greenhouse gases.

The National Center for Atmospheric Research – "Climate Change and Water Resources: A Primer for Municipal Water Providers:
http://www.ucar.edu/communications/staffnotes/0606/water.shtml
Water utility managers now have a primer to help them learn about how climate change may affect the resource they manage. In the new book, Kathy Miller (ISSE) and David Yates (RAL) describe the science of climate change, suggest how it might affect water resources, and offer advice on planning and adaptation. The book is one of the first to address climate change and urban water utilities together. The focus is on usable information. The book is accessible to people from the industry, and involves them directly in identifying vulnerabilities and options for adaptation.

Clearwater Information Exchange – Council Staff Education & Training
http://www.clearwater.asn.au/stormwater_infoexchange.cfm?areatopic=true&AreaID=43&TopicID=103&CategoryID=1
The Clearwater InfoExchange **Stormwater database** provides information to assist councils and industry groups in Victoria Australia to manage stormwater more sustainably. This site is designed to be interactive so that councils and other organizations can share their experiences and knowledge.

Natural Capitalism Solutions
Natural Capitalism Solutions creates innovative, practical tools and implementation strategies to enable companies, communities and countries to reduce their carbon footprint. It facilitates stakeholder engagement in such settings as NGO/ corporate disputes, community economic development and government climate mitigation programs.

NCS developed this Climate Protection Manual for Cities presenting case studies, best practices, cost/benefit analyses, legislation, technical descriptions and contacts to facilitate climate action planning and implementation. It explains in detail ICLEI's five-step process in creating Climate Action Plans. Helps its clients implement energy efficiency auditing and retrofits, high performance municipal building codes, transportation programs, investment in green energy and many other climate protection strategies.

Orton Family Foundation
database website is a resource for communities (their professional planners, public agencies, and concerned citizens) to identify tools and processes for better community design and decision making.
http://www.smartgrowthtools.org/
http://www.orton.org/

Thomas Jefferson Sustainability Council
The council is using a multi-stakeholder process to preserve and assess the regional environment. The three-year program is bringing builders, developers, environmentalists, social scientists, elected officials, teachers and many others together to explore the definition of sustainability, indicators of sustainability and the comparative risks of current and proposed development policies
http://www.smartcommunities.ncat.org/success/thomas_jeff_sust.shtml

San Francisco Sustainable City Website
The website allows citizens to engage in the sustainability planning and education process through a forum on the site. The "listserv" is for broadcasting announcements about events, workshops, forums, programs, publications, websites and other resources that are relevant to sustainability issues.
http://www.sustainable-city.org/

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Chapter 5: Local Action Plan Best Bets **Municipal Buildings**

DOCUMENT CONTENTS

Retrofit City Buildings

Buildings are responsible for 50% of greenhouse gas emissions. Reducing the amount of energy used in municipal buildings contribute significantly to a city's greenhouse gas reduction targets. It can also save an enormous amount of money. Retrofitting a building means making changes or additions to a building that has already been constructed. Energy efficiency retrofits can be performed on any existing building, including city offices, libraries, police stations, fire stations, or any other structure owned by the municipality that uses electricity or heating fuels like natural gas.

Although the up-front cost of energy efficient technologies is often higher than their conventional counterparts, the energy efficient options save money in reduced monthly electricity bills. Many efficiency measures pay back in months, and go on to save enough to pay for themselves many times over in the course of their lifetime. Some, such as more efficient light bulbs will pay for themselves out of saved labor costs, because they last so much longer.

Energy efficiency retrofits of buildings include but are not limited to replacing old lighting with high efficiency lighting, replacing old appliances and equipment with ENERGY STAR® equivalents (www.energystar.gov), upgrading the HVAC system, adding insulation and window-shading, eliminating air leaks from doors and windows, and using automated systems like room occupancy sensors.

Lighting Retrofits

Compact Fluorescent Light Bulbs

Compact fluorescent light bulbs (CFLs) use one-quarter to one-third as much electricity as incandescent bulbs and last up to ten times as long. Replacing a 100-watt incandescent with a 32-watt CFL can result in energy savings of as much as $30 over the bulb's life. They also produce less heat so installing

them can reduce air conditioning loads. Their superior quality light can increase worker productivity and reduce error rates.[294]

ENERGY STAR®-qualified CFLs[295] provide the same amount of light as standard incandescent bulbs. CFLs also reduce the risk of burns and fires associated with the use of halogen bulbs that can reach temperatures of 1,000 degrees Fahrenheit.

T8 Flourescent Lamps with Electronic Ballasts vs. T12 with Magnetic Ballasts

All fluorescent lamps utilize bulbs and ballasts. One can replace both parts with more energy-efficient technologies. By replacing standard magnetic ballasts and T-12 fluorescent lamps with more efficient T-8 lamps and electronic ballasts, a building can consume 40% less energy for lighting.

The standard commercial lighting with the 1.5-inch diameter (T-12) cool-white fluorescent lamps and transformer-type magnetic ballasts is quickly becoming an obsolete technology. The combination of high-efficiency 1-inch (T-8) lamps coupled with electronic ballasts can reduce total energy use for lighting significantly. The light produced by the new systems more closely resembles natural light. The new technology also eliminates the rapid flicker and the faint buzz of traditional fluorescent lights. For each fixture of four lamps that is upgraded, the city can save about $12 a year in energy costs.[296] New T-5 bulbs are even smaller and more efficient.[297]

Room Occupancy Sensors

Occupancy sensors are automatic controls that detect when people enter and exit a room and adjust lighting, heating and cooling within the room as needed. Properly installed occupancy sensors can reduce energy costs associated with lighting and HVAC by up to 80%.[298] Modern sensors can self-adjust by "learning" about occupancy patterns throughout the day and warn room occupants of a pending shutdown. Override options allow room occupants to postpone sensor-triggered changes until they leave. Two types of occupancy sensors currently in the market are infrared sensors and ultrasonic sensors.

Utility Savings Initiative Fact Sheet-Occupancy Sensors allows cities to estimate the potential cost savings from adopting occupancy sensors.[299]

Energy Efficient Windows

According to the Department of Energy, 25% of the energy used to heat a building goes right out the windows.[300] The most efficient windows produced today insulate four times better than windows produced two decades ago. Multiple layers of thin plastic films suspended between the lights of glass can improve the insulation capacity of a window dramatically. Another factor is the thickness of air space locked in between the panes of glass in the windows. More air space will insulate much better than a thin air space. The insulation can be improved even more by substituting a low-conductivity gas such as argon for the air in the sealed air space.[301] Tinted glass coatings and low-emissivity (low-e) coatings reduce the amount of solar heat that enters the building while maintaining necessary light levels. Thin-walled steel, silicone foam and butyl rubber edge seals also contribute to maintaining an airtight seal and increase the insulation of windows.

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[294] Joe Romm, Greening the Building and the Bottom Line, Increasing Productivity Through Energy Efficient Design, www.rmi.org/store/p12details963.php, 20 December 2006.
[295] ENERGY STAR® web site, www.energystar.gov/index.cfm?c=cfls.pr_cfls, 22 September 2006.
[296] T-8 Fluorescent Lamps and Electronic Ballasts, Madison Gas and Electric website, www.mge.com/business/saving/detail/t8.htm, 19 September 2006.
[297] Service Lighting, www.servicelighting.com/library/light_bulbs_fluorescent_t5_lighting.cfm, 20 December 2006.
[298] "Low-Cost Occupancy Sensor Saves Money," Atmel Applications Journal, www.atmel.com/dyn/resources/Prod_documents/mega88_3_04.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Bulidings/Atmel_mega88_3_04.pdf, 19 September 2006.
[299] Occupancy Sensors, Utilities Savings Initiative, www.p2pays.org/ref/32/31316.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/OccupancySensors_factsheet.pdf, 19 September 2006.
[300] Divya Abhat, "GREEN LIVING: HOUSE & HOME. Green Glass, Stylish Window Treatments Help Clear the Air," www.emagazine.com/view/?2858, 20 December 2006.
[301] Alpen Inc.website, www.alpeninc.com/features/hm_low_e/index.html, 20 December 2006.

Even more important than the type of glass used, is to ensure that the cracks around the windows are properly caulked. Most buildings have enough little cracks to amount to leaving a window open all year.

Retrofit City Building

CASE STUDY: Portland, OR

In 1991, the city of Portland created a program called the City Energy Challenge (CEC) to reduce overall energy use in its municipal facilities and operations.

During the ten years after its creation, the CEC saved the city of Portland $9.6 million in energy costs.[302]

That resulted in avoiding the emission of 115,000 tons of carbon dioxide during the same decade.[303] The promotion of energy efficiency in city buildings and facilities comprises a significant part of this program. The following three examples of municipal building retrofits in Portland demonstrate that upgrades of existing city buildings can provide positive returns on investment in under a decade.

The Portland Building is one of the highlights of the CEC Project. It is a 15-story municipal office building constructed in 1982 with a total floor area of 360,000 square feet. The retrofit process began in 1992 as a three-phase project to install several different energy efficient improvements throughout the building. During Phase I the building's lobby received a massive upgrade of its lighting system. Old lighting fixtures were replaced with CFLs. The interior walls received a new coat of lighter-colored paint. With these improvements, the lighting levels in the lobby increased dramatically while the total wattage used fell from 21.5 to 1.5 watts per square foot. Phase II of the Portland Building retrofit targeted the lighting fixtures throughout the rest of the building and employed similar technology upgrades. Phase III of the retrofit included the installation of a lighting control system that turns office lights off at a specified time. To avoid inconvenience, the system shutdown can be overridden by a room's occupants.

The total estimated investment of $200,000 in retrofits for the Portland Building save the city taxpayers approximately $35,000 a year in reduced energy costs.[304]

Fire Station #1
In 1994, several fire stations in Portland received major retrofits as part of the CEC project. A major upgrade of Fire Station #1 cost $80,000 to implement and saves $8,000 a year. The station's old lighting system of 300 T-12 magnetic fluorescent lights was replaced with T-8 electronic systems. Occupancy sensors were installed in many of the station's rooms. The retrofit also included a new, more efficient HVAC system.

Portland City Hall
In 1998, the CEC project turned an old, dark stuffy city hall building into a model of unique energy efficiency retrofitting. Efficient CFL light fixtures that maintained the building's historic character replaced the outdated lighting system. Walls received a new layer of insulation. New double-glazed glass windows replaced old ones that had been covered up during previous renovations. The renovation of interior atriums and their skylights that had also been hidden by previous "upgrades" provided a natural source of light throughout the building's four floors. With a total investment of $105,000, the Portland City Hall Renovation Project saves the city an estimated $15,000 a year.

[302] CEC Ten Year Report, Office of Sustainable Development, City of Portland, 2001, www.portlandonline.com/shared/cfm/image.cfm?id=111736, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/CEC_TenYearReport.pdf, 29 September 2006.
[303] Ibid.
[304] E-mail from Michael Armstrong, City of Portland, June 30, 2006.

City Facility	Investment	Annual Savings	Simple Payback	Tons of CO_2 Avoided per year	$/ton CO_2 avoided
Portland Building	$200,000.00	$35,000.00	5.7 years	291.67	- $74.29
Fire Station #1	$80,000.00	$8,000.00	10 years	66.67	- $40.00
Portland City Hall	$105,000.00	$15,000	7 years	125.00	- $25.26

Table: Returns on Investment and per-ton CO_2 Reduction Costs
City of Portland Municipal Buildings[305]

Complementing the major renovations of these and other municipal buildings is the city of Portland's policy of purchasing only ENERGY STAR® or equivalent products, when available, for any equipment that uses electricity, natural gas or fuel oil. It is estimated that each non-ENERGY STAR® personal computer that is replaced with an ENERGY STAR® equivalent accounts for nearly one ton of CO2 avoided and $15-$25 of annual electricity cost savings.[306]

Funding for CEC

The Energy Challenge receives its funding through a 1% surcharge on each municipal bureau's energy bill with an annual cap of $15,000 from any one agency. The $75,000 raised covers the cost of an energy manager for the city. The City Energy Challenge saves the city an estimated $2.3 million in expenses each year.

In addition to the in-house surcharge, the State of Oregon offers tax credits for energy and building efficiency projects.

Although the city governments of the State of Oregon do not have to pay taxes and therefore do not benefit directly from a tax credit program, these tax credits may be "passed through," or transferred from the city government to other entities. This enables city governments to trade tax credits with local businesses in exchange for goods or services. The businesses can then use the tax credits, keeping the tax benefits within the community and cultivating competition among local businesses for the provision of energy efficient products.

Model Plans

City of Portland 1990 Energy Policy

City of Portland 2000 Energy Policy Progress Report[307]— *1990 Energy Policy: Impacts and Achievements*

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(503) 823-7082

[305] Michael Armstrong, city of Portland. City of Portland City Energy Challenge Ten-Year Report, Office of Sustainable Development. Note: CO2 calculations based on 15-year building lifespan, $0.085/kWh and 0.00065 tons CO2/kWh (from Climate Trust U.S. Marginal Grid Intensity Factors).

[306] Charleston Local Action Plan on Climate Change, December 2003, p. 7, www.cofc.edu/ghgas/Charleston_SC_%20LAP.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/Charleston_LAP.pdf, 29 September 2006.

[307] Portland Energy Impacts & Achievements Report, 2000, http://www.caleep.com/docs/resources/policies/Portland-energypolicyupdate2000.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/Portland_Energy2000.pdf, 19 September 2006.

CASE STUDY: Tucson, AZ

In June 2006, the city of Tucson created the Office of Conservation and Sustainable Development. One of the new office's initiatives is the promotion of energy efficiency design principles and technologies in municipal facilities and throughout the desert community of 500,000 people.

The state of Arizona requires all buildings to meet the Model Energy Code (MEC), a set of national standards for lighting, insulation, window glazing and other energy efficiency features. The city of Tucson established its own energy efficiency standards for buildings in 1998 that are 50% higher than the MEC. The Tucson "Sustainable Energy Standard" applies to all new construction and renovation of municipal buildings and facilities. After positive feedback on the program from contractors and builders, the city of Tucson expanded the SES. It is now a citywide voluntary standard on all construction. The process involves designers and contractors to ensure that all parties understand the benefits and potential savings of energy efficiency.

The following table highlights the retrofit of one of the city of Tucson's municipal buildings under the SES. For additional information about the city of Tucson's energy efficiency programs, visit their web site.[308]

The Thomas O. Price Service Center Building is a city administrative office building with one floor and 23,400 square feet. In 1995, the city of Tucson began a major energy efficiency upgrade of the building, including a lighting retrofit, installation of an energy management and control system, and the replacement of a constant volume air handling system to a variable air volume system. The following chart details the costs and returns on investment of the specific retrofits.

Project	Investment	Annual Savings	Simple Payback	Tons of CO_2 avoided/year	$/ton CO_2 avoided
Lighting Retrofit	$31,300.00	$5,700.00	5.5 years	61.28	- $58.96
Occupancy sensors	$3,000.00	$375.00	8 years	4.03	- $43.42
Energy management & control system/variable air volume system (and others)	$24.993.00	$22,400.00	5.7 years	240.8	- $57.53
New roof coating	$24,993.00	$4,000.00	6.25 years	43	- $54.27
TOTAL	$187,493.00	$40,000	5.77 years	349.11	- $78.77

Table: Returns on Investment and per-ton CO_2 Reduction Costs[309]

[308] Tucson homepage, www.tucsonaz.gov, 19 September 2006.

[309] SWEEP, www.swenergy.org/casestudies/arizona/tucson_topsc.htm
Note: CO_2 calculations based on 15-year building lifespan, $0.06/kWh and 0.000645 tons CO_2/kWh (from Climate Trust U.S. Marginal Grid Intensity Factors).

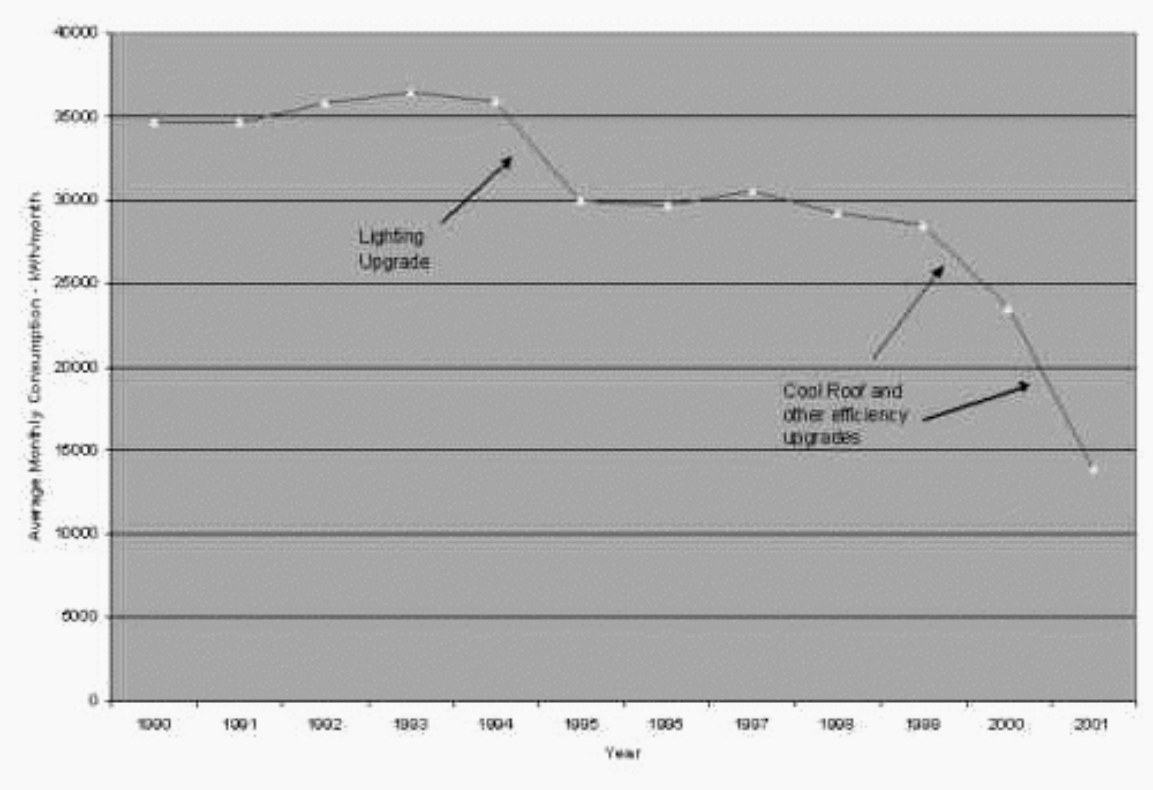

Figure : Thomas O. Price Service Center Building One, Average Monthly Electricity Use (kWh)[310]

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[310] SWEEP, www.swenergy.org/casestudies/arizona/tucson_topsc.htm, 19 September 2006.

Retrofit City Buildings

CASE STUDY: Fort Worth, TX

Between 2001 and 2003, the city of Fort Worth, Texas, reduced its electricity consumption by 16%. This was in part due to the passage of Senate Bill 5 (SB5),[311] the Texas Emissions Reduction Plan, by the Texas Legislature in 2001. The new law required all city and county governments in the state to implement all cost-effective energy efficiency measures. The law requires the governments to establish a goal of 5% reductions annually in electricity use for government facilities and operations between2002 and 2006.

The city of Fort Worth surpassed the state's efficiency benchmarks, by implementing cost-effective strategies in coordination with a private company that specializes in energy efficiency retrofit projects known as an Energy Savings Company (ESCO). In Fort Worth's case, the $3 million performance contract offered projected savings on electricity of more than 4 million kilowatt hours a year for total electricity savings of $259,000 a year.[312] The city also qualified for a sizeable rebate from the local utility.

Many states have ESPC legislation, including Florida[313] and Wisconsin[314]. There are many other resources that might be useful to a municipality exploring the use of ESCOs, including the National Association of Energy Service Companies[315] and Model Performance Contracting Legislation[316]

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[311] Texas Legislature Online, http://www.legis.state.tx.us/, 19 September 2006.
[312] Rebuild America State and Local Government Success Story, September 2004, www.rebuild.org/attachments/SolutionCenter/Fort_Worth_FINAL102604(1).pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/Fort_Worth_rebuild.pdf, 29 September 2006.
[313] ESPS legislation—Florida www.flsenate.gov/statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=Ch0489/SEC145.HTM&Title=-%3e2003-%3eCh0489-%3eSection%20145,.also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/ESPCFloridaLegislation.pdf, 19 September 2006.
[314] ESPS legislation—Wisconsin folio.legis.state.wi.us/cgi-bin/om_isapi.dll?clientID=54264357&infobase=stats.nfo&j1=energy%20savings%20performance%20contracts&jump=energy%20savings%20performance%20contracts&record={CBA4}, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/ESPCWisconsinLegislation.pdf, 19 September 2006.
[315] National Association of Energy Service Companies, www.naesco.org, 19 September 2006.
[316] Model Performance Contracting Legislation, www.naseo.org/energy_sectors/buildings/performance_contracting.htm, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/ESPCSampleLegislation.pdf, 19 September 2006.

Retrofit City Buildings

CASE STUDY: Visalia, CA

In 2001, the city of Visalia, California[317] began work on three major projects to increase energy efficiency in their city operations.

1. Upgrading their HVAC systems
2. Replacement of the majority of building lighting
3. Installing traffic signals with LED lighting

The city hired Invensys Building Systems, a performance contracting company who guarantees energy reduction and electricity cost savings. The company will pay the difference between the expected results and actual results if expectations are not met.

The city replaced 55 HVAC Systems with Bryant (Carrier) units in 12 of the city's buildings, costing $241,098. The city received a $35,000 rebate from its utility, Southern California Electric.

Based on project estimates, the net present value of the HVAC retrofit for 10 years of energy savings is $67,015.[318]

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Energy Service Companies and Energy Savings Performance Contracts

Energy Service Companies (ESCOs) are private businesses that specialize in energy efficiency retrofitting projects.

City governments can contract with ESCOs to develop and implement cost-saving retrofit projects. The ESCO conducts an energy audit of the city facilities, presents an analysis of specific energy savings that can be implemented, and provides an estimated timetable for payback of costs. The ESCO finances the entire project with no upfront cost to the city. The ESCO recovers its costs and makes a profit from a percentage of the energy savings over a period of time agreed upon with the city. These contracts, known as Energy Savings Performance Contracts (ESPCs), act as a guarantee of energy savings for cities that prefer to mitigate the risk of heavy upfront costs for energy efficiency retrofit projects. Due to the tremendous amount of cost-savings potential in most buildings, payback periods for ESCOs are usually between two and ten years. Upon completion of the ESPS, the city owns a more efficient building that costs much less to operate and has a higher value.

A report issued in 2002 by the National Association of Energy Service Companies and Lawrence Berkeley National Laboratory notes that total services provided by ESCOs annually exceeds $1.9 billion.[319] The report estimates that lighting retrofits by ESCOs achieve a median 47% savings over the old lighting systems and combination lighting and non-lighting retrofits achieve a median savings of 23%. ESCOs are also a source of new jobs for the community.

Energy Savings Performance Contracts (ESPC) authorizations exist at both state and federal levels. Unfortunately, the federal Energy Savings Performance Contracting program was set to expire on October 31, 2006. Because federal authorization for ESPCs is not guaranteed beyond 2006, it is vital that states ensure the viability of ESCOs for years to come. Coalitions of environmental, labor, community and business leaders are lobbying state governments to provide this authorization.

[317] City of Visalia website, www.ci.visalia.ca.us/, 5 December 2006.
[318] Flex Your Power Example, www.fypower.org/pdf/CS_LG_Visalia.pdf, 5 December 2006.
[319] "New Report Documents $2 Billion Annual Investment in Energy Efficiency by ESCOs." National Association of Energy Service Companies, 2002.

CASE STUDY: New Haven, CT

The city of New Haven, Connecticut, has saved approximately $24.7 million since a major energy overhaul. Starting in 1994, Mayor John DeStefano, Jr. and his administration identified the rising costs and usage of energy in municipal facilities as a major risk to the city's financial well-being. They took steps to mitigate the risk with energy efficiency upgrades. According to the City's Energy Conservation Program Summary in August of 2005, New Haven paid $14 million in energy-related costs for its city buildings and operations in 1994. In addition to more than 300 existing facilities and a citywide street lighting system, the city of New Haven had plans to upgrade its schools and build several new schools for the community.

The city formed an Energy Committee to analyze the energy situation and devise an action plan. The Committee wisely identified energy efficiency as the most cost-effective way to address the growing energy demand and costs. Even with the additional energy demand of 23 new and renovated schools, the Energy Conservation Program has cut the city's energy cost by $5 million per year. The city has established a goal of achieving an additional $6.1 million per year of savings by the year 2010.

The Energy Conservation Program includes an ESPC between a private contractor and the Board of Education. Over the nine years of the lease, the schools will achieve a guaranteed $8.8 million in cost savings with the installation of $6.1 million in improvements. Seven years into the Performance Contract, the Board of Education has already saved $8.35 million.[320]

The Energy Committee's strategy includes monitoring energy use and managing demand. With a series of grants from Rebuild America and other state and federal grants, as well as a performance contract with United Illuminating for the installation of infrastructure, the city installed an Energy Management System to monitor energy use and control electricity in all of its facilities from a central location. The system limits energy consumption during peak hours when electricity is much more expensive. The energy management does not adversely affect the facilities' ability to function normally.

To fund the significant investment necessary to implement the Energy Conservation Program, the city of New Haven has applied for and received $2.5 million in state and federal grants. It has also qualified for $955,501 in utility rebates and incentives as a result of its reduction in total energy use.

Among the many technologies the city has used to achieve such high levels of energy savings are:

Occupancy sensors

Upgrade of lighting with high-efficiency fluorescent lights

Replacement of old traffic lights with LED traffic lights

High pressure sodium street lights

Installation of high-efficiency motors and pumps

Energy monitoring systems

[320] City of New Haven Energy Conservation Program Summary, 30 August 2005, p. 7. Online: www.cityofnewhaven.com/Finance/pdfs/EnergyConserReport8-30-2005.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/NewHaven_EnergyConserReport.pdf, 21 September 2006.

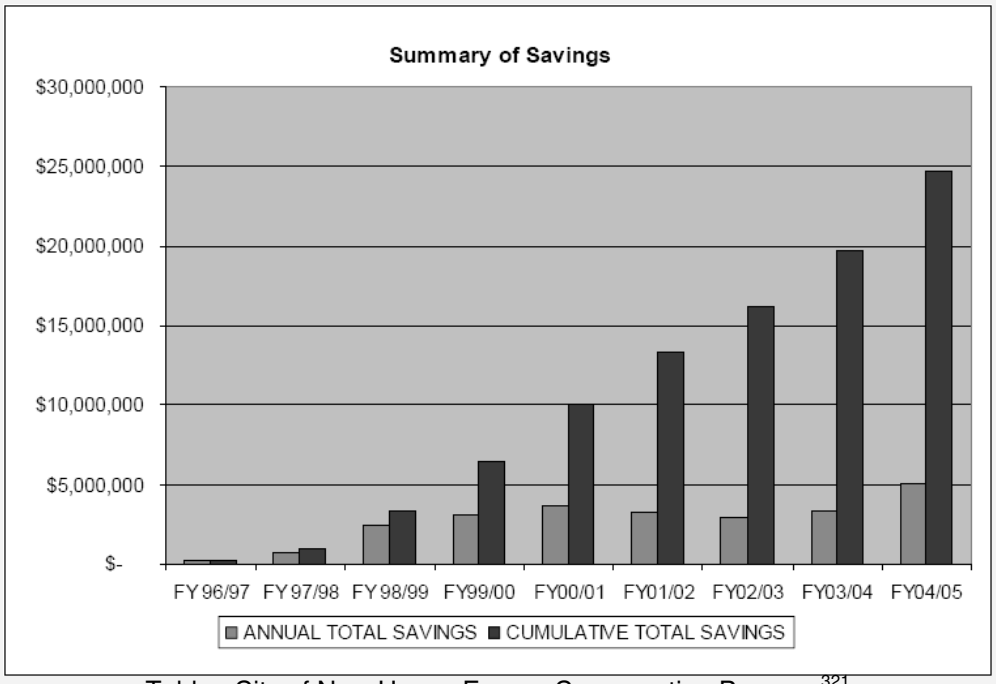

Table: City of New Haven Energy Conservation Program[321]

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Energy Efficiency Standards in New Construction and Renovations

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System is the most widespread set of national standards for buildings. It was developed by the U.S. Green Building Council (USGBC) to provide consistent guidelines in the design and construction of many types of high-performance buildings, and a quality assurance program. The LEED Rating System evaluates the building as a whole system. The building can achieve a level of Certified, Silver, Gold or Platinum, based on meeting a number of different criteria with points given for each measure.

In a report written for the California Sustainable Building Task Force in 2003, several architects and construction contractors compared the actual costs of 33 green buildings with the estimated costs of the same buildings using standard designs. The results of the survey indicate that compliance with LEED Certification standards increases upfront costs by under 2% (or $3 to $5 per square foot). This 2%

[321] Ibid.

upfront investment is estimated to produce a life-cycle savings of 20% of total construction costs.[322] Another study by Davis Langdon Seah International suggests that cost premiums for efficiency improvements can range between 1 and 4% for LEED Silver and up to 10% for LEED Platinum certification.[323] Over the course of the LEED certified buildings' lives, the savings in total costs can be as much as 10 times more than the extra cost of sustainable design.[324] An investment of $100,000 to integrate sustainable design features into a new building can therefore produce a return of $1 million in saved costs over the building's life.

LEED Standards for Retrofits include Major Renovations[325], Sustainable Operations and Maintenance of Existing Buildings[326] and Tenant Improvements of New or Existing Office Space.[327]

Benefits of Green Buildings

There are several advantages to incorporating LEED Certified designs into city buildings. By using fewer resources, the city will significantly reduce operating costs. Several studies suggest that employees are more productive and generally more satisfied working in a building that uses more natural light.[328] Another study by the Lawrence Berkeley National Laboratory indicates that reducing indoor air pollutants through green building design could save U.S. businesses $58 billion in avoided sick time and another $200 billion in increased worker productivity.[329] Incorporating green building standards for new city

buildings contributes to the protection of ecosystems and biodiversity, improves the quality of the city's air and water, sends fewer tons of waste to the city's landfills and conserves the area's natural resources. Green buildings can also be a significant public relations tool, attracting the best and brightest workers to the city's offices. A recent Harvard Business Review article on green buildings concluded that the term "green building," "Suggest lower overhead costs, greater employee productivity, less absenteeism, and stronger employee attraction and retention….Green is not simply getting more respect; it is rapidly becoming a necessity as corporations—as well as home builders, retailers, health care institutions, governments and others—push green buildings fully into the mainstream over the next five to ten years. In fact owners of standard buildings face massive obsolescence. They must act now to protect their investments. 'Building owners are starting to do reviews of their portfolios to see how green their buildings are and what they need to do to meet growing market demand.'"[330]

Life Cycle Cost Analysis

The costs to operate and maintain a building usually exceed the initial cost of its construction many times over. Life cycle cost analysis is an innovative tool for project analysis that takes these long-term costs into account when comparing different design options for a new building. It factors into the equation the following sets of costs:

Initial design and construction costs

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[322] Greg Kats, "The Costs and Financial Benefits of Green Buildings: A Report to California's Sustainable Building Task Force", October 2003, p. viii, www.usgbc.org/Docs/News/News477.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/USGBC_News477.pdf, 19 September 2006.

[323] Lisa Faye Matthiesson and Peter Morris, "Costing Green: A Comprehensive Cost Database and Budgeting Methodology", July 2004, p. 16. Available online davislangdon-usa.com/Attachment%20Files/Research/costinggreen.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/CostingGreen.pdf, 19 September 2006.

[324] Kats, "The Costs and Financial Benefits of Green Buildings: A Report to California's Sustainable Building Task Force."

[325] U.S. Green Building Council, www.usgbc.org/DisplayPage.aspx?CMSPageID=220, 23 September 2006.

[326] U.S. Green Building Council, www.usgbc.org/DisplayPage.aspx?CMSPageID=221, 23 September 2006.

[327] U.S. Green Building Council, www.usgbc.org/DisplayPage.aspx?CMSPageID=145, 23 September 2006.

[328] Judith Heerwagen, "Do Green Buildings Enhance the Well Being of Workers?" Environmental Design and Construction Magazine. July/August 2000. Available online at www.edcmag.com/CDA/ArticleInformation/coverstory/BNPCoverStoryItem/0,4118,19794,00.html, 21 September 2006.

[329] William J. Fisk, "Health and Productivity Gains From Better Indoor Environments and Their Relationship With Energy Efficiency", Annual Review of Energy Environment. October, 2000, https://www.usgbc.org/Docs/Resources/Fisk(LBNL)HealthandProductivityEE2000.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/Fisk_HealthandProductivity_2000.pdf, 19 September 2006.

[330] Charles Lockwood, "Building the Green Way," *Harvard Business Review*, June 2006.

Operating costs (energy, water, wastewater, trash collection, recycling, and other utilities) Maintenance and repair

Environmental costs/benefits (impact on air quality, water quality, natural environment)

Social costs/benefits (productivity of workers, indoor air quality, worker sickness)

Value (positive or negative) of the building after specified lifespan timeframe

The federal government evaluates energy and water conservation projects and renewable energy projects in all federal buildings using life cycle costing methodology.[331]

Energy Efficiency Standards

CASE STUDY: Oakland, CA

In 1998, the Oakland City Council adopted a Sustainable Development Initiative as an overriding set of principles guiding the city's economic development. The Initiative includes five action points that the Council identified as the best opportunities for implementing the ambitious plan. One of the action points is the integration of green building design in all new city-funded construction projects and major renovations. The city developed sustainable design guidelines that cover site selection and preparation, transportation to/around the location, water and energy use, indoor environmental quality, selection of building materials, and waste reduction. All projects that utilize the city of Oakland funds must meet these sustainable design standards.

City LEED Mandate

Chapter 15.35 of the city of Oakland's Municipal Code[332] states:

To promote economic and environmental health in Oakland, it is key that the city itself, through the design, construction, operations and deconstruction of its own facilities, provide leadership to both the private and public sectors in the arena of energy efficiency and "green" building practices. The most immediate and meaningful way to do this is to require the integration of green building strategies in as many public city buildings as feasible.

Therefore, the purpose of these provisions is to prescribe green building requirements to covered city building projects and traditional public works projects.

The city of Oakland requires that all new buildings that cost more than $3 million and all major renovations to existing buildings that cost more than $3 million achieve LEED Silver certification or better. The law also stipulates that a LEED-accredited professional must be on the principal design team. The Oakland Sustainable Design Guide[333] is a tool that informs designers, builders, operations staff and occupants about the process of integrating green design into new and renovated city facilities. The Design Guide builds off of other green building rating systems, including LEED, Green Building Challenge '98, and BREEAM, but is uniquely tailored to fit the needs and priorities of the city of Oakland.

The Design Guide provides green building strategies that are organized according to seven environmental design topics, listed:

1. Site Strategies
2. Water Strategies
3. Energy Strategies
4. Interior Environmental Quality Strategies
5. Material Strategies
6. Waste Strategies
7. Transportation Strategies

Each of the strategies has performance indicators that must reach certain standards to obtain a specified number of points.

[331] Life Cycle Costing Manual is a guide to understand the LCC methodology established by the Federal Energy Management Program, www.bfrl.nist.gov/oae/publications/handbooks/135.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/LCCA Guide_FEMP.pdf, 27 September 2006.

[332] Full provisions of Chapter 15.35 available at www.bpcnet.com/cgi-bin/hilite.pl/codes/oakland/_DATA/TITLE15/Chapter_15_35_GREEN_BUILDING_R.html, also archived, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/Oakland_Chpt15.35.pdf, 30 October 2006.

[333] Oakland Sustainable Design Guide, www.oaklandpw.com/page46.aspx, 19 September 2006.

There are a total of one hundred points that are distributed among the strategies according to the perceived environmental and human impacts and can be weighted to reflect the city's priorities. The scoring system can also be changed to account for specific opportunities and constraints of the project.

The Oakland Sustainable Design Guide is flexible enough to allow it to grow and change with the development of new technologies and new city priorities. It is a process-oriented guide that is easy to follow and addresses the entire life cycle of the buildings. The Guide makes it easy for everyone involved in the design, construction and use of new and renovated city buildings to incorporate the principles of sustainable design and meet the requirements that the city has established.

To promote the principles of the Sustainable Design Guide among local businesses and residents, Oakland created a Green Buildings Resource Center in February 2000. The Center offers a variety of resources on site design, building products, energy/water efficiency, and solid waste management.

The city of Oakland also offers monthly lunch training sessions for city staff in green building & purchasing strategies.

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Energy Efficiency Standards

CASE STUDY: Salt Lake City, UT

Salt Lake City Mayor Rocky Anderson issued an Executive Order in 2005 mandating that all new municipal buildings and major renovations meet at least LEED Silver certification.[334] Salt Lake City has been a strong leader with the implementation of its Climate Action Plan.[335] By 2005 Salt Lake City has reduced the carbon emissions in its municipal operations to 21% below its 2001 baseline level. The recently-inaugurated Intermodal Transportation Hub building is LEED "certified."

The Executive Order signed by Mayor Anderson mandates:

> It is the requirement of this Executive Order that, in order to obtain the benefit of reduced operating and maintenance costs and other building efficiencies, as well. as cost-saving healthy environmental practices, the City will endeavor to apply the LEED guidelines to City construction to the extent practicable, and will design and construct facilities that will qualify for a LEED rating of at least a "Silver" level. Because LEED certification can provide significant savings beyond any initial incremental construction cost increase, the City finds that endeavoring to achieve LEED certification is in the best interest of the City

Since Executive Orders are only enforceable while the mayor that signed it is still in office, the Salt Lake City Council plans to pass a permanent version of this legislation.

The Salt Lake City High Performance Building Task Force is responsible for the implementation of LEED standards in the design and construction of new city buildings and in major renovations. There is also a significant effort to promote the construction of high performance buildings in the private sector.

> By making this commitment to high performance buildings, we will set an example for other environmentally-minded businesses, and we will help stimulate the market for sustainable building technologies…We will also explore all of our options in terms of creating incentives for businesses to implement these principles. We allocate millions of dollars each year to

[334] Executive Order: www.slcgreen.com/pdfs/execorderLEED.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/LEED_ExecutiveOrder_SLC.pdf, 21 September 2006.
[335] Salt Lake City Climate Action Plan, www.slcgreen.com/pages/actionplan.htm, 19 September 2006.

non-governmental projects through our Redevelopment Agency and Community Development Block Grants—all of which are opportunities to encourage high performance building.

-- Rocky Anderson, Mayor of Salt Lake City[336]

Results of Salt Lake City High Performance Building Standard

Intermodal Hub: When it reaches full capacity in 2008, the hub will serve as a transportation nerve center, complete with an Amtrak station, Greyhound bus depot, Utah Transit Authority bus transfer station, TRAX light rail station, commuter rail station, taxi cab stands and added amenities for bicyclists. The additional charge for building the Intermodal Hub to the LEED "certified" standard was approximately 2% of the total budget. With the LEED design saving a projected 20-25% per year in energy costs, it is estimated to payback the additional construction costs in less than 10 years.

Salt Lake City Main Library[337]: The new main library in Salt Lake City opened in 2003 and cost $65 million to construct, and although it has not received official LEED certification it incorporates many LEED elements in its design, including a five-story glass wall facing the expansive Wasatch range and a large park area outside and around the building.

The Sorenson Unity Center: Planned for Salt Lake City's Burgeoning west side, the Sorenson Unity Center is planned and budgeted for LEED certification. This will be the second LEED certified building constructed by Salt Lake City.

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Energy Efficiency Standards

CASE STUDY: Scottsdale, AZ

On March 22, 2005, the city of Scottsdale became the first U.S. city to adopt a LEED Gold standard for all new and renovated city buildings. The new Scottsdale Senior Center, completed in 2006, is the city's first LEED Gold building.

In 1998, Scottsdale established Arizona's first Green Building Program. The residential home program is a voluntary, consumer-driven effort to encourage environmentally responsible building in the fragile ecosystem of the Sonoran Desert. The Green Building Program offers incentives to designers and construction companies that participate. Since 1998, the city has issued 932 green building permits. In 2005, 33% of all single-family residential homes achieved Scottsdale's Green Building Program standards. The program's consumer base is rapidly expanding, with an increase of 189% in green housing starts between 2004 and 2005.[338] A recent survey (conducted by the National Association of Home Builders NAHB) Research Center found that 46% of consumers expecting to buy a newly built home or spend more than $10,000 on renovations wanted to incorporate green features into their homes and did not consider the cost of green building features an obstacle.

The city of Scottsdale's Resolution No. 6644[339] requires all new city buildings of any size to be designed, contracted and

[336] Salt Lake City Press Release from 10 October 2006, www.slcgov.com/mayor/pressreleases/hp%20buildings.htm, 19 September 2006.
[337] Link to Mayor Anderson's comments on Library Inauguration, archived at www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/MayorAnderson_SLCMainLibrary_2003.pdf, 21 September 2006.
[338] City of Scottsdale Green Building Program website, "One Out of Three Scottsdale Homes are Going Green", www.scottsdaleaz.gov/news/2006./January/01-12-06.asp, 19 September 2006.
[339] Resolution No. 6644: www.ci.scottsdale.az.us/greenbuilding/LEED/LEED_ResNo6644.pdf, also archived at www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/Scottsdale_LEED_ResNo664419.pdf, 19 September 2006.

built to achieve LEED Gold certification. In addition, all future renovations and non-occupied city buildings must be designed, contracted and built to include as many principles of both the LEED program and the city's Green Building Program as possible. The city of Seattle is the only other US city to implement LEED Gold standards for municipal construction.

For all city of Scottsdale construction projects that have an expected simple payback of more than five years, city staff must analyze which level of LEED certification is most appropriate for that specific project and make recommendations to the City Council. This clause allows the Scottsdale City Council to maintain control over the costs of municipal construction projects. Scottsdale city staff work closely with local designers and contractors in the development of city construction projects, a relationship that stems from the strength of the Scottsdale Green Building Program.

The Scottsdale Green Building Program provides resources and incentives to both consumers and construction companies for the promotion of green buildings throughout the city. Resources available to local designers and construction contractors include a lecture series, workshops, special events and green design manuals. The educational programs provide information on energy/resource efficiency and feature experts in all areas of environmental design and construction. Green homeowners receive a "homeowner's manual" that explains the different features of their new home.

The Green Building Program[340] rates building projects in the following six environmental impact areas:

1. Site use
2. Energy
3. Indoor air quality
4. Building materials
5. Solid waste
6. Water

A green building point rating system is used to evaluate the projects. There are over 150 green building options, providing greater design flexibility while maintaining a whole building systems approach. The Green Building Program is voluntary and open to all builders in the Scottsdale area.

Builders that participate in the program are required to attend the educational programs the city offers. They must also take part in the annual events like the Green Building Expo. As a reward for their participation, builders qualify for expedited permitting and other assistance from the city, positive media exposure via construction site signs and recognition on the city's website, and a listing in the Green Building directory.

Results[341]

The new Scottsdale Senior Home[342] is 37,600 square feet and cost nearly $12 million to construct. It is the city of Scottsdale's first LEED Gold municipal building. The city estimates that the building's green features added about 2% to the total price tag and will use roughly half the power of a conventional building. The Senior Home design incorporates an array of solar panels that produce 30% of the building's electricity.

The building's location was planned in order to maximize natural light and shading. Other energy saving features include an extremely efficient heating and cooling system and a superinsulated roof. The Scottsdale Senior Home has an expected simple payback of less than five years.

The ASU Scottsdale Center for New Technology and Innovation is currently under construction and will be the largest commercial project in Scottsdale with LEED certification. The city hopes the center's green features will attract tenants and businesses that provide technology-related services.

Other city projects in the pipeline include:

Arabia Library (LEED Silver)

Police Forensic Lab

[340] For more information on Scottsdale's Green Building program visit -www.ScottsdaleAZ.gov/greenbuilding, 19 September 2006.
[341] Scottsdale Green Building Program Progress Report 2005, www.scottsdaleaz.gov/greenbuilding/Reports/0106ProgressRpt.pdf, also archived at www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/ScottsdaleGrnBuildingReport_2005.pdf, 21 September 2006.
[342] Senior Center Green Features, www.ci.scottsdale.az.us/smittys/pdf/SrCtrGreen.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/SrCtrGreen_2006.pdf, 21 September 2006.

Police District Station 1

Fire Station No. 2

Westworld Exhibit Hall

Scottsdale Center for the Performing Arts Interior Remodel (LEED Silver)

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Energy Efficiency Standards

CASE STUDY: Austin, TX

The city of Austin has long been recognized as the leader in municipal Green Building programs. Austin's Green Building Program was created in 1991 and is administered by the city's municipal energy utility, Austin Energy[343]. It won an award for Local Government Initiatives at the United Nations Earth Summit in Rio de Janeiro.

In addition to several programs for private homes, commercial buildings and multi-family complexes, the city of Austin requires all new city-funded projects to attain LEED Silver certification.

Their user-friendly website[344] contains detailed information on the city's program and has links to many case studies and resources.

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Energy Audits in Major Municipal Buildings

Energy audits are the first step in retrofitting municipal buildings. By conducting an audit, cities become aware of the areas needing improvement. Most cities first evaluate buildings based on their financial accounting system. Financial systems can show inefficiencies through increased energy consumption and cost in their buildings. The next step is to conduct an energy audit and then update existing buildings to make them more energy efficient. Other cities need conduct an audit to determine how to allocate budget for future municipal building improvements.

The New Jersey Department of Environmental Protection explains in their Energy Audit Guide[345] the three types of audits. Each is described in order of increasing degree of detail. The type of audit used is discussed at the preliminary consultation stage.

1. Walk-through Audit.
   This is the least expensive. It involves an examination of the building or facility, including a visual inspection of each of the associated systems. Historic energy usage data are reviewed to analyze patterns of energy use and compare them with sector/industry averages or benchmarks for similar

[343] www.austinenergy.com/Energy%20Efficiency/Programs/Green%20Building/index.htm, 19 September 2006.
[344] Austin's main web site: www.ci.austin.tx.us/, 19 September 2006.
[345] New Jersey Department of Environmental Protection "How to Conduct an Energy Audit: A Short Guide for Local Governments and Communities" www.njcleanenergy.com/media/Energy_Audit_Guide.pdf#search=%22Municipal%20Buildings%20Energy%20Audit%22, 19 September 2006. This resource explains the audit process, types of audits and the steps required to conduct an audit for local governments, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/Energy_Audit_Guide.pdf, 19 September 2006.

structures. The walk-through audit provides an initial estimate of potential savings and generates a menu of inexpensive savings options usually involving incremental improvements in O&M. Information from this level of audit also serves as a basis for determining if a more comprehensive audit will be needed.

2. Standard Audit.
   This involves a more comprehensive and highly detailed evaluation. Facilities, equipment, operational systems and conditions are assessed thoroughly and on-site measurements and testing are conducted to arrive at a careful quantification of energy use, including losses. The energy efficiencies of the various systems are determined using accepted energy engineering computational techniques. Technical changes and improvements in each of the systems are analyzed to determine the corresponding potential energy and cost savings. In addition, the standard audit will include an economic analysis of the proposed technological improvements and ECM.

3. Computer Simulation.
   The computer simulation approach is the most expensive and often is recommended for more complicated systems, structures or facilities. This involves using computer simulation software for prediction purposes (i.e., performance of buildings and systems) and consideration of effects of external factors (e.g., changes in weather and other conditions). With the computer simulation audit, a baseline related to a facility's actual energy use is established, against which effects of system improvements are compared. This audit often is used for assessing energy performance of new buildings based on different design configurations and equipment packages.

Energy Audits

CASE STUDY: Boothbay Harbor, ME

In 2005, Boothbay Harbor Town Manager, Carlo Pilgrim, decided to have an energy audit done on the municipal building after the electric bills were consistently high. The audit revealed that in 2004 of the total $12,247 electric costs, 73% or $8,999 was spent on electricity and 27% or $3,248 was spent on fuel oil. Of these numbers the audit suggested around 50% of electricity used was from the lighting. Various suggestions were made for do-it-yourself measures. These were the suggested changes for lighting:

Repaint or clean reflective surfaces

Reset exterior lighting schedule

Relamp incandescent to compact fluorescent Service Technician:

Install occupancy sensors in bathrooms

Install photoelectric cells

Install additional switching

Relamp outside lights to high pressure sodium

These lighting changes alone were estimated to save the town 14,304 kilowatt-hours of electricity per year at a savings of $1,559.18. Boothbay Harbor requested bids on an electrical update of the municipal building based on Mayhews recommendations in the January 20 and 27 issues of the Register. As of January 28, the town had not received any bids on the project.[346]

CONTACT

Town Manager
Carlo Pilgrim
Code Enforcement
Office/Maintenance Repairs
Dabney Lewis
(207) 633-7714

[346] Boothbay Register, boothbayregister.maine.com/2005-02-03/municipal_makeover.html, 19 September 2006.

Energy Audits

CASE STUDY: Southlake, TX

The city of Southlake put in place a comprehensive energy policy in 2002. Part of this plan called for periodic energy audits.

> The city shall periodically schedule energy audits of city facilities and current overall energy consumption. The data from these audits shall be used for the purposes of energy conservation planning, budget development, and serving as a basis for designated operational reviews to identify methods to increase energy conservation. Recommendations from energy audits will be evaluated based on the criterion of cost effectiveness and upon the impact on service delivery to city residents.[347]

Having this clearly stated in the energy policy is a clear reminder to inspectors to take energy issues into consideration for all audits and building modifications.

CONTACT

Building Inspections
(817) 748-8218

Energy Audits

CASE STUDY: Berkeley, CA

Berkeley is continually auditing their residential, commercial and municipal buildings to maintain records about potential upgrades and retrofits. Audits are typically performed when a new technology is discovered that could improve specific facility operations, when billing information reveals increases in energy consumption per square foot and cost, and for general follow up to maintain records. Berkley's Energy Office conducted approximately 2,000 energy audits in 2003 in the residential, commercial, industrial and local governmental sector. The following breaks down audits done in each sector[348].

Residential

500/yr. Residential Energy Conservation Ordinance (RECO) audits

300/yr. CA Youth Energy Services audits

130/yr. Weatherization audits

Commercial

Berkeley has set a target of 1,500 commercial audits by 2003 (over 1.5 years) as part of its Smart Lights program.

One thousand of these audits will include lighting improvements.

70% of these audits will occur in Berkeley, thirty will occur in neighboring cities.

Industrial

32 industrial audits/yr. as part of Climate Wise (a national program designed to reduce greenhouse gas emissions through resource conservation and efficiency).

Municipal
5 municipal audits/year.

CONTACT

Energy Officer
Neal Desnoo
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(510) 981-5434

[347] Southlake Policies and Procedures, www.seco.cpa.state.tx.us/zzz_sb5-tep/sb5southlake.pdf#search=%22city%20municipal%20energy%20audits%22, 19 September 2006.
[348] Sustainability Community Inventory, Energy (2003) www.ci.berkeley.ca.us/sustainable/community/08_Energy.pdf#search=%22city%20municipal%20energy%20audits%20policies%22, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/Berkeley_Energy.pdf, 19 September 2006.

Additional Resources

The U.S. Green Building Council
www.usgbc.org

The State of Minnesota Sustainable Building Guidelines
www.moea.state.mn.us/greenbuilding/cost.cfm

Green Building Professionals Directory
www.greenbuilder.com

Oikos Green Building Source
oikos.com/

Build It Green promotes healthy, energy and resource-efficient buildings in California
www.builditgreen.org/

Green Building Resource Guide
www.greenguide.com/

California Green Building Design and Construction
www.ciwmb.ca.gov/GreenBuilding/

BuildingGreen.com publishes *Green Building Products*, a residential green product directory, and *Environmental Building News*, a highly respected monthly newsletter.
www.buildinggreen.com/

The ENERGY STAR® Challenge
www.energystar.gov/ia/business/leaders/Summary_of_States3.pdf

Green Schools Resources
www.nesea.org/buildings/greenschoolsresources.html

Additional Links and Resources
www.greenbuildingpages.com/links/weblinks_gov.html

Minnesota Sustainable Design Guide
www.develop.csbr.umn.edu/msdg2/MSDG/overview.html

"Implement"- Seattle's Sustainable Building Tool
www2.ci.seattle.wa.us/Implement/

U.S. Department of Energy Building Energy Codes Program is an information resource on national model energy codes. They work with other government agencies, state and local jurisdictions, national code organizations, and industry to promote stronger building energy codes and help states adopt, implement, and enforce those codes
www.energycodes.gov/

Flex Your Power is a resource for energy efficiency and conservation information
www.fypower.org/

G/Rated is Portland's gateway to green building innovation, offering initial consultation and resources specific to your green building project. Under the direction of Commissioner-in-charge Dan Saltzman,G/Rated is accelerating the adoption of cost effective green building practices as the standard of development in Portland.
www.green-rated.org

Seattle's Sustainable Building Program
www.seattle.gov/light/conserve/sustainability/

Austin, TX Sustainable Building Sourcebook contains information relevant to the Austin area, such as regulatory issues, climate, installation guidelines, and sources of assistance. The Sourcebook also provides pertinent information on various aspects of sustainable building strategies and possible implementation issues that may be found in less familiar approaches to building.
www.austinenergy.com/Energy%20Efficiency/Programs/Green%20Building/Sourcebook/index.htm

For more resources, check the footnotes of this document.

Chapter 5: Local Action Plan Best Bets **Infrastructure**

DOCUMENT CONTENTS

Light-Emitting Diode (LED) Traffic Signals

Many cities have begun replacing their old incandescent halogen bulb traffic lights with much more energy efficient and durable light-emitting diode (LED) traffic lights. LED arrays in the new traffic lights include hundreds of individual LEDs each the size of a pencil eraser. There are three principle advantages to upgrading municipal traffic lights to LEDs:

1. LEDs are brighter. LED traffic lights emit light more evenly, making them brighter overall and more visible in foggy conditions.

2. LED traffic lights last for 100,000 hours, compared to incandescent bulbs, which have filaments that burn out and may last only 8,000 hours before needing to be replaced. Replacing bulbs costs money for materials and labor and the replacement inhibits traffic flow. Fewer burned-out lights increases safety of intersections.
3. LEDs consume less energy, about 85% less than incandescent bulbs.

Typical incandescent traffic lights use 100-watt or 150-watt bulbs that are operating 24 hours a day, utilizing more than 2.4 kilowatt-hours per day. At 8 cents per kilowatt-hour, one intersection can cost almost $600 per year in electricity. Large cities with thousands of intersections spend millions of dollars on electricity just for traffic lights. LED arrays consume 12-20 watts instead of 100, reducing overall energy consumption considerably. Portland spent $2.1 million to change out red and green traffic lights to LEDs and received a 4-year payback on the project.[349] Solar panels can power LED traffic lights in remote areas, reducing the costs of installing power lines.

[349] Personal communication with David Tooze, Portland's Energy Specialist.

Another benefit of LED traffic signals is the fact that they do not burn out all at once. When an incandescent filament burns out, the entire light ceases to function. In an LED, a single diode or a cluster of diodes can stop working or burn out, but the other diodes operating independently will continue to function normally. This feature eliminates the safety risks and traffic congestion problems of burnt-out traffic signals.

LED Traffic Signals

CASE STUDY: Sacramento, CA

Between 1994 and 2004, the city of Sacramento upgraded the traffic lights in more than 1,000 of its 1,300 intersections. The decade-long conversion from incandescent lamps to LEDs has reduced the energy consumption by the Sacramento Municipal Utility District (SMUD) by a total of 1.4 megawatts. When all the intersections are completed, the estimated energy savings will be an estimated 2 megawatts.

Despite initial skepticism concerning the value of upgrading to LEDs given the higher upfront costs, the SMUD invested in the conversion of its first major intersection in April of 1995. The city's 30-day electric bill for that intersection dropped from $148 to $21.40.[350] Current overall savings of the traffic light upgrades across Sacramento County are an estimated $557,000 a year.

Additional financial incentives provided by the SMUD include rebates of about $225 for each on-peak kilowatt that the city and county reduce.

A policy encouraging the upgrade of traffic lights to LEDs by the California Energy Commission (CEC) has resulted in the conversion of over 13,000 intersections throughout the state. The stated goals of the policy are to assist local government agencies in saving money, conserving energy to avoid crises like the blackouts of 2001 and increasing the overall safety of intersections. The CEC offers loans and grants to local agencies for the implementation of LED upgrades.

Results of the CEC incentive program include the replacement of nearly 250,000 old incandescent red, green and amber traffic signals, along with pedestrian walk and do not walk signals, with new LED lamps. The new LED lights reduce the State's need for electricity by nearly 10 megawatts, enough electricity to power nearly 10,000 homes.

The reduced electricity demand should save the state an estimated $7.9 million every year on electricity costs.

CONTACT

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[350] SMUD, LED Traffic Signals, www.smud.org/education/led.html, 22 September 2006.

LED Traffic Signals

CASE STUDY: Chicago, IL

The city of Chicago has an estimated 2,800 intersections. Through a joint venture between the Chicago Department of Transportation (CDOT) and the City's Bureau of Electricity, old traffic lights at 350 intersections have been replaced with LED traffic signals. According to Matt Smith, Director of Communications at CDOT, the new LED traffic signals have demonstrated their efficiency through significantly reduced energy costs.[351] The city estimates that it will save $2.5 million annually by retrofitting all of its intersections. The program has already reduced the city's annual CO_2 emissions by 7,250 tons.

An added benefit of switching to LEDs is the ability to use backup power supply for traffic signals during power outages. In conjunction with the LED retrofit program, the city of Chicago has installed PowerBack ITS Systems at approximately 800 new and existing traffic intersections. The PowerBack ITS System is a complete battery backup system for traffic signal intersections that keeps traffic signals on when the power goes out. The PowerBack ITS Series will operate traffic signals after a power outage in either normal or "flash" mode for up to 24 hours. Although such backup power supplies can be used in traditional incandescent traffic signal systems, they provide a much longer range of emergency coverage with more energy efficient LEDs.

CDOT has also begun implementing the use of activated or actuated traffic signals that can detect when a vehicle is in the intersection. This network of vehicle detectors automatically detects traffic movement and patterns and allows automated adjustments of the traffic signal operation to streamline the flow of traffic. Stop-and-go traffic wastes energy since gasoline-powered cars use almost as much energy idling as driving. Timing traffic lights, particularly during commuting hours in the commuting direction, will alleviate congestion and excessive stop-and-go traffic. The results of CDOT's integrated traffic management program are a better understanding of traffic patterns, better coordinated traffic signals at any particular intersection, increased efficiency of traffic flow, and fewer accidents.

Mayor Daley's Traffic Management Task Force meets regularly to review major construction projects and special events that are likely to have significant impact on the city's traffic. Members of CDOT, the Mayor's Office, and other key city departments and agencies work with media outlets to design solutions and inform the public on road closures, alternate routes and traffic advisories.

CONTACT

Director of Communications
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Chicago Department of Transportation
(312) 744-7261

[351] U.S. Mayors Best Practices Database, www.usmayors.org/uscm/best_practices/traffic/best_traffic_initiative_chicago.htm, 22 September 2006.

LED Traffic Signals

CASE STUDY: Berkeley, CA

The city of Berkeley received more than $225,000 in rebates from the utility, Pacific Gas & Electric (PG&E), for replacing nearly 3,000 traffic signal bulbs with energy-efficient LED fixtures.[352] The city replaced old red and green traffic incandescent bulbs over several years as part of an energy conservation program sponsored by PG&E. Amber bulbs, since they are used so infrequently, are seldom replaced and are usually the last priority for replacement in municipal retrofit projects.

According to the city of Berkeley's Climate Action Plan[353], the retrofit costs for LED traffic signals are as follows:

8" diameter red lights $170 each
12" diameter red lights $240 each
Pedestrian control lights $160 each

LED technology has experienced significant growth in recent years and these prices will likely continue to decrease with time.

The city of Berkeley estimated that it will reduce its energy use for traffic signals by more than 563,000 kWh, which is roughly equivalent to $56,000 per year of reduced energy costs.[354] According to Neal DeSnoo, energy officer for the Office of Energy and Sustainable Developed for the city of Berkeley, actual energy savings from 1998 to 2005 were 890,000 kWh for all the signals and exceeds the original estimate of 563,000 kWh. Meter measured energy savings has been reduced from 1,341 kWh in 1998 to 451 kWh in 2005—approximately 66% in savings. Additional savings in reduced maintenance costs increase the payback rate of the upgrade investment. The amount of electricity saved also equates to the reduction of 323 metric tons of CO_2.

Following The California Energy Commission's (CEC) recommendation that cities optimize their traffic signals every three to five years, the city of Berkeley integrates signal coordination and traffic flow management into its transportation plan. According to the CEC, cities participating in CalTran's Fuel Efficient Traffic Signal Management (FETSIM) program reduced gasoline use by 19%. As an added benefit, travel time was also reduced by an average of 7.5%.

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Traffic Flow Management Systems

Traffic flow management consists of set light timing, activated traffic signals, signal synchronization and more techniques that work to improve traffic flow. With these programs commuters should experience a reduction in travel time, less gas consumption and cost savings due to the coordination of signals. These strategies reduce air pollution and GHG emissions caused by idling.

[352] Berkeley Press Release, January 2003, www.ci.berkeley.ca.us/news/2003/01jan/011403energyrebate.html, 22 September 2006.
[353] Berkeley Climate Action Plan, www.baagmd.gov/pln/GlobalWarming/BerkeleyClimateActionPlan.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Infrastructure/Berkeley_CAP.pdf, 29 September 2006.
[354] Ibid.

Traffic Flow Management

CASE STUDY: Colorado Springs, CO

The city of Colorado Springs, Colorado traffic signal timing team studies 30-40 arterial streets each year to determine optimal traffic flow coordination.[355] In 2005, the city released the Traffic Signal Coordination Planning Effort Report that describes the potential upgrades and new technologies the city could adapt to minimize traffic.[356]

In the report the city recognizes the potential time and cost saving benefits traffic flow management can have. "Each dollar spent optimizing signal timing and implementing system improvements can yield up to $40 in fuel savings." "As national studies indicate, coordinating previously uncoordinated signals can result in a reduction in travel time ranging from 10% to 20%. According to our own recent studies conducted along Academy in February, there is a 10% to 30% improvement in travel times resulting from coordinated signals."

The key systems Colorado Springs uses to coordinate their traffic flow include:

- Communications Links to Signals
- Traffic Signal Controller Equipment
- Advanced Traffic Detection System

CONTACT

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High Efficiency Street Lighting

According to a review conducted by the California Energy Commission, street lighting accounts for as much as a quarter of a municipality's electric bill.[357] The choice of what kind of street lighting to use affects the city budget as much as it influences the city's ambience. New technologies in lighting provide more efficient ways to effectively illuminate neighborhoods and public spaces. The quality and brightness of street lighting does not need to be compromised in order to significantly reduce the amount of electricity consumed.

High Pressure Sodium Lamps

High pressure sodium lamps (HPS) are a very popular option for municipal street light systems across the country. HPS lighting is 57% more efficient than incandescent street lamps and 32% more efficient than mercury vapor lamps. HPS lamps produce 90-150 lumens per watt[358] (compared to 30-48 lumens per watt in mercury vapor lamps).[359] HPS street lighting systems have a payback period of about six years compared to mercury vapor lamps.[360] However, the orange-yellow light produced by HPS lamps does not contain light in the blue spectrum, diminishing people's ability to use peripheral vision at night. It also does not render colors as well as other lamp types.

Low Pressure Sodium Lamps

Low pressure sodium lamps (LPS) are even more energy efficient than HPS lamps. They were designed to operate at low

[355] Colorado Springs, Traffic Flow Coordination website, www.springsgov.com/Page.asp?NavID=2482, 5 December 2006.
[356] Traffic Signal Coordination Planning Effort, www.springsgov.com/units/traffic/SignalCoordinationPlan.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Infrastructure/ColoradoSprings_SignalCoordinationPlan.pdf, 5 December 2006.
[357] Currents: An Energy Newsletter for Local Governments, www.lgc.org/freepub/PDF/Energy/currents/09_streetlighting99.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Infrastructure/LGC_newsletter.pdf, 29 September 2006.
[358] Ibid.
[359] City of Los Angeles, Environmental Affairs Office. 2001. Los Angeles Energy Climate Action Plan is under revision in October 2006. Also archived at, www.climatemanual.org/Cities/ Chapter5/BestBets/Infrastructure/LAClimateActionPlan.pdf, 25 September 2006.
[360] Currents: An Energy Newsletter for Local Governments, www.lgc.org/freepub/PDF/Energy/currents/09_streetlighting99.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Infrastructure/LGC_newsletter.pdf, 29 September 2006.

temperatures and maintain luminance throughout the lamps' lifetime. The light produced by LPS lamps is a dull yellow color, does not allow for effective peripheral vision, and does not render colors well. It is the lighting of choice around observatories since the monochromatic light can be filtered by telescopes. LPS color limitations make it difficult to use. Therefore, the intensity of sodium lamp lighting levels may need to be adjusted to perform as well as lower wattage, wider spectrum white lighting.

Metal Halide Lamps

Metal halide lamps use an electric current that passes through a gas to create light. The bright white light is very effective for rendering colors at night and does not adversely affect peripheral vision. Metal halide lamps produce large amounts of heat and can burn out quickly. The brightness of the lamps also creates a high potential for glare. Metal halide lamps are twice as energy efficient as the mercury vapor lamps they replace. Metal halides require 60-100 lumens per watt and last on average 10,000-15,000 hours.[361]

Induction Lighting[362]

Induction lighting uses the energy from a magnetic field combined with a gas discharge to create light. It is very energy efficient, has a long life, and produces a high-quality white light. While the other lamp types last on average between 10,000-30,000 hours, the induction lamp has a100,000-hour life span. Because it is a relatively new technology, induction lighting still has a high upfront cost. The greater efficiency and lower maintenance costs can help to offset the additional cost of the system over the life of the bulbs.

	Pros	*Cons*
MERCURY VAPOR	Inexpensive to install and purchase Medium life Dimmable Good color rendering due to white light	Expensive to operate due to inefficiency Tend to be glary due to intense light Dramatic lumen depreciation over time Use hazardous material (mercury)
HIGH PRESSURE SODIUM	Energy efficient Widely used, reliable Medium life	Orangish-yellow light Safety concerns due to color rendition Cannot restrike immediately
LOW PRESSURE SODIUM	Very energy efficient, medium life Minimum glare Able to restrike immediately Do not attract most insects	Orangish-yellow color Safety concerns due to color rendition Expensive fixtures
METAL HALIDE	Good color rendering More efficient than mercury vapor Widely used	Short life, high maintenance Less efficient than HPS, LPS and Induction High temperatures burn out ballasts
INDUCTION LIGHTING	Energy efficient Low maintenance costs due to long life Good color rendering due to white light Immediate ignition & re-ignition No flickering	High initial cost Difficult to retrofit existing fixtures Use small amounts of mercury Not dimmable Need a high-frequency generator

Table: The Pros and Cons of Lamp Options[363]

[361] Ibid.
[362] Induction Lighting, www.imsasafety.org/journal/septoct04/7.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Infrastructure/InductionLamps.pdf, 25 September 2006.
[363] Local Government Commission newsletter www.lgc.org/freepub/PDF/Energy/currents/09_streetlighting99.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Infrastructure/LGC_newsletter.pdf, 29 September 2006.

Lamp and Light Fixtures

A significant factor in the efficiency of a street lighting system is the orientation and design of the lamp and light fixtures. By focusing light in the direction it is most needed, a light fixture can decrease the total amount of light needed. Additional factors affecting a light fixture's overall efficiency include the lamp's height, the distance between poles, and the fixture's cutoff angle. The most efficient streetlight design is the full cutoff fixture since it does not waste light into the night sky.

Image: from International Dark Sky Association[364]

Remote Streetlight Control

A new technology allows cities to remotely program when streetlights dim or turn off depending on levels of pedestrian and vehicle traffic. The application may offer significant energy and operational savings. Advocates of the new technology claim that the ability to remotely control street lights could cut energy consumption by as much as 40%.[365] A field study conducted in Vancouver, British Columbia, found that one such program, the Lumen IQ system,[366] reduced electricity consumption for streetlights by 25%. Estimated payback for 100, 250 and 400 watt lamps are 2.68, 1.26, 0.82 years respectively.[367]

High Efficiency Street Lighting

CASE STUDY: Medford, MA

The city of Medford has approximately 4,600 streetlights. Although the local electricity utility owns the majority of the streetlights, the city pays the electricity bill. It has worked closely in conjunction with Massachusetts Electric to convert all of the city's old mercury vapor lamps to HPS lamps.[368] According to the city of Medford's Climate Action Plan,[369] the city expects to save nearly $20,000 annually on its electricity bill and will reduce its CO_2 emissions by 148 tons.

CONTACT

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[364] International Dark Sky Association, www.darksky.org/index.php, 25 September 2006.
[365] "Streetlight Intelligence Teams With Honeywell to Improve Energy Efficiency," *Business Wire*, 17 November 2005.
[366] www.streetlightiq.com/products/STI_lumenSIMS.html, 22 September 2006.
[367] These estimates are based on turning lights off and no cycling or photo control problems, www.bpa.gov/energy/n/tech/energyweb/docs/SlidesPubs/Smart%20Pack_short%20presentation.ppt, 31 October 2006.
[368] Medford Clean Energy Committee, www.medfordcleanenergy.org/index.html, 30 October 2006.
[369] Medford Climate Action Plan 2001, www.massclimateaction.org/pdf/MedfordPlan2001.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Infrastructure/MedfordPlan2001.pdf, 25 September 2006.

High Efficiency Street Lighting

CASE STUDY: Flagstaff, AZ

More than half of the city of Flagstaff's street lights are low-pressure sodium lamps. Municipal regulations that limit the total number of lumens per acre have encouraged the conversion of the city's streetlights to LPS. Many citizens of Flagstaff comment[370][371] on the positive effects that the lower light levels have on stargazing. The Flagstaff Police Department does not believe that the lower light levels have caused a negative effect on witness or vehicle identification for crime investigations.[372]

CONTACT

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High Efficiency Street Lighting

CASE STUDY: San Diego, CA

The Gaslamp Quarter in San Diego is a busy pedestrian area with many shops, restaurants and outdoor events. The city of San Diego retrofitted 179 HPS light fixtures with induction lighting in the 16-block Gaslamp Quarter to enhance the ambience and safety of the night-time environment. The city saves approximately $12,700 a year in maintenance and energy savings from the retrofit. Over the lifetime of the induction lighting system, the lamps of the HPS system would have had to be replaced about four times. The induction lamp is also brighter than an HPS lamp of the same wattage. Although the HPS lamps are more efficient in lumens per watt, the city saves energy by utilizing a lower wattage induction lamp. The induction lamp system has been praised by San Diego residents for the whiter and fuller light it produces.[373]

CONTACT

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[370] "Residents warming up to yellow-lit road" (*Arizona Daily Sun*, 16 Sept. 1987). www.nofs.navy.mil/about_NOFS/staff/cbl/LPSnet/ADS.870916.html, 22 September 2006.
[371] "Romantics, stargazers make case for adding yellow lights" (*Arizona Daily Sun*, 23 October 1987) www.nofs.navy.mil/about_NOFS/staff/cbl/LPSnet/ADS.871023.html, 22 September 2006.
[372] Letter from Flagstaff Police Department, www.nofs.navy.mil/about_NOFS/staff/cbl/LPSnet/FLAGPDonLPS.doc, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Infrastructure/FlagstaffPD_LPSletter.pdf, 25 September 2006.
[373] Currents Newsletter, www.lgc.org/freepub/PDF/Energy/currents/09_streetlighting99.pdf, also archived www.climatemanual.org/Cities/Chapter5/BestBets/Infrastructure/LGC_newsletter.pdf, 29 September 2006.

Increase Efficiency of Municipal Water and Wastewater Utilities

About 3% of the nation's electricity supply is consumed by water and wastewater utilities.[374] Water and wastewater systems spend about $4 billion a year on energy to pump, treat, deliver, collect and clean water.[375] This cost can account for as much as one-third of a municipality's total electricity bill.

Many systems operate at less than optimal efficiency. Causes of inefficiency in a water or wastewater system include:

Incorrectly selected and inefficient pumps

Limited capacity in transmission and distribution systems

Lack of automatic or remote control of pumps/ valves

Buying power at peak price times

Operator error

The Environmental Protection Agency (EPA) ENERGY STAR® program has recently expanded its industrial component to include an evaluation of water and wastewater energy performance.[376] The new program estimates that a 10% reduction in energy use at publicly-owned water and wastewater utilities through cost-effective investments and technology upgrades can save 5 billion kWh of electricity and over $400 million annually. The upgrades can also result in a significant reduction of total water consumption.

The primary objectives of a municipal water/wastewater system are to supply the water demanded by the public and maintain water quality while minimizing capital costs. Small publicly-owned utilities may believe that they cannot justify a significant investment to reduce the energy costs for a water/wastewater system if the total energy costs are relatively small. However, many efficiency upgrades can provide significant cost savings with a relatively small capital investment.

Large utilities can achieve significant cost savings with a whole-system approach to identifying sources of inefficiencies in their pumping systems.[377] Life cycle cost analysis can provide insight into the total returns on investment a utility can expect from a more efficient system.

The best way to identify significant cost saving opportunities within a water/ wastewater system is to perform an audit. Audits identify the different areas where inefficiencies exist and present costs of implementation and potential savings. Many private energy consulting companies provide such specialized energy audits.

The best bets for significant energy savings in water/wastewater facilities include: [378]

Manage demand to avoid peak electric rate periods

Modify or replace inefficient pumps

Install energy efficient motors

Control pump speed and flow electronically with variable frequency drives

Install efficient lighting

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[374] EPRI, 1996a, Water and Wastewater Industries: Characteristics and Energy Management Opportunities, Series CR-106941, St. Louis, MO.

[375] Energy Star Water and Wastewater Energy Focus Program Fact Sheet, available online: energystar.gov/ia/business/government/wastewater_fs.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Infrastructure/EnergyStar_wastewater.pdf, 29 September 2006.

[376] Ibid.

[377] For more information on cost-saving opportunities, see the following document(s):
1. Todd Elliot, "Energy-Saving Opportunities for Wastewater Facilities: A Review,"Prepared for Energy Center of Wisconsin, June 2003. www.ndwrcdp.org/userfiles/WU-HT-03-33.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Infrastructure/Elliot.pdf, 25 September 2006.
2. Alliance to Save Energy "Watergy" Project, www.watergy.org, 22 September 2006.

[378] EPA Wastewater Management Fact Sheet, www.epa.gov/owm/mtb/energycon_fasht_final.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Infrastructure/EPA_WWTP.pdf, 30 October 2006.

Implement training programs to reduce worker error

The use of renewable energy or fuel cells for power can also increase efficiency, although the initial costs are greater than the other measures listed above.[379]

Utilities can reduce the total electricity needed to provide the required services, including replacement of inefficient pumps and motors or minimize the flow rates of water and wastewater on the consumer side through educational campaigns and strategic pricing. Any municipal policy that aims to increase the overall efficiency of a water/wastewater utility should include a combination of both.

Water and Wastewater Efficiency

CASE STUDY: Columbus, GA

The city of Columbus, Georgia has saved over $1 million in energy costs over the past five years by overhauling its water utility.[380] The Columbus Water Works is a municipally-owned water and wastewater utility that provides services to the community of 186,000 people. An analysis performed by the Water Works identified energy costs as the utility's largest single expenditure. Through a process of reengineering and retrofitting old equipment, the city increased the water system's energy efficiency and cut energy costs significantly.

The retrofit included many different elements. The entire wastewater and drinking water treatment system was reengineered to be fully automated. Old motors throughout the system were replaced with more energy efficient models. Automated motor operators retrofitted onto the system's compressed air blowers reduced the utility's energy costs by 25%, with less than a one year payback.[381] An energy consultant evaluates the utility's energy use every quarter and recommends improvements.

Employees are encouraged to make recommendations for efficiency improvement projects. Managers and team leaders attend biannual trainings on energy efficiency.

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Water and Wastewater Efficiency

CASE STUDY: Fairfield, OH

Fairfield Wastewater Treatment Facility in Ohio provides services to 45,000 people. Since 1986, the utility has increased the energy efficiency of its operations through an automated system and continuous technology upgrades.

In 1999 the Wastewater Division implemented a real-time rate-pricing program using data from previous years to calculate an energy usage baseline. When electricity prices peak, the facility uses its automated system to shut down temporarily and save money. This system has shifted 35–40% of peak loads to cheaper, off-peak periods, resulting in energy bill reductions of up to 17%.[382] Continuous monitoring of the system's operations and energy use allow

[379] King County Fuel Cell Demonstration Project, dnr.metrokc.gov/wtd/fuelcell/, 5 December 2006.
[380] "Watergy Taking Advantage of Untapped Energy and Water Efficiency Opportunities in Municipal Water Systems", 2002, www.ase.org/uploaded_files/watergy/watergyfull.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Infrastructure/Watergy_2002.pdf, 22 September 2006.
[381] Ibid.
[382] Ibid.

the utility to maintain optimal performance

Fairfield's utility management uses a general set of guidelines to facilitate investment decisions in energy efficiency upgrades. The Fairfield Wastewater policy states that efficiency upgrades that cost less than $15,000 and have a payback of less than five years receive automatic authorization. This process gives project managers much more flexibility in including such upgrades in their annual budgets.

There is a 21-member team composed of operations staff members that meets regularly to discuss new technology and energy efficiency ideas. Fairfield Wastewater also encourages feedback and input from staff at weekly operations meetings.

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Water and Wastewater Efficiency

CASE STUDY: Austin, TX

The city of Austin Water and Wastewater Utility provides services to over 600,000 people. The semiarid climate of Central Texas requires the city of Austin to manage its water resources wisely. The hilly terrain places a heavy demand on the utility's pumping system.

To reduce the overall energy use of pumping water through the transmission and distribution system, members from several departments meet regularly to share ideas for improving the efficiency of the utility's pumping system. The ad-hoc committee has implemented measures to upgrade the system's pumps to more efficient models and to limit pumping to off peak hours.

The Austin Water and Wastewater Utility interfaces with the largest water consumers in the residential, commercial, and industrial sectors. The utility continuously monitors energy use and water flow through a series of submeters throughout the distribution system. This information allows the utility to coordinate repairs and upgrades more efficiently. Austin reports a rate of total water loss through its distribution system of only 8%.[383]

The utility also monitors water consumption of up to 30 categories of water users, such as hospitals and schools. This data allows the utility to focus its demand-side management efforts on the most egregious wasters of water.

The water utility offers a sizeable incentive to industrial customers for reducing long-term water consumption. The water utility pays one dollar for every gallon of water consumption reduced per day for up to $40,000 per company. This one-time payment is available to customers of all sizes who make lasting efficiency improvements to their systems.

The city of Austin recently upgraded the pumping system at its municipal power plant, saving millions of dollars a year.[384]

The city of Austin recently passed a municipal bond authorizing the installation of a reclaimed water pumping system. Any non-potable water users can connect to the system and purchase the cheaper reclaimed water. Clients include industrial users and irrigation companies. The system has a capacity to recycle up to 40 million gallons per day. This greatly reduces the demand for Austin's clean water resources and decreases costs for wastewater treatment.

The utility also markets its water efficiency improvement programs and educates consumers. Consumers pay an additional 1% on their water bills to fund municipal water efficiency projects.

[383] Ibid.
[384] For more Austin's pump upgrade project, visit: www.nrel.gov/docs/fy05osti/37537.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Infrastructure/NREL_Austin_spotlight.pdf, 29 September 2006.

Project managers and employees of the Austin Water and Wastewater Utility receive regular updates on system performance and are encouraged to suggest improvements.

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www.ci.austin.tx.us/watercon/

Water and Wastewater Efficiency

CASE STUDY: San Diego, CA

The city of San Diego faces a growing demand for water and an increasingly tight supply. It has the unenviable task of maintaining services while minimizing total water consumption due to increased political pressure from other water-deficient cities and states. The daily volume of wastewater transported and treated in the MWWD facilities requires a considerable amount of electrical and thermal power. Pumps, lights, computers, mechanical valves and machinery consume electricity. Thermal energy, usually generated by electrical power or by burning natural gas, provides heat and cooling necessary for both buildings and the wastewater treatment process. It is in the best interest of the city of San Diego and its residents to maximize the potential of their scarce resources by minimizing the energy and water used to provide necessary services.

The San Diego Metropolitan Wastewater Department (MWWD) established a multi-year strategic plan to mitigate the risk of future energy shortages in California. One of the city's goals is to reduce the energy consumed at wastewater facilities by at least 7%. The MWWD has created an Energy Efficiency Program to achieve this goal. The MWWD Energy Efficiency Program targets cost-effective ways to achieve water and energy savings in the following areas:

Facility and equipment efficiency upgrades

Water reclamation

Capture and reuse of methane

Cogeneration

The energy savings made by the MWWD and the Energy Efficiency Program maintain lower sewer rates and reduce the risk of rolling electrical blackouts due to excessive peak energy demand.

Point Loma Wastewater Treatment Plant[385] Digesters at the Point Loma Wastewater Treatment Plant use heat and bacteria to break down the organic solids removed from wastewater. One of the by-products of this biological process is methane gas, a potent greenhouse gas that can also be used to generate electricity. The gas emitted from waste is approximately 60% to 65% methane, also known as digester gas (DG).

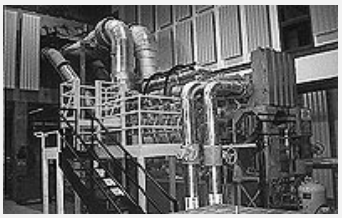

Image: Point Loma Wastewater Treatment [386]

MWWD has installed such cogeneration systems in several of its plants. During fiscal year 2000, one wastewater plant saved the city of San Diego more than $500,000 in energy costs and earned an additional $400,000 from selling excess power back to the grid.[387]

California government grants make cogeneration projects more cost-effective. Current grants are approximately $1,000/kW for reciprocating internal combustion (IC) engines,

[385] Point Loma Wastewater Treatment Plant, www.sandiego.gov/mwwd/facilities/ptloma.shtml, 22 September 2006.
[386] City of San Diego MWWD website, www.sandiego.gov/mwwd/initiatives/energy.shtml, 22 September 2006.
[387] "Watergy Taking Advantage of Untapped Energy and Water Efficiency Opportunities in Municipal Water Systems", 2002, www.ase.org/uploaded_files/watergy/watergyfull.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Infrastructure/Watergy_2002.pdf, 22 September 2006.

$1,300/kW for microturbines, and $4,500/kW for fuel cells on renewable fuels like digester gas and landfill gas.

The city of San Diego complements its energy efficiency upgrades with an aggressive demand-side management policy to minimize the total water consumed by the city. Consumers receive information on how to minimize water consumption. San Diego also treats and reuses wastewater. One of the city's reclamation plants treats up to 30 million gallons of wastewater every day. MWWD sells the reclaimed water at a reduced price to customers for use in landscaping, irrigation, industrial, and agricultural purposes. Pipelines and equipment used in the reclaimed water process are specially marked or color coded to differentiate them from drinking water pipes. MWWD also uses a flow metering alarm system to minimize undetected sewage spills.

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Landfill Gas-to-Energy Projects

As trash decomposes, it produces methane gas, a GHG that traps more than 21 times more heat per molecule than CO_2.[389] Municipal solid waste landfills account for more than a third of human-related methane emissions in the United States.[390] Methane gas comprises about one-half of the volume of landfill gas. The other half of the gas is a mixture of CO_2, other gases and traces of organic compounds.

Landfill gas is recovered using a system of wells and either a blower/flare system or a vacuum system. The gas is pumped to a central collector where it is converted into the appropriate form depending on what its ultimate use will be. Methane can be used to fuel vehicles, supply industrial operations, power an electricity generator or can even be upgraded to higher-quality methane gas for distribution via pipeline. To generate electricity from landfill gas, the methane from the landfill gas is used to power internal combustion engines or turbines. Other technologies for producing electricity from landfill gas are currently under development and may increase the overall efficiency of the process. This process reduces municipal energy costs by providing a low-cost alternative to conventional fossil fuels. Landfill gas that leaks is a wasted economic opportunity.

Capture and use of landfill methane also reduces bad odors and health hazards. A study in the State of New York found that women living near 38 landfills with landfill gas leaking into the surrounding environment have a four-fold increased chance of bladder cancer or leukemia.[391] As with all waste issues, an essential element of the solution to the problem of landfill gas emissions is reducing the quantity of waste generated.

According to the EPA, there are more than 395 landfill gas capture projects in the country and nearly 600 municipal landfills that could qualify for a methane capture retrofit.[392] The potential for electricity production at the remaining landfills would be sufficient to provide power to 900,000 homes.[393]

Since 1979, federal regulations promulgated under Subtitle D of the Resource Conservation and

[388] City of San Diego, Metropolitan Wastewater, www.sannet.gov/mwwd/, 29 September 2006.
[389] EPA Global Warming Emissions, yosemite.epa.gov/oar/globalwarming.nsf/content/emissions.html, 22 September 2006.
[390] EPA Landfill Methane Outreach Program, www.epa.gov/lmop/overview.htm#methane, 22 September 2006.
[391] "Investigation of Cancer Incidence and Residence Near 38 Landfills With Soil Gas Migration Conditions, New York State, 1980-1989," State of New York Department of Health, (Atlanta, Ga: Agency for Toxic Substances and Disease Registry, June, 1998). Available from the National Technical Information Service in Springfield, Virginia [800-553-6847]; publication PB98-142144.
[392] EPA landfill map of projects, www.epa.gov/lmop/docs/map.pdf, also archived 25 September 2006 at, www.climatemanual.org/Cities/Chapter5/BestBets/Infrastructure/LandfillGas_ProjectsMap.pdf..
[393] EPA LMOP Benefits, www.epa.gov/lmop/benefits.htm, 22 September 2006.

Recovery Act (RCRA)[394]—which regulates the design and operation of municipal solid waste landfills—have required controls on migration of landfill gas. The regulations require methane monitoring and establish standards for methane migration control. Monitoring requirements apply to a landfill during operation and for a period of 30 years after closure. Landfills affected by RCRA Subtitle D must control gas by establishing a program to periodically check for methane emissions and prevent off-site migration. Gas-to-energy projects facilitate the achievement of these standards by minimizing the quantity of gas underground and by providing a cash flow in the form of energy to offset the upfront costs of the gas recovery infrastructure.

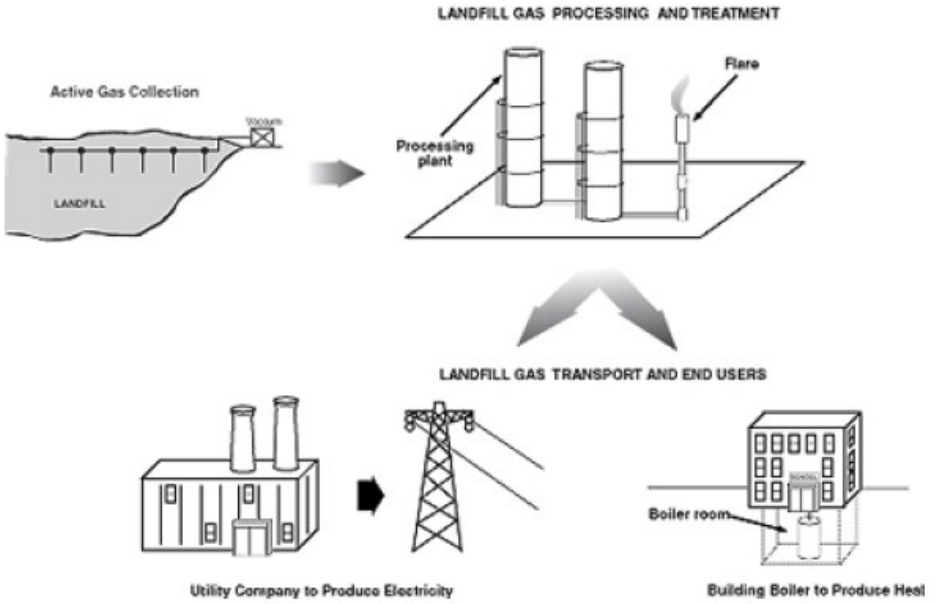

Image courtesy of EPA[395]

Landfill gas can also be used directly in several industrial processes including the operation of boilers, kilns and greenhouses. Most processes that use natural gas or require quantities of heat can substitute the use of landfill gas. The EPA lists the following industries that used landfill gas in their manufacturing and/or industrial processes:

Auto manufacturing

Chemical production

Food processing

Pharmaceuticals

Cement and brick manufacturing

Wastewater treatment

Consumer electronics and products

Paper and steel production

Some landfill gas recovery projects utilize cogeneration to increase the overall efficiency of the recovery and reuse process. The thermal energy produced as part of the electricity generation process can be stored in the form of steam or hot water and used for heating, cooling or other applications.

Landfill gas recovery and reuse:

Reduces emissions of a potent greenhouse gas

Offsets use of non-renewable sources of energy (natural gas, coal, oil)

Provides low-cost source of electricity

Minimizes odors emitted from landfills

[394] RCRA Regulations: www.access.gpo.gov/nara/cfr/cfrhtml_00/Title_40/40cfr258_00.html, 22 September 2006.
[395] EPA LMOP, www.epa.gov/lmop/over-photos.htm#3, 27 September 2006.

Eliminates health risks associated with organic compounds in landfill gas

Reduces risk of explosion from built-up methane gas pockets

Benefits local economy

Reduces cost of compliance with local, state and federal air quality regulations

Landfill Gas to Energy Projects

CASE STUDY: Los Angeles, CA

The Sanitation Districts of Los Angeles County (Districts) began recovering the estimated 26,000 cubic feet per minute (cfm) of landfill gas generated at Puente Hills Landfill, the largest landfill in the nation, in the 1980's.[396] The intent of the landfill gas collection project was to minimize landfill gas emissions to the atmosphere and limit below-ground migration of the gas in accordance with federal regulations. The Districts originally used the landfill gas to fuel an electricity production facility that has been operating at the site since January of 1987. After noticing that a percentage of the gas was not being utilized and had to be flared, the Districts decided to begin converting that gas to vehicle fuel.

In October of 1993, the Districts opened the country's first facility to convert landfill gas to vehicle fuel. Wells inserted deep into the landfill capture the gas and transport it to a processing facility where it is purified through membranes to remove CO_2 and water vapor. The resulting compressed natural gas (CNG) is used as a fuel for landfill equipment, garbage trucks, water trucks and employee rideshare vans.

Landfill gas from Puente Hills is also transported to the Districts' Joint Administrative Office where it is used for heating and cooling. The Districts also sell a portion of the gas to Rio Hondo College for heating school facilities and for powering a CNG vehicle.

The Puente Hills gas-to-energy facility produces enough CNG fuel for a fleet of 11 vehicles and produces about 50 megawatts of power, enough to provide electricity to 70,000 homes. The Districts operate two smaller gas-to-energy facilities, Palos Verdes (6 MW) and Spadra (8.5 MW). Since the capital costs of all three facilities have already been recuperated, the Districts only pay for maintenance and operation costs of the facilities. This amount is more than offset by the sale of electricity to local utilities. In 1997, electricity sold from the Puente Hills facility alone amounted to $16.5 million in net revenues.[397]

Puente Hills Landfill

Image courtesy of Los Angeles County Sanitation District[398]

[396] LA County Sanitation Districts, www.lacsd.org/swaste/Facilities/LFGas/CNGFacility.htm, 22 September 2006.
[397] LA County Sanitation District, www.lacsd.org/swaste/Facilities/LFGas/Gas-To-EnergyFacilities.htm, 27 September 2006.
[398] LA County Sanitation District, www.lacsd.org/swaste/Facilities/LFGas/CNGFacility.htm, 27 September 2006.

The project prevents the release of large quantities of landfill gas to the atmosphere and helps minimize the accumulation of nitrogen oxides (NOx) that contribute to the formation of smog. With greenhouse gases now being regulated in California, the project may potentially minimize the regulatory costs of compliance that other landfills without gas recovery mechanisms may face.

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Landfill Gas to Energy Projects

CASE STUDY: Riverview, MI

The city of Riverview, Michigan, owns and operates the Riverview Land Preserve landfill in Wayne County. In a joint project with the local utility, Detroit Edison, the city recovers and sells landfill gas to generate energy. The partnership began in 1987 with the development of a landfill gas-to-energy project on the 212-acre landfill. A subsidiary of Detroit Edison collects the gas and sells it to Riverview Energy Systems, where it generates electricity in two gas turbines. Detroit Edison then purchases the electricity under a 25-year power purchase agreement. The gas-to-energy project provides enough electricity for 3,700 homes.

The city has achieved attainment of federal methane gas migration requirements at its landfill in a cost-effective way. The project provides revenue directly to the city as stipulated in the terms of the contract. Since the installation of the project facilities, property values surrounding the landfill have increased and new neighborhoods have been constructed. The so-called "Mount Trashmore" that was once an eyesore and a safety hazard has also been turned into a wintertime skiing and recreation area.

The Riverview gas-to-energy project is a good example of local governments and local industries collaborating to achieve positive results. Detroit Edison not only receives a locally produced and inexpensive source of electricity, but also the positive publicity that this project continues to generate.[399]

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[399] EPA LMOP Riverview Project, www.epa.gov/lmop/res/riverview.htm, 27 September 2006.

Landfill to Gas Energy Projects

CASE STUDY: Orange County, FL

Orange County's landfill gas-to-energy system collects gas from the 200 acres of waste at the Orange County landfill. The gas is piped to the Stanton Energy Center where it is used to fuel a generator. The landfill produces an estimated 6,000 cfm of gas, enough fuel to generate electricity for 13,000 homes.[400]

The Orange County Solid Waste Department sold the landfill project to DTE Biomass which will own and operate the landfill gas recovery project over the term of a 20-year contract with Orange County. The project received $4 million in federal funding and also benefits from multiple tax incentives.

Orange County recuperated its initial costs with the sale of the project for $5 million and will earn an estimated $400,000 annually on the landfill gas rights. The project reduces methane emissions by 31,000 tons per year.

The Orange County Solid Waste Department worked closely with the EPA's Landfill Methane Outreach Program (LMOP) in the development of this project. The LMOP provides information on technologies to help optimize efficiency and production while minimizing the costs of the gas recovery system. They work with several municipalities across the country in the design and implementation of landfill gas-to-energy projects. Orange County received recognition from the EPA as the 1998 Partner of the Year.

CONTACT

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[400] EPA Landfill Methane Outreach Program www.epa.gov/lmop/res/orange.htm, 27 September 2006.

Additional Resources

LED and Traffic Flow Management:

Margaret Suozzo, A Market Transformation Opportunity Assessment for LED Traffic Signals, April 1998
www.cee1.org/gov/led/led-ace3/ace3led.pdf#search=%22berkeley%20led%20traffic%20lights%20pacific%20gas%22

Optimizing Traffic Light timing through simulations
www.informs-cs.org/wsc04papers/188.pdf

Dallas Light timing program to improve air quality
www.dallascityhall.com/pdf/pio/CooperativeProgram.pdf

U.S. Climate Change Technology Program
www.climatetechnology.gov/library/2005/tech-options/tor2005-114.pdf

California Energy Commission LED Replacement Program (Has list of project costs for many California cities)
www.energy.ca.gov/releases/2002_releases/2002-03-14_led_signals.html

State of Illinois LED Traffic Signal Rebate Program Application
www.illinoiscleanenergy.org/images/ICEFC_PDFs/2006%20LED%20Application%20Fill-in.pdf#search=%22chicago%20LED%20traffic%20%22

Seattle Department of Transportation Traffic Signal Optimization Program,
www.seattle.gov/transportation/signaloptimization.htm

Institute of Transportation Engineers, Traffic Signal Timing,
www.ite.org/signal/optimization.asp

Efficient Streetlights

Lincoln, NE street lighting policies
www.ci.lincoln.ne.us/City/attorn/designs/ds230.pdf

Issues and Facts about Low Pressure Sodium Lighting
www.nofs.navy.mil/about_NOFS/staff/cbl/LPSnet/LPS-references.html

Lighting Rates for Palo Alto
www.cpau.com/docs/rates/ratespdf/E14-070105.pdf

International Dark-Sky Association
www.darksky.org/

The Local Government Commission (LGC) is a nonprofit, nonpartisan, membership organization that provides inspiration, technical assistance, and networking to local elected officials and other dedicated community leaders who are working to create healthy, walkable, and resource-efficient communities.
www.lgc.org/index.html

Efficient Water and Wastewater Utilities

Consortium for Energy Efficiency (CEE) Resources Page
www.cee1.org/ind/mot-sys/ww/cr.php3

EPA Wastewater Management Fact Sheet
www.epa.gov/owm/mtb/energycon_fasht_final.pdf

Watergy
www.watergy.org

Alliance to Save Energy
www.ase.org

U.S. Department of Energy, Office of Industrial Technology
www1.eere.energy.gov/industry/

Office of Industrial Technology Software Tools
www1.eere.energy.gov/industry/bestpractices/software.html

Wisconsin Wastewater Operator's Association
www.wwoa.org

King County Fuel Cell Demonstration Project
dnr.metrokc.gov/wtd/fuelcell/

World Health Organization (WHO)-Regional Centre for Environmental Health Activities
www.emro.who.int/ceha/clearingh_waterdemand/portals/wutiliz/index.asp

"Major Sources of Efficiency Savings," ***Future Investment in Drinking Water and Wastewater Infrastructure*****,** November 2002.
www.cbo.gov/showdoc.cfm?index=3983&sequence=6

Motor System Efficiency in Water and Wastewater Systems: A Call to Action," American Council for an Energy-Efficient Economy, 2002.
www.cee1.org/ind/mot-sys/ww/call.pdf

Green Pages – Service Providers for Municipal Wastewater Treatment Systems
www.eco-web.com/index/category/2.2.html

Lawrence Berkeley National Laboratory Water and Energy Technology Team
water-energy.lbl.gov/index.php?wastewater

Water Conservation Program in Mountain View, CA
The city of Mountain View, California has a very comprehensive water conservation program to provide resources and incentives to both commercial and residential customers. For information on the program, visit:
www.ci.mtnview.ca.us/living/water_conservation.htm

Northwest Energy Efficiency Alliance Case Studies
Ellensburg Wastewater Treatment Plant[401]
Kennewick Wastewater Treatment Plant[402]

DMOZ Water Utility Open Directory of Companies
dmoz.org/Business/Energy_and_Environment/Utilities/Water/

City of San Diego Metropolitan Wastewater Energy Efficiency Program
www.sandiego.gov/mwwd/initiatives/energy.shtml

Water and Wastewater International Publication Article on Cogeneration for Municipal Wastewater
ww.pennnet.com/Articles/Article_Display.cfm?Section=ARTCL&ARTICLE_ID=254314&VERSION_NUM=2&p=20

Anaerobic Digester Methane to Energy A Statewide Assessment, 2003, Prepared for Focus on Energy
www.focusonenergy.com/data/common/pageBuilderFiles/Anaerobic_Report.pdf

Landfill Gas to Energy:

EPA Landfill Methane Outreach Program
www.epa.gov/lmop/

Landfill Gas Control Measures
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry
www.atsdr.cdc.gov/HAC/landfill/PDFs/Landfill_2001_ch5.pdf#search=%22riverview%20michigan%20landfill%20gas%22

EPA LMOP Database of Participating Municipalities
www.epa.gov/lmop/proj/xls/lmopdatami.xls
(link to Excel spreadsheet)

More Case Studies
www.epa.gov/lmop/res/index.htm#4

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[401] Case study archived, www.climatemanual.org/Cities/Chapter5/BestBets/Infrastructure/Ellensburg_case.pdf, 27 September 2006.
[402] Case study archived, www.climatemanual.org/Cities/Chapter5/BestBets/Infrastructure/Kennewick_case.pdf, 27 September 2006.

Chapter 5: Develop a Local Action Plan Best Bets **Municipal Transportation**

DOCUMENT CONTENTS

Reduce Municipal Vehicle Fleet Emissions

Reducing the amount of emissions produced by municipal vehicle fleets has the potential to make a significant contribution to a city's greenhouse gas (GHG) reduction targets. It will also save money and create a more beautiful place to live, work and play. Vehicle emissions reductions are a particularly visible area for improvement given the highly publicized nature of rising gasoline prices and the ensuing debate over foreign oil dependency. Vehicle emissions reductions can be applied to city transit, employee cars, police patrol cars, waste removal trucks, school buses, street sweepers or any other vehicle in the municipal fleet.

Although the initial cost of emissions reduction options is often higher than continuing to use conventional vehicles, in the longer-term, fuel-efficient or alternative fuel options will save costs and pay for themselves many times over.

Municipal vehicle fleet emissions reductions can occur through the use of hybrid and other highly efficient vehicles, the introduction of alternative fuels, and campaigning for idle reduction policies. The best strategy is diversification in order to try out pilot projects for what works best and still prepare for advancements in different sectors. The city of Seattle's Clean and Green Fleet Action Plan (being revised and updated) is a good model for how to create a diversified strategy. The 2003 document still available on their website summarizes Seattle's plan to implement cleaner operating vehicles and increase vehicle efficiency and use by breaking down the programs, recommended actions, cost impacts, environmental impacts and departmental lead. The State of Washington is modifying the guide for its own use.[403]

Hybrid

Hybrid electric vehicles (HEVs)[404] are efficient vehicles that use a small motor and an electric engine to generate the power to operate the vehicle. Today, most people have heard of an HEV and many people have a basic understanding of how they work.

In addition to offering reduced emissions of GHG, hybrid vehicle technologies are worthy of adoption due to their high fuel economy, which helps reduce dependence on petroleum from foreign sources and saves money.

One practical and highly visible method of implementing hybrid vehicles in any city is to ensure that the Mayor is transported around the city in a hybrid. This provides leadership by example and serves as a visual statement that reducing emissions and air pollution, and contributing to climate protection are important priorities.

Efficiency savings depends on the make and model of HEV, since some use the technology to increase power instead of mileage efficiency.[405]

Municipal Fleet Emissions Reduction

CASE STUDY: King County, WA

In 2004, King County, Washington purchased 235 hybrid diesel-electric buses to replace the existing fleet.[406] This purchase is expected to reduce fuel consumption by 750,000 gallons a year, and save $3.5 million annually in both fuel and maintenance costs. The hybrids cost $645,000 each—about $200,000 more than a traditional diesel bus. The up front cost of $47 million was expected to pay for itself in about 13 years. As of 2006, given higher fuel costs, it is expected to be a 8 year payback.

In 2006, King County had the National Renewable Energy Laboratory (NREL) perform a fuel economy comparison. The hybrid diesel-electric buses performed 29% better than conventional buses on King County routes and showed a 32% GHG emission reduction. In addition to purchasing the hybrid diesel-electric buses the county is also converting all existing and new buses to biodiesel (B20).[407]

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(206) 684-1498

[403] Seattle Clean and Green Fleet Action Plan, www.seattle.gov/environment/Documents/CleanGreenFleetAP.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/TransportationMunicipal/Seattle_CleanGreenFleetAP_2003.pdf, 5 December 2006.
[404] For more information about Hybrid electric vehicles, www.eere.energy.gov/cleancitie/hev/what_is_hev.html, 29 September 2007
[405] To determine what the mileage savings are refer to www.fueleconomy.gov, 30 October 2006.
[406] For more information, www.metrokc.gov/kcdot/news/2004/nr040527_hybrids.htm, 27 July 2006.
[407] Personal Communication with Jim Boon, 2 October 2006.

Alternative Fuels

Alternative fuels, as defined by the Energy Policy Act of 1992, include ethanol, natural gas, propane, hydrogen, biodiesel, electricity, methanol and p-series fuels. Using these alternative fuels in vehicles can generally reduce harmful pollutants and exhaust emissions. Also, most of these fuels are produced domestically and derived from renewable sources. It is important to diversify the cities' alternative fuel programs to both to try different programs and prepare for advancement in different sectors technology.

Electricity

Electricity can be used as a transportation fuel to power battery electric and plug-in hybrid vehicles. Pure electric vehicles or EVs, require a large energy storage device, such as a battery. EV batteries have a limited storage capacity and their electricity must be replenished by plugging the vehicle into an electrical source. The electricity for recharging the batteries can come from the existing power grid, or from distributed renewable sources such as solar or wind energy. Plug-in Hybrid vehicles use smaller batteries changes when a power source is available, or their fuel tank when it is not, hence the name "plug-in." See Fuel Transitioning for more information on plug-in hybrids [408]

Municipal Fleet Emissions Reductions

CASE STUDY: Chattanooga, TN

Chattanooga and Hamilton County, Tennessee[409] are reversing a history of environmental neglect by infusing sustainability concepts and practices into all aspects of local planning and public services. A prominent example of local sustainability initiatives, the transit authority for the city of Chattanooga and Hamilton County formed an innovative public-private partnership to develop, build, test and operate electric transit vehicles (ETVs) and ETV systems in downtown Chattanooga. Since 1991, 10 electric buses have gone in service on a downtown shuttle route, a local non-profit has been launched to promote research and provide information and a company has been formed to manufacture electric buses. Program benefits include reduced congestion on downtown streets, reduced air emissions, and over 30 new manufacturing jobs.

Emission reductions include:

Particulate emissions avoided - 600 lbs. per year (0.27 metric tons)

CO emissions avoided: 2,900 lbs. per year (1.32 metric tons)

NOx emissions avoided: 10,800 lbs. per year (4.90 metric tons)

CO_2 emissions avoided: 3.5 million lbs. per year (1587.57 metric tons)

Local Economic activity includes:

AVS, Chattanooga's electric bus manufacturer has sold 29 buses - more than 60% of electric transit vehicle sales outside California. Local electric bus manufacture supports 35 jobs.

Shuttle system related retail development is projected to reach $12 million generating $800,000 in city and county tax revenue.

CONTACT

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(423) 757-5168

[408] U.S. DOE www.eere.energy.gov, 27 September 2006.
[409] Smart Communities Network, www.smartcommunities.ncat.org/success/chattano.shtml, 27 September 206.

Biodiesel[410]

Biodiesel is a domestically produced, renewable fuel that can be manufactured from vegetable oils, animal fats, or recycled restaurant greases. Biodiesel is safe, biodegradable and reduces serious air pollutants such as particulates, carbon monoxide, hydrocarbons and air toxics. Blends of 20% biodiesel with 80% petroleum diesel (B20) can generally be used in unmodified diesel engines; however, users should consult their original equipment manufacturer engine warranty statement. Biodiesel can also be used in its pure form (B100), but it may require certain engine modifications to avoid maintenance and performance problems and may not be suitable for wintertime use.

According to the U.S. Department of Energy, B100 reduces CO_2 emissions by more than 75% over petroleum diesel. Using a blend of 20% biodiesel reduces carbon dioxide emissions by 15%. Biodiesel also produces less of other air pollutants, including particulate matter, carbon monoxide (CO) and sulfur dioxide (SO_2) emissions.[411]

Currently, a federal biodiesel tax incentive is helping reduce the cost of biodiesel.[412] The credit equates to a one penny per percent of biodiesel in a fuel blend made from agricultural products like vegetable oils, and one-half penny per percent for recycled oils. This incentive is taken by petroleum distributors and passed on to consumers. A USDA a study estimated this incentive will increase the demand for biodiesel to at least 124 million gallons per year. And depending on other factors, including crude oil prices, the industry projects that demand could be much higher.

Municipal Fleet Emission Reduction

CASE STUDY: San Francisco, CA[413]

In 2006 the city of San Francisco's Mayor Gavin Newsom signed an Executive Directive to accelerate the pace of biodiesel use in city fleets.[414] The city has been a long-term user of a B20 biodiesel blend (80% petroleum diesel, 20% biodiesel) with the San Francisco Airport, Department of Public Works, MUNI buses, San Francisco Zoo and ferries using the fuel successfully.

The directive calls for fleet managers to identify vehicles that can be quickly transitioned to B20 use and make the necessary preparations for this transition. All diesel-using departments are required to begin using biodiesel as soon as is feasible with the following targets: 25% use of B20 by March 31, 2007 and 100% use by December 31, 2007. San Francisco uses about 8 million gallons of diesel a year, so the shift to B20 will result in significant petroleum displacement and emissions reduction. In related news, the San Francisco Fire Department has announced a pilot program to test B20 in two fire trucks, six engines and one ambulance. The pilot will be conducted in the southeastern part of the city, which struggles with poor air quality.

The National Biodiesel Board (NBB) has recently praised the city of San Francisco for its commitment to biodiesel. Joe Jobe, CEO of NBB said, "This makes San Francisco the largest U.S. city ever to institute such broad biodiesel use."

CONTACT

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(415) 355-3700

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[410] U.S. DOE, www.eere.energy.gov, 5 October 2006.
[411] An Overview of Biodiesel and Petroleum Diesel Lifecycles, USDA and DOE joint report, 1998, www.nrel.gov/docs/legosti/fy98/24772.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/TransportationMunicipal/USDA_DOE1998.pdf, 30 October 2006.
[412] To learn more about the biodiesel tax incentive, go to the National Biodiesel Board's Tax Incentive website: www.nbb.org/news/taxincentive/, 30 October 2006.
[413] National Biodiesel Board www.biodiesel.org/resources/pressreleases/fle/20060522_sanfran_b20nrfinal.pdf#search=%22San%20Francisco%20Biodiesel%20program%22, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/TransportationMunicipal/2006_sanfran_b20nrfinal.pdf, 27 September 2006.
[414] San Francisco Executive Directive, www.newrules.org/de/archives/000124.html, 5 October 2006.

Hydrogen

Hydrogen (H2) could play an important role in developing sustainable transportation in the U.S., because in the future it may be produced in virtually unlimited quantities using renewable resources. While hydrogen technology is still evolving, the fuel has been used effectively in a number of internal combustion engine vehicles mixed with natural gas. Hydrogen has the potential to be a major fuel source in the longer term, but the technology will not be market-ready in the short term. (See Renewable Energy Planning for more information on Hydrogen as an alternative energy source)

Compressed Natural Gas (CNG)

Natural gas is domestically produced and readily available to end-users through the utility infrastructure. It is also cleaner burning and produces significantly fewer harmful emissions than reformulated gasoline or diesel when used in natural gas vehicles.[415] A study conducted by NREL in 2000 compared CNG, bi-fuel CNG and gasoline vans on pre-existing routes in Colorado. The study found CO2 emissions were 22% to 25% less for the CNG vans than their gasoline counterparts.[416] In addition, commercially available medium- and heavy-duty natural gas engines have demonstrated over 90% reductions of CO and particulate matter and more than 50% reduction in NOx relative to commercial diesel engines. Natural gas can either be stored onboard a vehicle as compressed natural gas (CNG) at 3,000 or 3,600 psi or as liquefied natural gas (LNG) typically at 20-150 psi.

Ethanol

Ethanol is an alcohol-based alternative fuel produced by fermenting and distilling starch crops that have been converted into simple sugars. Feedstocks for this fuel include corn, sugar, barley and wheat. Ethanol can also be produced from "cellulosic biomass" such as trees and grasses. The technology for this "cellulosic ethanol" still needs further development for the fuel to be cost effective. However, this fuel source has great potential. Ethanol is most commonly used to increase octane and improve the emissions quality of gasoline.

Ethanol can be blended with gasoline to create E85, a blend of 85% ethanol and 15% gasoline. E85 and blends with even higher concentrations of ethanol, E95, for example, qualify as alternative fuels under the Energy Policy Act of 1992 (EPAct)[417]. Vehicles that run on E85 are called flexible fuel vehicles (FFVs) and are offered by several car manufacturers. There are already more than 6 million E85 compatible vehicles on American roads.[418] Enabling these owners to have access to E85 stations, due to the limited suppliers in many states, is now the challenge.[419]

Benefits of using Ethanol (E 85) include:

Ethanol reduces demand for imported oil.

Ethanol is a renewable fuel source. In MN ethanol is made from starch found in corn and cheese-making byproducts.

It is safe and approved. E85 is made from 85% ethyl alcohol (ethanol) and just 15% petroleum, and is approved by all flexible fuel vehicle manufacturers.

E85 reduces ozone-forming pollution by 20% and GHGs by nearly 30%.

Ethanol is less toxic and therefore reduces the release of the compounds like benzene, toluene and xylene, which are required in gasoline.

Ethanol boosts engine horsepower. E85 has a 105 octane rating and burns cooler than gasoline, keeping engines clean.

Cost. E85 is typically costs less than gasoline.

Cleanup. Ethanol degrades quickly in water, which reduces gasoline spills and leaks.

[415] U.S. DOE Alternative Fuels, www.eere.energy.gov/afdc/afv/gas_vehicles.html, 30 October 2006.
[416] NREL SuperShuttle CNG Fleet Evaluation Report, 2000, www.eere.energy.gov/afdc/pdfs/supershuttle_final.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/TransportationMunicipal/NREL_supershuttle.pdf, 30 October 2006.
[417] Freedom Car and Vehicle Technologies Program www1.eere.energy.gov/vehiclesandfuels/epact/, 30 October 2006.
[418] National Ethanol Vehicle Coalition, www.e85fuel.com/index.php, 5 December 2006.
[419] National Ethanol Vehicle Coalition, Refueling station locator, www.e85refueling.com/, 5 December 2006.

Municipal Fleet Emission Reduction

CASE STUDY: Minneapolis, MN

The city of Minneapolis[420] fleets included 53 E85 vehicles, 5 hybrids and 3 maintenance shop tricycles as of March 2006. In 2005, their vehicles and equipment used 1,100,000 gallons of ultra low sulfur unleaded gasoline[421] and 760,000 gallons of B5 fuel (5% biodiesel). In 2004, the city contracted with a local gas station to provide E85 fuel to its vehicles but the station was not conveniently located. The city's 2006 plan includes lessons learned in 2004 & 2005, and is developing an E85 fueling station at its most heavily used maintenance facility.

Costs of using Ethanol in Minnesota:

Vehicle cost: Flexible Fuel Vehicles (FFV) cost about the same as regular vehicles.

Fuel cost: E85 is $1.99/galon at area gas stations compared to over $2.65/galon for regular unleaded gas.

Fuel location: The city of Minneapolis and Hennepin County are jointly funding the new E85 Fueling Station. Hennepin plans to purchase E85 vehicles.

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Idle Reduction Campaigns

"Idle reduction" is typically used to describe technologies and practices that reduce the amount of time heavy-duty trucks and cars idle their engines. Reducing idle time saves fuel, engine wear and money. In addition, it reduces emissions and noise.

Ten Tips to Conduct an Anti-Idling Campaign[422][423] from Missauagua, Canada

1. Attack the myths about engine idling
   Three major idling myths need to be challenged:
   - Your engine should be warmed up for long periods before driving;
   - Idling is good for your engine; and
   - Shutting off and restarting your vehicle is hard on the engine.

   You need to put these front and center in your campaign along with the facts. The myths and facts are important information that should be in the information materials, Web site, etc.
2. Get your own house in order
   For municipalities, your message goes a long way with the public if you first get your own house in order. The must take the lead on issues like idling, so launch a workplace initiative to reduce idling across municipal operations.
3. Partnerships are key to success
   To effectively implement your campaign, you need to develop local community partners, for example, local school boards and universities.
4. Finding and managing project staff
   Use a community-based social marketing approach. This involves personal "interventions" or, personal

[420] U.S. Conference of Mayors Energy & Environment Best Practices Survey Report, mayors.org/uscm/best_practices/EnergySummitBP06.pdf#search=%22ethanol%20E85%20best%20practices%20city%22, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/TransportationMunicipal/EnergySummitBP06.pdf, 26 October 2006.
[421] Ultra low sulfur diesel can reduce GHG and other air pollutants. EPA National Clean Diesel Campaign, www.epa.gov/cleandiesel/, 19 October 2006.
[422] Missauagua, Canada www.mississauga.ca/portal/residents/idlefree?paf_gear_id=10200022&itemId=42200036&returnUrl=%2Fportal%2Fresidents%2Fidlefree, 27 September 2006.
[423] Canada Natural Resource Idling Information Page, oee.rncan.gc.ca/communities-government/idling.cfm?attr=12, 27 September 2006.

interactions by project staff to encourage drivers in reducing idling at community locations. You need people power to do the interventions and it can be tricky to find and manage the staff. Determine if there are environmental internship programs at the local university for resource help.

5. Council and senior management support is critical
   For municipalities, foster strong support from your council and senior management. Your mayor could help launch the campaign and formal council endorsement should be sought. In Greater Sudbury, the anti-idling campaign was adopted by Earthcare Sudbury, a partnership of the city and 40 community groups; this helped to cultivate broad-based community support and awareness.

6. Utilize pre-existing campaign materials
   Draw extensively on the images, information and graphic materials available on NRCan's Idle-Free Zone Web tool kit. Create your own new tools using the web site images, including t-shirts, radio spots, letterhead, a dedicated anti-idling web site, etc. The tool kit is a great starting point, and you can tailor it for local use. You need to know your community and what the local hooks are.

7. Schedule field work during consistently moderate temperatures
   Schedule the implementation of initiatives when temperatures are expected to be consistently moderate, such as spring and early fall, for all aspects of field work (re: pre-intervention data collection, interventions, and post-intervention data collection.

8. Focus on your target audience
   Some audiences are more receptive to the anti-idling message than others. In the city of Mississauga's experience, the most successful component was drivers (i.e., parents and caregivers) at elementary schools who are concerned about the health of their children. Information kits distributed to schools educated children about idling and the kids then took the message home.

9. Build a campaign web site
   A web site is a great low-cost way to make anti-idling information readily accessible and allows regular updates as the campaign progresses. A contact e-mail address allows visitors to make inquiries, comments or suggestions easily, and response time and printing costs can be minimized by referring to the Web site.

10. The message should be visible and memorable / communications input
    Use strong messaging and images (i.e., vehicle tailpipe that looks like a smoking gun), and colors to promote the campaign. Your campaign will also go smoother if you have communications expertise on your project team.

Municipal Fleet Emission Reductions

CASE STUDY: Mississauga, Canada[424]

In 2002, the city of Mississauga partnered with Natural Resources Canada to conduct a "*Towards an Idle-Free Zone in the city of Mississauga*" campaign. The city utilized many of the communications tools Natural Resources Canada provided and aimed the campaign at public awareness, schools, residential, workplace, private sector, transit education and municipal hotspots. A few of the results are listed next.

Results of the Workplace Initiative:

96% of city employees were aware of the anti-idling campaign;

[424]Mississauga Idle Free Campaign, www.mississauga.ca/portal/residents/idlefree, 27 September 2006.

31% reported that the campaign had changed their idling behavior;

Meetings with transit management have resulted in a new policy reducing the maximum idling time for city buses from 15 minutes to 5 minutes[425]

Results of School Initiative

Before the interventions were conducted, 54% of drivers were observed idling their vehicles while waiting for children.

Almost 500 drivers were approached at 20 elementary schools visited by campaign staff

The frequency of idling decreased from 54% to 29%

The duration of idling decreased from 8 minutes to 3.5 minutes.

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Municipal Fleet Emission Reductions

CASE STUDY: Lane County, OR

The Lane Regional Air Protection Agency (LRAPA) created the Everybody Wins Program as a project to reduce diesel emissions from idling heavy-duty trucks.[426] LRAPA developed an innovative lease-to-own program to help truckers reduce their idling time through the use of auxiliary power units (APUs). APUs were installed on 100 trucks in Phase 1 of the program, which helped to develop the installation and service infrastructure to support APU technology on the I-5 corridor in Oregon. Phase I of the project is expected to conserve around 1 million gallons of diesel fuel over the life of the 100 APUs and reduce idling emissions in the trucks with APUs by 75%-90%.

Phase 2 of the program is now underway, with the goal of installing another 250 APUs by 2007. LRAPA received a $500,000 grant from the Environmental Protection Agency (EPA) SmartWay Transport Partnership for the second phase. In Phase 2, LRAPA will place passive GPS data loggers on board 100 of the 250 trucks to track the usage of APUs. After a year of data on the APUs has been collected, LRAPA will submit a case study report to the EPA, which will then be used to demonstrate the effectiveness of the idle reduction technology to the trucking industry.[427] As a result of the program, the non-profit Cascade Sierra Solutions was created in March 2006 with the mission of continuing and expanding the Everybody Wins Program throughout Oregon, Washington and California.[428]

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[425] oee.rncan.gc.ca/transportation/idling/material/reports-research/cppi-final-report.cfm?attr=28, 27 September 2006.
[426] Lane Regional Air Protection Agency, www.lrapa.org/projects/everybody_wins/, 5 December 2006.
[427] West Coast Diesel, www.westcoastdiesel.org/programs.htm, 5 December 2006.
[428] Cascade Sierra Solutions, www.cascadesierrasolutions.org, 5 December 2006.

Programs to Reduce Driving

Many commuters are offered subsidized parking but get no comparable benefit if they use such alternative modes as walking, biking, telecommuting or public transit. When commuters are offered subsidized parking or its cash equivalent, automobile commuting trips typically decline 15-25%.[429] The result would not only include significant reduction in emissions, but also a diminution in traffic accidents, congestion and fossil fuel consumption.

Parking cash out[430] means that commuters who are offered a subsidized parking space can instead choose the equivalent cash value or other benefits. For example, employees might be able to choose between a free parking space, a monthly transit pass, vanpool subsidies or $50 cash per month. This typically reduces automobile commuting by 10-30%, and is fairer, since it gives non-drivers benefits comparable to those offered motorists. More strategies to reduce driving for residents are discussed in the Chapter 5, Residential Transportation Section.

A study of 1,110 Los Angeles area employee commute trip reduction programs found that financial incentives were the most effective of all the strategies evaluated.[431] The table below summarizes the findings.

Type of Benefit	Change in Drive Alone Mode Share
Bicycle Subsidy	-2.7
Vanpool Seat Subsidy	-5.4
Transit Subsidy	-3.1
Other Employee Benefits	-4.1

Table: Effect of Various Financial Incentives on Commute Trips

Transit voucher programs typically shift 20-percentage points of recipients' commute travel from auto to transit.[432] [433] Another study found that total vehicle trips declined by 17% after Parking Cash Out was introduced at various urban and suburban worksites, as illustrated in the next figure.[434] These automobile trips reductions tend to increase over time: one employer found that solo commuting continued to decline each year after Parking Cash Out was introduced, as more employees found opportunities to reduce their driving and take advantage of the benefit.

[429] Victoria Transportation Policy Institute www.vtpi.org/wwclimate.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/TransportationMunicipal/wwclimate.pdf, 27 September 2006
[430] Ibid.
[431] Cambridge Systematics, *The Effects of Land Use and Travel Demand Management Strategies on Commuting Behavior*, Travel Model Improvement Program, USDOT (www.bts.gov/tmip), 1994.
[432] Oram Associates, *Impact of the Bay Area Commuter Check Program: Results of 1994 Employee Survey*, Metropolitan Transportation Commission (Oakland; www.commutercheck.com), 1995.
[433] Judith Schwenk, *TransitChek in the New York City and Philadelphia Areas*, Volpe Transportation Systems Centre, USDOT (www.volpe.dot.gov), October 1995.
[434] Donald Shoup, "Evaluating the Effects of California's Parking Cash-out Law: Eight Case Studies," *Transport Policy*, Vol. 4, No. 4, 1997, pp. 201-216.

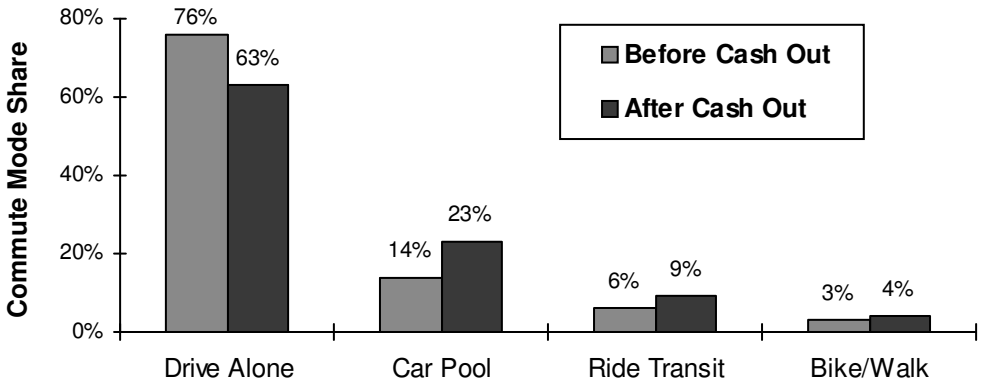

Figure: Cashing Out Impacts on Commute Mode[435]

Parking Cash Out results in reduced automobile commuting and increases in carpooling, transit and non-motorized travel.

Municipal Fleet Emission Reduction

CASE STUDY: Oakland, CA

The city of Oakland established a Commuter Check Program[436] for employees. The program encourages the use of mass transit, by allowing employees to set aside pre-taxed dollars that are specifically designated for utilizing mass transit. The program encourages rider-ship on buses, trains and ferries while lowering taxable earnings.

A monthly payroll deduction of $100 plus an administrative fee is used to offset commuter expenses. Vouchers equaling the same set aside amount are mailed to the employee and can then be used at various locations that dispense tickets and passes.

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Municipal Fleet Emission Reductions

CASE STUDY: Pleasanton, CA

The suburban city of Pleasanton, California offers $1.50 per day to employees who use a commute alternative instead of driving to work alone. All city employees are eligible to participate with no minimum days required. The program has resulted in an annual savings of 20,625 trips, which translates into 12,375 gallons of fuel and 123 tons of CO_2. In 1993, the year before the program was implemented, only 28 employees were commuting to work using alternative modes. Average participation in 1994 was 55

[435] Ibid.
[436] Oakland Commuter Check Program, www.oaklandnet.com/government/fwawebsite/personnel/personnel_benefitsp3.htm, 27 September 2006.

employees per month and grew to 66 participants in 1995.[437] By 2004 average participation was 57 employees per month representing a steady interest in the first ten years of operation. At the close of the 2006 fiscal year, average monthly participation was up to 62 employees per month. The program has increased its incentive rate to $2.00 per day.[438]

The city of Pleasanton is also listed on the Best Workplaces for Commuters web site because of their innovative programs to promote alternative commute programs.[439]

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Modify Transportation Contracts to Incentivize Alternative Fuel Use

Alternative Fuels for School Buses

There are many niche markets for biodiesel, but school buses, in particular, can be considered 'low hanging fruit'. The fact that there are about 460,000 school buses in the U.S.—nearly six times as many as all the nation's public transit buses combined—is reason enough. But the fact that children—especially young children—tend to be more susceptible than adults to the toxic and potentially cancer-causing emissions from petrodiesel has been an even more compelling reason for school boards and parents across the nation to insist on switching school buses to biodiesel. program designed to help school districts clean up their bus fleets. The fact that the EPA received more than 120 applications requesting almost $60 million is a clear indication of how popular the program has become. Numerous school districts have integrated biodiesel into their fleets:[440]

In 1997 the Medford, New Jersey, school district was the only one in the nation to run its fleet on biodiesel.[441]

The Clark County, Nevada, school district now powers more than twelve hundred of its buses with biodiesel, making it the largest school bus fleet in the nation (and possibly the world) to use biodiesel. The district school buses use 3.5 million gallons of biodiesel each year. [442]

In Kentucky nine school systems are now running six hundred buses on biodiesel.[443]

Although the details are still a little confusing, there is increasing evidence that other school bus fleets are also saving money by using biodiesel, even though the fuel costs more than petrodiesel. How is this possible? Biodiesel use results in reduced maintenance costs and increased mileage per gallon.

The federal government has been helpful in this process. Congress included $5 million in the Environmental Protection Agency's (EPA) budget for Clean School Bus USA,[444] a cost-shared grant

[437] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm8.htm, 24 October 2006.
[438] Personal Communication with Lisa Adomalis, 27 October 2006.
[439] Best Workplace for Commuters, www.bwc.gov/empkit/case-studies.htm#city, 27 October 2006.
[440] "Biodiesel, Growing a New Energy Economy" by Greg Pahl, Chelsea Green Publishing Company, 2005,
[441] National Biodiesel Board, www.biodiesel.org/resources/users/stories/medfordnj.shtm, 27 September 2006.
[442] Clark County School District Insider, www.ccsd.net/news/publications/insider/05-06/Insider_Fall.pdf#search=%22biodiesel%22, 30 October 2006.
[443] For information on the six districts participating in Clean Cities pilot program: www.eere.energy.gov/afdc/apps/toolkit/pdfs/kentucky_success.pdf#search=%22school%20districts%20and%20biodiesel%22, 30 October 2006.
[444] EPA Clean School Bus www.epa.gov/cleanschoolbus/ 27 September 2006.

Transportation Contracts

CASE STUDY: Saint Johns, MI[445]

The Saint Johns Public Schools in Michigan was the first Michigan school district to switch its entire fleet of buses (totaling thirty-one) to B20 when it began utilizing biodiesel in 2002.

The school has kept careful maintenance records from both before and after biodiesel was adopted in April 2002. The main cost savings have been due to extended intervals between oil changes, according to Wayne Hettler, garage foreman and head mechanic for Saint Johns. "I'm convinced," he says, "that we are able to extend the oil changes because the B20 burns cleaner and isn't dirtying the oil as quickly. We're using oil analysis to determine oil change times. We solely credit biodiesel for cleaning up the oil, thus saving the district the costs of oil, filters, labor and the like. I challenge other fleets to 'read' their fleet records and make these cost saving changes after switching to B20."

Longer fuel-pump life due to biodiesel's higher lubricity and increased miles-per-gallon rating are also cited by Hettler as adding even more savings. "Pre-April 2002, our fleet's mileage averaged 8.1 miles per gallon. Now we average 8.8. That's a huge difference in miles per gallon for buses," said Hettler. A combined savings of $3,500, even after the extra cost of the biodiesel is deducted, is predicted by the district for the two year period. If savings can be realized by this school bus fleet, it seems reasonable to assume that other fleets can do the same.

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Transportation Contracts

CASE STUDY: Warwick, RI

On the East Coast, the Warwick, Rhode Island, school district not only uses B20 biodiesel in its entire seventy-bus fleet but has been successfully heating three of its school buildings with B20 since 2001.[446]

Utilizing the change as an 'experiential education' opportunity the district has also begun integrating biodiesel education into its classroom curriculum. This program is modeled after the high school curriculum on alternative fuels developed by the Northeast Sustainable Energy Association called "Cars of Tomorrow and the American Community."

In addition to switching fuels, Warwick Public Schools has undertaken a number of energy-saving initiatives. The district utilizes teaching tools that include a 5kWh solar array, a solar car and a fuel cell. According to Robert Cerio, who educates about and manages the energy program, these efforts combined with district-wide improvements such as lighting retrofits and an energy management system—have resulted in annual energy savings of $500,000 during the past four years, according to Cerio.[447]

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[445]Michigan Soybean Committee http://www.michigansoybean.org/ , 30 October 2006.
[446]Rebuild America www.rebuild.gov, 27 September 2006.
[447]Rebuild Warwick, www.rebuild.org/attachments/successstories/RhodeIslandBiodiesel.pdf#search=%22warwick%20public%20schools%2C%20energy%20management%20program%22, 30 October 2006.

Alternative Fuels for Waste Haulers[448]

Waste haulers are one of the most inefficient vehicles on U.S. roads. They burn approximately a gallon of fuel for every 2.8 miles, travel approximately 25,000 miles annually and consume 8,900 gallons of diesel per year. The 136,000 refuse trucks operating on U.S. roadways may burn nearly 1.2 billion gallons of diesel fuel per year—equivalent to almost 30 million barrels of oil.

Alternative fuel sources are becoming more apparent and economically viable.

Greening Garbage Trucks, authored by James S. Cannon, documents changes since 2002:

Use of alternative fuel refuse trucks—nearly all powered by natural gas—has doubled from 692 to almost 1,500. The number of cities in which these trucks operate has also doubled, from 26 to 57.

Refuse trucks have become the most rapidly growing natural gas vehicle sector in the U.S. Their use has expanded more rapidly as a percentage than any other vehicle sector. Its 89% increase was four times the overall 20% increase (between 2002 and 2004) in natural gas vehicle use nationwide.

New natural gas fleets have come into operation in Paris, Madrid and Mechlun, Belgium.

Although natural gas truck use has risen dramatically, the number now on U.S. roadways constitutes less than 1% of the total refuse truck population of 136,000. Even so, this sector is the second most promising market for natural gas vehicle use after the transit bus sector, which has a market penetration of 12%.

- The nation's five largest natural gas refuse truck fleets are operating in California.

City	Fleet Owner	Size of Fleet
Los Angeles, CA	City of Los Angeles	252 LNG
El Cajon (San Diego), CA	Waste Management-San Diego	126 LNG
Sacramento, CA	County of Sacramento	105 LNG (55 LNG/diesel, 50 LNG)
San Diego, CA	Environmental Services Dept.	77 dual-fuel LNG
Fresno, CA	City of Fresno	69 LNG

Table: Location of California Natural Gas Fleet Owners, Including Size of Fleet [449]

U.S. fleet operators identified seven factors that encouraged their shift from diesel to natural gas fuel trucks and three major obstacles to change.

The seven positive factors were:

1. State government programs that provide incentives for purchasers of alternative fuel
2. Concern about rising gasoline and diesel prices, which have sparked fleet interest in alternatives to petroleum-based fuels
3. Looming new environmental standards for heavy-duty engines, which natural gas engine manufacturers are already prepared to meet
4. Growing concerns about national security and US dependence on foreign oil
5. Strong natural gas vehicle industry presence in the refuse truck market
6. Concern among urban leaders and health officials about the health effects of diesel exhaust, which contains carcinogens
7. Recognized benefits of less noise

[448] Greening Garbage Trucks, Trends in Alternative Fuel Use 2002-2005, James S. Canon. informinc.org/ggt_project1.php, also archived at www.climatemanual.org/Cities/Chapter5/BestBets/TransportationResidential/GGT_2005.pdf, 27 September 2006.
[449] Ibid.

The three primary obstacles to change were:

1. The higher costs of natural gas vehicles and their refueling infrastructure and the higher costs of biodiesel fuel
2. Performance issues that still affect natural gas trucks
3. Reduced federal funding for key DOE programs and a legal setback for the most ambitious

Transportation Contracts

CASE STUDY: Los Angeles, CA[450]

The largest growth has occurred in the city of Los Angeles fleet, which grew from 10 natural gas trucks in 2002 to 252 in 2005. This increase occurred despite a serious setback in 2004, when the entire fleet of roughly 160 natural gas trucks was temporarily removed from service to repair the source of leaks in the liquefied natural gas (LNG) fueling system and to counter problems with overheating of the engines. (The trucks soon returned to service and have performed well since then.) Leonard Walker, former Equipment Superintendent with the city of Los Angeles told INFORM that the city "bought natural gas trucks to improve the air quality. The City Council took a proactive position and voted to improve the air quality by supporting the SCAQMD (South Coast Air Quality Management District) ruling[451] to purchase alternative fuel trucks before it was mandated by law."

He noted that the fleet is "performing okay considering it is a new technology" and that "public support for the dual-fuel trucks is positive."

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Other clean fuels and advanced technologies are emerging in refuse vehicles: use of biodiesel (San Jose, California), hydraulic hybrid technology (in Los Angeles) and use of bio-methane fuel, a win-win strategy capturing a powerful GHG that was escaping from landfills for use as a clean renewable refuse truck fuel (with projects in Burlington, New Jersey; Los Angeles & San Diego, California and Gothenburg, Sweden.)

[450] Ibid.
[451] Rule 1193. Clean On-Road Residential and Commercial Refuse Collection Vehicles www.aqmd.gov/tao/FleetRules/1193Refuse/index.htm, 27 September 2006.

Transportation Contracts

CASE STUDY: Hybrid Technology[452] for Refuse Vehicles

In late 2004, a developer of hydraulic-hybrid technology—Permo-Drive, Inc., based in Ballina, Australia—began a program to test its hydraulic-hybrid system in refuse collection vehicles operating in Los Angeles, California. For this test, Permo-Drive is collaborating with Waste Management, a major manufacturer of truck chassis, a tier-one driveline systems integrator, and a refuse truck body builder. This team will build and test a hybrid-hydraulic refuse collection vehicle. In 2005, the Hybrid Truck Users Forum, a coalition of heavy-duty hybrid-electric truck developers, established a working group to promote the use of hybrid-electric technology in refuse trucks. In 2006, the working group hopes to begin testing hybrid-electric refuse trucks.

CONTACT

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Transportation Contracts

CASE STUDY: Bio-Methane[453]

A demonstration landfill gas recovery project, conducted in Burlington County, New Jersey, in 2004 and 2005, successfully produced excellent quality gas and used it to fuel two refuse trucks. In this project, landfill gas was purified using a proprietary CO_2 Wash system, developed by Acrion Technologies, Inc., which produced a contaminant-free stream of methane (75%) and carbon dioxide (CO_2) (25%). This methane-carbon dioxide stream was further separated into high-purity methane (less than 100 parts per million CO_2) using membranes manufactured by Air Liquide. Additional processing liquefied the methane into high purity LNG truck fuel. The trucks were refueled with LNG at a Chart Industries fueling station located at the EcoComplex facility adjacent to the Burlington County landfill. The fuel powered two Mack trucks, with E7G engines, owned by Waste Management. Mack is now focusing on selling this process commercially and is conducting free assessments for landfills to determine the economic feasibility of building landfill gas recovery facilities.

CONTACT

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[452] Greening Garbage Trucks, Trends in Alternative Fuel Use 2002-2005, James S. Canon. informinc.org/ggt_project1.php, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/TransportationResidential/GGT_2005.pdf, 27 September 2006.
[453] Ibid.

Additional Resources

Hybrid Resources

- Hybrid Center provides information on consumer and technology www.hybridcenter.org/
- Calculate the potential mileage savings for hybrid vehicles www.fueleconomy.gov
- Clean Cities' HEV Cost Calculator allows fleets to compare the costs, benefits, and emissions of HEV with those of conventional vehicles www.eere.energy.gov/cleancities/hev/cost_calc.html

Natural Resources Canada has developed ready-to-use graphic materials, articles, tools and templates that can help you organize a public education campaign at your workplace or develop a larger-scale awareness and outreach campaign in your community. oee.rncan.gc.ca/communities-government/idling.cfm?attr=12

U.S. DOE Energy Efficiency and Renewable Energy Resources Clean Cities
Clean Cities develops comprehensive toolkits that help coalitions and stakeholders reach their petroleum displacement goals. With technical information, step-by-step instructions, answers to frequently asked questions, related links, and more, Clean Cities' toolkits point users in the right direction. Choose the following toolkits to learn how to build niche markets, install alternative fuel infrastructure, and calculate the cost savings of hybrid electric vehicles. www.eere.energy.gov/cleancities/

Alternative Fuels Data Center
www.eere.energy.gov/afdc/

Toolkits Available for Alternative Fuels
www.eere.energy.gov/cleancities/toolkits.html

- Airport Shuttle Outreach Toolkit www.eere.energy.gov/afdc/apps/toolkit/airport_shuttle_toolkit.html
- E85 Fleet Toolkit www.eere.energy.gov/afdc/e85toolkit/
- School Bus Toolkit www.eere.energy.gov/afdc/apps/toolkit/school_bus_toolkit.html
- Transit Bus Niche Market Toolkit www.eere.energy.gov/afdc/apps/toolkit/transit_bus_toolkit.html
- HEV Cost Calculator www.eere.energy.gov/cleancities/hev/cost_calc.html

National Biodiesel Board is the national trade association representing the biodiesel industry as the coordinating body for research and development in the United States www.biodiesel.org

Chicago Locomotive Idle Reduction Project.
Environmental Protection Agency, March 2004.
www.epa.gov/smartway/documents/420r04003.pdf

Wisconsin Diesel Truck Idling Grant Program
www.legis.state.wi.us/lc/2_PUBLICATIONS/Other%20Publications/Reports%20By%20Subject/Environment%20and%20Natural%20Resources/IM05_02.pdf

Chicago districts' alternative fueled fleet success stories,
www.chicagocleancities.org/stories.shtml

Chapter 5: Local Action Plan Best Bets **Office Waste Reduction and Recycling**

DOCUMENT CONTENTS

Cities and municipalities can realize substantial economic savings simply by reducing the amount of office waste they generate. Reduced use, increased efficiency, recycling and the reuse of materials can deliver numerous economic and environmental benefits to cities. There are many forms of waste. This chapter focuses on office wastes, especially paper. Similar analyses can be made for all forms of municipal waste.

Office Practices to Reduce Waste[454]

While recycling is an important part of reducing our impact on the environment, it is important to combine recycling with waste prevention programs to implement practices that reduce consumption and to reuse office supplies. An enormous amount of waste is generated every year in offices due to inefficient use patterns. One of the first places to start is reducing paper use in offices:[455]

The average office worker uses 10,000 sheets of copy paper each year. Producing and delivering that paper requires energy, whose use releases carbon.

The U.S. consumes 30% of the world's paper with 5% of the world's population.

Americans throw away enough office paper every year to build a 12-foot-high wall stretching from New York to San Francisco. When paper rots in a landfill, it releases methane gas, a far more potent greenhouse gas than carbon dioxide.

[454] For more information visit California Integrated Waste Management Board Waste Prevention and Recycling, www.ciwmb.ca.gov/WPW/Office/, 29 September 2006.
[455] Minnesota Office of Environmental Assistance, www.reduce.org/, 29 September 2006.

Increasing efficiency increases profits. First place an emphasis on reducing use, then on reducing waste and finally recycling the waste that is still generated. Cities should start with the concepts and practices that staff are most familiar with, and are thus more likely to rapidly embrace. Do what is easiest to get staff started, but recognize that even the easy things require a commitment to making changes in daily habits.

Reduce

Here are some simple ways to significantly reduce paper waste.

Set photocopiers and printers to print on both sides by default. If this is not possible, save paper that can be used on the second side, and reuse it.

Make computer files instead of paper files whenever possible. There are many free or inexpensive software programs, such as Stickies[456] or NoteWhen[457] that reduce or eliminate the need for sticky notes and note pads. Small handheld computers are especially good for note taking, calendar scheduling, and other tasks that traditionally use paper. With recent advances in computer software, it is now easier than ever to create documents that are encrypted, password protected, and safe from either unauthorized access or alteration using sophisticated free and low cost software. Electronic signatures are increasingly becoming accepted and are legally binding.

Electronic files also save floor and file space, and most electronic documents are safer than paper. Backup copies can be easily transferred to high-capacity, low-cost removable media, such as compact discs or removable hard drives and stored off-site. Backups can also be transferred over secure Internet connections for off-site storage. Offices are then safer from fire or flood and theft.

Fight junk mail—Take steps to reduce the amount of junk mail that offices receive. While this may take a little staff time at first, in the end staff time will be saved by not having to weed out the junk, fewer trees will be lost to produce the paper, less fuel will be used in the production and sale of the paper not to mention the saved printing and delivery costs.

- Remove Your Business From Two Major Mailing List Databases:

1. Dun & Bradstreet (D&B) maintains the largest company database worldwide, collecting information on more than 70 million business establishments from 217 countries. An authorized representative of the business can request the "delisting" process orally or in writing, resulting in its removal from marketing directories, publications and/or mailing lists. To have your business delisted, call D&B's customer service center at 1-800-333-0505 or send an e-mail to custserv@dnb.com.
2. InfoUSA maintains information on more than 12 million businesses in the U.S. To remove your business from their lists, fax a letter to (402) 331-0176 with: "Attention—Business Update Department" on top. The letter should include the complete business name, address, and phone number; the name and title of the person requesting the deletion; and that person's signature. You can also send this letter by regular mail to InfoUSA, P.O. Box 27347, Omaha, NE, 68127.

- Remove Your Business from Specific Company Mailing Lists:
  Not every company uses the mailing list databases maintained by Dun & Bradstreet and InfoUSA. You can either establish a system where one person is designated to contact individual, persistent mail solicitors or encourage all your employees to contact mail solicitors. You can create a preprinted postcard to make it easier for employees to contact solicitors, thus increasing the likelihood that they will. When sending a mailing list deletion request card, be sure to write "Attn: Direct Marketing Dept." under the company address. Even if the company does not have a separate direct marketing department, this will help the card be delivered to an individual within the company who can delete your name from their mailing list.

[456] Zhorn Stickies, www.zhornsoftware.co.uk/stickies/index.html, 29 September 2006.
[457] PC Magazine Article, www.pcmag.com/article2/0,1759,1559699,00.asp, 29 September 2006.

- If a company continues to send unwanted mail, report the persistent offender to the National Waste Prevention Coalition's "Business Junk Mail Complaint Bureau." If the bureau receives several complaints about a particular company, it will notify that company.[458]

- The Federal Trade Commission website on unsolicited mail gives direction on how to remove yourself from unwanted mail.[459] The Direct Marketing Association Mail Preference Service also gives people a way to opt out of junk mail.[460] The Center for a New American Dream provides a free Junk Mail Organizers Kit.[461]

Reuse

Reuse envelopes to send mail whenever possible. Use labels to cover the old address on used envelopes. Some companies sell reuse labels[462] for envelopes, which have a discrete message at the bottom explaining that this envelope was reused to save trees.

Have each staff set aside paper that they use on only one side so that it can be reused for printing drafts in your printer, or stapled together to make scratch pads. As employees accumulate paper, they can transfer it to a storage box near a printer or photocopier.

Recycle

Start a recycling program Determine which material you want to recycle, find someone to pick up the material (for example Yellow Pages directories generally have recycling vendors who will pick up old directories), put recycling bins around your office, and get staff to participate. Having management participate is important to creating a successful recycling program.[463] Look under headings such as recycling, refuse, waste disposal for local programs.

Reduce Packaging

Select products from suppliers and manufactures that use minimal packaging.

Reuse packing material whenever possible[464]

Spread the word. A good example is the best motivator, and you might help persuade local residents and businesses to practice waste prevention. Eliminating excess packaging in one Wal-Mart product line saved the company $2.4 million a year and 1 million barrels of oil in shipping.

[458] Contact Tom Watson, Coordinator, National Waste Prevention Coalition. Phone: (206) 296-4481, tom.watson@metrokc.gov.
[459] Federal Trade Commission, Consumer Alert, www.ftc.gov/bcp/edu/pubs/consumer/alerts/alt063.htm, 7 January 2007.
[460] P.O. Box 9008, Farmingdale NY 11735-9008.
[461] The Center for a New American Dream, www.newdream.org/cnad/user/junkmail_kit.php?params=bf76072cf86a5bb1396c012786c1028d, 7 January 2007.
[462] Northern Sun, Save A Tree Labels. www.northernsun.com/cgi-bin/ns/2032.html, 29 September 2006.
[463] For a more thorough explanation of how to begin a recycling program visit: www.ciwmb.ca.gov/BizWaste/OfficePaper/Campaign.htm, 29 September 2006.
[464] CIWMB, Packaging Waste Reduction. www.ciwmb.ca.gov/Packaging/, 29 September 2006.

Office Paper Reduction

CASE STUDY: Miami, FL

The management of paper related to hundreds of thousands of traffic cases filed in Miami-Dade County each year is a monumental challenge. The Clerk's Office and the Court have progressed from simple manual procedures to highly complex automated processing systems. Demands for greater efficiency and capacity in managing the never-ending flow of these documents encouraged new and creative ways to manage these court records. The SPIRIT (Simultaneous Paperless Image Retrieval Information Technology) Project,[465] a technology-based information system developed for the Traffic Division of Miami-Dade County, was launched in 1995. Accenture[466] developed the SPIRIT software program for the Miami-Dade County. Projects were initiated to provide improved service to the various agencies that process traffic cases, attorneys and the public.

The SPIRIT Project addresses every aspect of the traffic court process, from scheduling traffic cases, scanning documents, front counter processing, public viewing, the judge's workbench and end of session processing. All are handled by a specially designed software system that dramatically reduces the amount of paper used in court and cuts down the number of clerks needed. Some of the benefits of SPIRIT include:

Over a 5-year period, the Clerk's Traffic Division reduced the number of full time positions by 40 and transferred excess employees to the budget office and other vacant position within the Clerk's Office.

The Clerk's Traffic division is now handling and processing 32% more citations than in 1995, with a 167% increase in infraction cases scheduled for court, all with 15% less staff.

The Traffic Division's use of SPIRIT reduced overtime from a high of $412,649 for the fiscal year 1996-97 to a projected low of $150,000 in 2001-02.

An improved system for setting schedules has led to a significant reduction in police officer court overtime and increased officers' hours on the street.

The error rate of data entry has been reduced from 15% to less than 1%.

All traffic clerks have access to SPIRIT case files simultaneously allowing, totally decentralized service to the public at all district locations.

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[465] Clerk of Courts, 11th Judicial Circuit of Florida, Miami-Dade County, www.miami-dadeclerk.com/dadecoc/SPIRIT.asp#SPIRIT_System_Overview, 29 September 2006.
[466] Accenture website, www.accenture.com, 29 September 2006.

Office Paper Reduction

CASE STUDY: New York, NY

New York City Department of Environmental Protection (DEP) WasteLe$$ Program[467] is the city's waste prevention and recycling resource for home, agencies and school, and businesses.

The NYC DEP made some simple changes in its office practices that reduced the amount of waste it produced and produced cost savings. The DEP made four changes: double-siding all copies, refurbishing printer toner cartridges, substituting electronic for paper telephone directories, and streamlining letterhead format.

The reproduction shop at the DEP makes all copies double-sided except when a single-sided copy is specifically requested. The number of double-sided copy jobs has risen to 92%, saving an estimated 5,520,000 sheets of paper every year, or about $26,000.[468]

As part of the NYCitySen$e Project, the DEP LeFrak City offices initiated a program to collect and return toner printer cartridges to the manufacturers for refurbishing or recycling. In addition, DEP plans to purchase refurbished toner cartridges through its purchasing agents.[469]

The DEP implemented a program to update, produce and disseminate its internal telephone directory electronically. Before the program began, DEP printed 2,500 telephone directories annually. Switching to electronic phone directories reduced annual paper use by 1.29 tons and saved around $14,800.

Since the DEP has 14 Deputy Commissioners and 12 regional headquarters, the letterhead needs of the Agency are constantly changing. DEP developed a standardized format for letterhead that includes DEP's logo and the Commissioner's name and provided individual computer templates for each office. The new letterhead system allows DEP staff to personalize and print letterhead on demand and eliminates the need to replace pre-printed letterhead with each new staff appointment.

CONTACT

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[467] NYCWasteLe$$ Program. www.nyc.gov/html/nycwasteless/html/at_agencies/govt_case_studies_waste.shtml, 29 September 2006.
[468] To calculate the waste prevention benefits and cost savings of duplex copying visit: www.nyc.gov/html/nycwasteless/html/at_agencies/measurement_tools_copying.shtml, 29 September 2006.
[469] To calculate the waste prevention benefits and cost savings associated with establishing a toner-cartridge recycling program visit: www.nyc.gov/html/nycwasteless/html/ at_agencies/measurement_tools_toner.shtml, 29 September 2006.

Chapter 5: Local Action Plan Best Bets **Municipal Purchasing Programs**

DOCUMENT CONTENTS

The purchasing decisions that municipal offices make can have a substantial impact on the overall environmental impact of the office while serving as an example to the community. Purchasing "green" or more environmentally friendly products can also support local vendors, and often helps recycling programs by creating markets for the collected materials that are processed and used to manufacture new products. In turn, this creates new jobs and helps strengthen the economy. It conserves natural resources, saves energy, and reduces solid waste, air, and water pollutants, and greenhouse gases that contribute to global warming.

In 2002, the U.S. spent around $50 billion on office supplies—a huge potential market for green products. The magnitude also means that there are ample opportunities for cost savings. Just sending printers and copying cartridges for remanufacturing could save U.S. offices $1.5 billion and at least 100,000 barrels of oil annually.[470] *Yet despite the fact that two-thirds of U.S. businesses have policies on recycling, only 40% have policies regarding the purchase of recycled materials.*

Recommendations for making a green purchasing program a success:[471]

Evaluate each recycled or environmentally preferable product to determine the extent to which the product may be used in practice by the agency and its contractors.

[470] Green Seal's Choose Green Report, seattle.gov/environment/Documents/GreenSealOfficeSupplies_finalCE.pdf, 29 September 2006.
[471] King County Environmental Purchasing Program, Model Environmentally Preferable Products Policy. Feb. 2004. www.metrokc.gov/procure/green/mdpolicy.htm, 27 September 2006.

Purchase recycled products with the best balance of recycled material and cost.

Ensure contracts that the office issues require recycled and environmentally preferable products whenever possible.

Ensure contracts for recycled products require that contractors provide certification of this content and report the amounts used.

Ensure that all printing by city agencies uses recycled paper and bears the chasing arrow logo or other imprint identifying it as such.

Use both sides of paper sheets whenever practicable in printing and copying. See Chapter 5 Waste Reduction Section.

Ensure that requests for bids and proposals issued by the city require that contractors and consultants use recycled paper and both sides of paper sheets whenever possible.

Report total purchases of environmentally preferable, recycled, and non-recycled products by the agency and its contractors annually to the climate protection agency.

Promote the use of recycled and other environmentally preferable products by publicizing and educating others about the procurement program.

Energy Efficient Standards for Municipal Office Equipment

ENERGY STAR® was introduced in 1992 by the U.S. Environmental Protection Agency (EPA) as a voluntary labeling program designed to identify and promote energy efficient products to save energy and reduce GHG emissions. Computers and monitors were the first labeled products. Through 1995, EPA expanded the label to additional office equipment products and residential heating and cooling equipment. In 1996, EPA partnered with the U.S. Department of Energy for particular product categories.

The ENERGY STAR® label is now on major appliances, office equipment, lighting, home electronics and much more. EPA has also extended the label to cover new homes and commercial and industrial buildings. Overall, ENERGY STAR® office products use about 50% less energy than standard office equipment.[472]

ENERGY STAR® has partnerships with more than 8,000 private and public sector organizations, and so delivers the technical information and tools that organizations and consumers need to choose energy-efficient solutions and best management practices. ENERGY STAR® has successfully delivered energy and cost savings across the country, saving businesses, organizations and consumers about $12 billion in 2005 alone—while saving enough energy to avoid annual greenhouse gas emissions equivalent to those from 23 million cars.[473]

The ENERGY STAR® website is a good source of information on every product available containing the ENERGY STAR® label. The site can identify the best ways to reduce total energy costs using ENERGY STAR® products.

[472] ENERGY STAR® website, www.energystar.gov/index.cfm?c=ofc_equip.pr_office_equipment, 27 September 2006.
[473] Ibid.

Energy Efficient Office Equipment

CASE STUDY: New York City, NY

In 2003, Mayor Bloomberg of New York City put into code the city's energy efficient purchasing practices that have been in use since 1994. Local Law No. 30 requires that all energy-using devices purchased by the city of New York be ENERGY STAR® labeled, providing that there are at least six manufacturers producing ENERGY STAR® products. During the fiscal year of 2002, NYC spent $90.8 million on ENERGY STAR® products, most of which went to purchasing computer related products such as CPU's, printers and monitors.[474] Jennifer Blum, of NYC's Department of Citywide Administrative Services said of the program, "New York City firmly believes that in our role as a market participant we should promote the purchase of energy-efficient products."

Indeed, New York's adoption of an exclusive ENERGY STAR® purchasing program sends a very strong message to appliance vendors and manufacturers that major purchasers are now opting for more efficient technology. The market is forcing manufacturers to comply, or risk losing business to more efficient competitors. New York City is a major player in reaching the tipping point for increased standardized efficiency in appliances.

While the program itself comes at zero cost, there may be slightly higher up front costs associated with more efficient appliances (although not always the case). Yet a net savings can be expected over time associated with the significantly decreased energy use.

In 2005, the city passed Local Law 119, which is a more expansive and stringent version of Local Law No. 30.

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[474] Lawrence Berkeley National Laboratory, Environmental Energy Technologies Division Newsletter. eetdnews.lbl.gov/nl16/estar.html, 27 September 2006.

Energy Efficient Office Equipment

CASE STUDY: Washington, D.C.

The municipal government of the District of Colombia passed the ENERGY STAR® Efficiency Amendment Act in 2004, requiring city officials to buy only ENERGY STAR® rated products for energy consuming devices.

The bill states that,

> In any solicitation by an agency for the purchase or lease of energy-using products, the agency shall include a specification that the products be ENERGY STAR® labeled; provided, that there are at least 3 manufacturers that produce products with the ENERGY STAR® label, and that there are at least 3 responsible vendors offering ENERGY STAR® labeled products.[475]

This program greatly resembles NYC's ENERGY STAR® legislation in that while reducing energy use within the city, it also takes advantage of D.C.'s high profile status to create positive publicity for purchasing of energy efficient products. Since the legislation was introduced, the DC Energy Office has scheduled several training sessions, offered by the EPA, for government officials to help them implement ENERGY STAR® purchasing District-wide.

The city's procurement ENERGY STAR® operation is currently self-regulating, but the Energy Office is working on putting enforcement mechanisms in place to hold city government offices accountable for their purchasing decisions.

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Recycled/Salvage Product Use Policies

Creating city policies that encourage or require the use of recycled products in city operations can reduce costs and serve as a good example to the community. However, it is also important to focus on how those products are used once they are purchased and how they are discarded when no longer needed.

Many office products, such as computers, printers and other electronic equipment can be recycled or refurbished for reuse. PCDisposal.com and other similar companies offer services such as direct pickup, erasing data from hard-drives, profit sharing from equipment resale, preparation for donation and online employee purchasing programs. Some computer manufacturers, Dell for example, will agree to take back and recycle used units for a small fee. When negotiating contracts, departments making large equipment purchases can require that the computer manufacturer take back the used equipment for recycling at the end of its life free of charge.

Architectural Salvage and Deconstruction

Architectural deconstruction is the systematic dismantling and reuse of part or all of a building. Reusable and recyclable materials are removed before the building is demolished. Doing this prevents large amounts of waste from ending up in a landfill. In addition to significantly reducing waste, in some communities, salvaged materials can be donated to a non-profit organization.[476] Such a tax deduction will offset the cost of recovering the materials making the process comparable to the cost of demolition and can earn points towards LEED™ certification.

The Canadian company i-wasteNot makes and operates community waste exchanges in the City of Chicago, California, Colorado, Georgia, Washington, Wisconsin, Massachusetts, British Columbia, Alberta and Ontario. Such exchanges prevent waste from reaching the landfill, creates jobs and new products instead of trash. Their

[475] www.energystar.gov/index.cfm?c=government.local_gov_news, 27 September 2006.
[476] ReSource, www.resourceyard.org. To contact call 303-419-5427 or e-mail decon@resourceyard.org.

online waste exchanges for residential, industrial and construction demolition waste facilitate the sale or donation of good used items and material for reuse and recycling. They bundle these waste exchanges within green community websites where requested, so that other tools like Green Business Directories, Green Events and Calendars, Reuse and Recycling Directories are available to citizen.[477]

Implementing a city policy of purchasing salvaged products whenever possible, and sending used office equipment to a non-profit salvage company instead of sending it to the landfill can stimulate local business and create new jobs by creating a market for and supplier of salvaged goods. The city of Portland developed a Furniture Surplus program where city employees can post and view surplus furniture so that it may be reused by another bureau. The program reduces waste and saves costs associated with procuring new supplies as well as disposal and recycling fees.[478]

Recycled/ Salvaged Products

CASE STUDY: Davis, CA

In 1997, the city of Davis, California adopted a municipal code that mandates city purchasing of recycled products. The codes require that the city purchase recycled material with the highest possible recycled content whenever possible. City departments must implement strategies to maximize their purchasing and use of recycled materials, equipment and machinery. In addition, departments must promote the use of products made from recovered materials and label products to indicate that they are recycled. The city also agreed to stimulate the market for recycled goods through cooperation with neighboring agencies.

Davis' procurement strategy has diverted an impressive 50% of its waste-stream away from the landfill.[479] Annual reports must be prepared by the various departments to catalogue the types and amount of recycled content purchased as well as the overall cost of these purchases. The mandates also require that no virgin materials be required in any products for city purchasing.[480]

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Recycled/ Salvaged Products

CASE STUDY: San Jose, CA

The city of San Jose is a pioneering leader in municipal recycling programs with a curbside pickup program serving over 165,000 residents. The city recognized, however, that just collecting neatly separated trash in bins is not quite enough to close the recycling loop.

San Jose city officials decided to create a market for the products produced from recycling by creating the Buy Recycled program in 1990. San Jose now purchases over 40 types of recycled content products. More recently, in September 2001, the

[477] iWasteNot Systems, www.i-wastenot.com/site/, 15 January 2007.
[478] City of Portland, Office of Sustainable Development, www.portlandonline.com/osd/index.cfm?a=117682&c=42401, 27 September 2006.
[479] New Renaissance, Vol 11, No.3, www.ru.org/113-Davis-California.htm, 27 September 2006.
[480] Davis Municipal Code, www.city.davis.ca.us/cmo/citycode/detail.cfm?p=15&q=473, 27 September 2006.

city council adopted a policy that addresses Environmentally Preferable Purchasing (EPP).

Within city offices, everything from copy paper to printer paper, as well as post it notes and folders contain post-consumer waste. Janitorial products such as paper towels and trash bags are made of recycled material, as is the compost used in city parks. All paper products and printing done through contracts outside of the city is mandated to be on recycled paper. The city has set a standard of using up to 95% recycled material for street signs, as well as refurbished aluminum.

San Jose's vehicular fleet maintenance crew utilizes recycled oil and antifreeze products in its fleet. At first this was a tough sell, but the recycled automotive products have greatly exceeded the crew's expectations. They now prefer the recycled oil because it burns better and runs cleaner.

The city saves around $10,000 every year through purchasing of recycled products, and reaps unquantifiable environmental benefits.

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Establish Local Purchasing Programs

Local purchasing programs are programs that prioritize patronizing local businesses before buying from "absentee" owners or large, distant corporations[481]. Buying locally reduces transportation costs and emissions of purchased goods and can also stimulate and support the local economy by supporting local businesses and jobs. In addition, people are increasingly likely to invest in or move to communities that preserve the culture embodied in its unique businesses. Buy-local programs are a good investment for a community's future because three times more money stays in the local economy when goods and services are bought from locally owned businesses instead of large chain stores.[482]

Cities can adopt a city procurement policy of buying from locals before non-local businesses and can also create a local first campaign where the city encourages the community as a whole to buy from local businesses.

Local city procurement policies are sometimes difficult to implement, especially for smaller cities without a large industrial sector. Combining a buy-local procurement policy with a buy-green procurement policy can become complicated and costly.

However, by making a conscious effort to look for local products before making purchasing decisions, cities can reduce the carbon footprint of purchases and boost their local economies with relatively little effort.

The advantage of a local first campaign is that it has a low cost to the city government and improves the local government's interaction with the community. Many such campaigns are organized by the local businesses themselves with the government playing a partnering role. Campaigns can consist of everything from rallies, public events, distribution of literature, stickers or placards placed in windows to designated local businesses, media coverage, websites with relevant information and much more. The success of a campaign largely depends on the effectiveness of its outreach to the community, so the more creative it is, the more likely it is to gain community involvement.

[481] BALLE, Business Alliance for Local Living Economies. www.livingeconomies.org/localfirst/whylocalfirst/, 27 September 2006.
[482] Buy Local Philly website, www.buylocalphilly.com/, 27 September 2006.

Local Purchasing

CASE STUDY: Philadelphia, PA[483]

Philadelphia's Buy Local program is an excellent example of a city program to promote patronage of independent local businesses. For every $100 spent on local businesses, $45 goes back into the local economy, as opposed to only $14 for a non-locally owned business. The website for the Buy Local program includes information regarding local businesses, a comprehensive directory of registered local businesses as well as information on how to register your business.

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Local Purchasing

CASE STUDY: Portland, ME[484]

Portland, Maine's, local purchasing program went into effect in the summer of 2006. For a $20 membership fee, qualifying businesses (the business must be registered in Portland, and the owners must live locally) can obtain a window decal and poster to be displayed at their business that reads "Buy Local: Keep Portland Independent". The fees also go toward maintaining the website, administrative costs and local media advertising.
The Portland Buy Local campaign is a non-profit group led by a coalition of local business owners, pro-business organizations, city officials, and consumer activists. The city of Portland marketing and economic development staff has helped guide and support this effort. As of 2006, the Buy Local campaign has around 160 participating local businesses.

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Local Purchasing

CASE STUDY: Santa Fe, NM

The Santa Fe Alliance[485] is a locally run program dedicated to building an alliance between local businesses, non-profits, government and community members. The Alliance has a commitment to educating the people of Santa Fe on the benefits of supporting locally run and owned businesses. Local businesses and non profits that chose to sign on to the program with a minimum donation of $100 for a business and $30 for a non-profit benefit through a link on the website to their business as well as publicity in Alliance newspaper advertisements and educational information. As of 2006, the Santa Fe Alliance has over 700 participating local businesses.

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[483] Ibid.
[484] Portland Buy Local Campaign, www.portlandbuylocal.org/index.html, 27 September 2006.
[485] Santa Fe Alliance, www.santafealliance.com, 27 September 2006.

Additional Resources

Other websites dedicated to building strong local economies through uniting local businesses and educating citizens on the benefits of local purchasing include:

The American Independent Business Alliance
www.amiba.net/

Business Alliance for Local Living Economies (BALLE)
www.livingeconomies.org

Local Town USA.COM
www.localtownusa.com

Institute for Local Self-Reliance
www.ilsr.org

The following is a list of some office products with green alternatives: [486]

- Highlighters, Markers, Correction Fluid: Buy non-toxic, water-based. Conventional aromatic solvent and alcohol-based contain toxic materials. Choose refillable markers if available.
- Clipboards: Buy recycled. Clipboards made of 100 percent post-consumer plastic are now available.
- Paper-based Office Products: Buy recycled, chlorine-free. Paper manufacture using virgin pulp consumes trees and is highly water intensive, energy intensive, and polluting.
- Binders and Folders: Binders made from 100% post-consumer recycled cardboard and 100% post-consumer recycled PET (from soft drink bottles) are available.
- Self-Stick Notes: Buy 100% recycled or use electronic programs like Stickies[487]
- Envelopes: Buy unbleached, light-weight and recycled. FedEx and other shippers use envelopes made of Tyvek because of their lighter weight and strength. The lighter weight translates directly into fuel savings, particularly in the case of long-distance shipments. Tyvek also incorporates 25% post-consumer recycled content from plastic milk and water jugs, and the used envelopes are recyclable.
- Pens and Pencils: Buy refillable pens, and pens made from recycled materials. Buy pencils made from recycled materials, such as lunch trays and shredded dollar bills.
- Toner Cartridges: Remanufactured cartridges can be obtained at roughly half the price of a new one while significantly reducing the environmental impact of discarding cartridges.
- Presentation Transparencies: Buy at least 50% total recycled content with at least 25% post-consumer recycled content.
- Slag cement (95% less CO_2 emitted than regular cement
- 80 PLUS computer power supplies for PCs and servers
- Bio-based lubricants,etc. (fleet uses)

The Federal Energy Management Program (FEMP)
FEMP criteria and the federal ENERGY STAR® energy efficiency labeling program identify efficient products, helping agencies "buy efficient." often as part of an agency's broader policy to "buy green."
eetdnews.lbl.gov/nl16/estar.html

City of Berkeley Resolution to adopt an Environmental Preferable Purchasing Policy.
A portion of the resolution states: Policy requires purchase of products and services that minimize environmental and health impacts, toxics, pollution, and hazards to workers and community safety and to the larger global community to the greatest extent practicable

Specifications are described for Source Reduction, Toxics Reduction and Pollution Prevention, Recycled Content products, Energy and Water Savings, Green Building Construction and Renovation, Landscaping, Forest Conservation, and Agricultural and Bio-based products.
www.ci.berkeley.ca.us/sustainable/government/101904.EPPPolicy.pdf

[486] Ibid.
[487] www.zhornsoftware.co.uk/stickies/index.html, 29 September 2006.

California Integrated Waste Management Board
For a directory of companies that meet or exceed these standards, please visit the California Integrated Waste Management Board's website[488]: A good deal of information can also be found on the best ways to reduce, reuse, recycle, and where to purchase recycled office supplies in this document hosted by Seattle's municipal website.[489]

EPA Report: Promoting Green Purchasing
EPA's Environmentally Preferable Purchasing (EPP) Program has announced the availability of a new document entitled "Promoting Green Purchasing: Tools and Resources to Quantify the Benefits of Environmentally Preferable Purchasing." This compilation of tools and resources will be useful to any organization trying to estimate the environmental and economic benefits of both past and projected EPP choices. www.epa.gov/epp/tools/epp_metrics.pdf

[488] www.ciwmb.ca.gov/RCP/Product.asp?VW=CAT&CATID=264, 27 September 2006.
[489] seattle.gov/environment/Documents/GreenSealOfficeSupplies_finalCE.pdf, May 2006.

Chapter 5: Local Action Plan Best Bets **Utilities**

DOCUMENT CONTENTS

Encourage Utility Providers to Offer Energy Efficiency Services

Cities typically obtain their electric and gas services either from municipal utilities or under contract from utilities that provide power to a much wider service territory. A few cities still derive their power from Rural Electric Co-ops.

Many of the best efficiency programs in the nation have come from municipally owned utilities. The programs profiled elsewhere in this manual of Osage, Iowa, Seattle City Light, Sacramento, California, and Burlington, Vermont are representative of the sorts of programs that a "muni" can offer. The difference between the efficiency programs offered by munis and those of "Investor owned utilities" has been so stark that many citizens have begun efforts to municipalize their service territory.[490]

But in truth, the privately held utilities can offer excellent efficiency and renewables programs, as well. In the 1980's Southern California Edison found it cost effective to give away over a million compact fluorescent light bulbs. The energy saved this way was cheaper than just running SCE's existing power plants. Utilities like Burlington Electric lease efficient light bulbs to their customers for pennies a month and give free replacements. Not only does this keep the bulbs from being thrown away, it enables customers to pay for the efficiency over time. Burlington's Smartlight program has 65,000 bulbs in circulation serving over 7,000 homes, achieving an annual savings of over $390,000.

For many years it was believed that it was in the financial interest of utilities to build more power plants. Indeed, until the early 1970's every new plant

[490] In recent years activists from San Francisco, Berkeley, CA, Eugene OR, Boulder CO, Enid OK, Las Cruces NM, DeKalm, Hermon, Lisbon, Potsdam, and Russell, New York, and hundreds of other town have pressed for their city to take over the delivery of electric service. Some succeeded, others decided to stay with the private utility, www.local.org/gatekeep.html, 30 November 2006.

lowered costs for everyone in the system. Utility regulations were structured to reward building more plants, customers were urged to buy "All Electric Homes" and incentives were given to use more electricity. For a variety of reasons, this is no longer true: every new plant that is added to a system raises every customer's rates, and has for almost 30 years. In many states, however, utilities are still rewarded for building more plants.[491]

Various states have experimented with regulations to encourage utilities to meet customers' needs in the cheapest way. Programs like Integrated Resource Planning, which require utilities to compare the cost of building new capacity with the cost of doing the same job of meeting customers' needs through energy efficiency, sought to level the playing field.[492] Every competent analysis has shown that efficiency costs far less than new supply. For example, good efficiency programs, to, say, retrofit light bulbs, cost about 1 - 2¢ per kilowatt hour saved, while just running a coal plant costs 4 – 5 ¢. New wind, in good sites can cost as low as 3¢. Running an existing gas plant typically costs 5 – 6¢. The average price of electricity from the grid is at least 8¢ per kilowatt hour, and building a new nuclear plant can cost as much as 20¢. And these numbers do not count the cost of emitting carbon and threatening the climate.

Obviously, it is in everyone's interests to pursue efficiency first, but few utility programs achieve this outcome. Until recently, utilities have tended to pursue only as much efficiency as regulators require them to. Only a few jurisdictions decoupled sales of electricity from utility profits, so utilities will no longer be rewarded for selling more electricity nor penalized for selling less.

There have been some notable exceptions. In California in the late 1980's, the Public Utility Commission shifted its regulations to reward utilities with a portion of the savings they created for their customers by implementing efficiency. Within a few years, no utility in California projected the need to build any more power plants, and all projected that they would meet all future demand growth through renewable generation. Under this plan Pacific Gas and Electric, the country's biggest private utility, spent $150 million in 1991 to help make its customers more efficient, and kept 15% of the resulting savings, boosting its 1990 profits by $40-50 million. Doing this returned over $40 million to PG&E's bottom line and saved its customers nine times that much. The PUC found that between 1990 – 93 such efficiency measures saved customers a net present value of almost $2 billion.[493] Unfortunately free market advocates overturned this program.

In the early 1990's there were an array of experiments underway to enable the market for delivering customer value to function better. Eight states request for proposals to vendors to compete in an open auction for all ways to make or save electricity at, say 1¢ per kilowatt hour. On receipt of bids they signed contracts. If they needed more capacity, they then reopened bidding for efficiency or supply at 2¢ per kWh, then 3¢. At around 2 – 3¢ they met all of their required capacity, dramatically cheaper than building a new fossil fired plant.

Some utilities traded saved electricity, rewarding customers for actively reducing electricity use, or for saving other customers´ electricity. There is talk of creating spot and futures, markets in saved electricity (in 1993, Britain created such a futures market). Some electric utilities sold unregulated electric efficiency in other utilities´ territories. Some jurisdictions implemented programs to charge fees to connect inefficient buildings to the grid, and paid rebates for connecting efficient buildings, both on an open-ended sliding scale.

Cities should discuss all of these are measures with their utility or Public Utility Commission.

It is important to recognize that despite the fixation of utilities and most policy experts on supplying kilowatt-hours at the lowest price, what customers

[491] The Negawatt Revolution, www.eco-web.com/editorial/00892.html, 30 November 2006.
[492] Western Area Power Administration, www.wapa.gov/powerm/pmirp.htm, 30 November 2006.
[493] Hawken, Lovins and Lovins, *Natural Capitalism*, P 273 – 74, Little Brown, 1999.

really want are the services that energy can deliver at least cost. And it is essentially always true that efficiency will do this cheapest, most reliably and with the fewest carbon emissions. Two programs, ENERGY STAR®, run by the Federal Department of Energy,[494] and the State Scorecard on Utility Energy Efficiency Programs, run by the American Council for an Energy Efficient Economy[495] offer assistance to utilities wishing to create energy efficiency programs.

Many states are now reviewing their utility policies. Simply entering "utility efficiency programs" in Google will return a wealth of information on what different states are doing. This is now a realm in which policy is evolving very rapidly, and a city would be unwise to assume that the past must govern the future.

In New York, state regulators have imposed what is called a "system Benefit charge" (SBC) on all sales of electricity to pay for energy efficiency measures. Since 1998 most low-income energy efficiency programs have been funded through this SBC on electricity bills and administered by the New York State Energy Research and Development Authority (NYSERDA).

The SBC program, known as New York Energy $mart SM, provides efficiency programs for all customer classes, including low-income renters and homeowners. The SBC program was created to ensure that certain energy efficiency and energy research programs were adequately maintained during the state's transition toward a more competitive electric market.[496]

As part of its utility restructuring, electric utilities in the State of New Hampshire established energy efficiency programs for statewide implementation by utilities regulated by the Public Utilities Commission. These programs serve residential, commercial and industrial customers. They include programs for new construction, retrofitting existing structures, and rebate programs for selected lighting and appliances. In addition to the statewide programs, individual utility-specific programs exist, including a pilot Pay-As-You-Save (PAYS) program.[497]

Energy Efficiency Program

Case Study: SCORE Pilot Program, TX

TXU Electric Delivery operates the largest distribution and transmission system in Texas, providing power to three million homes and businesses and operates more than 114,000 miles of transmission and distribution lines in Texas. In 2006, TXU Electric Delivery's sponsored the Texas Schools Conserving Energy (SCORE) program, enabling seven participating school districts representing 95,416 students at124 campuses to save enough energy to power 376 homes. In 2006, the programs saved 1,787 kilowatts and 4,257, 483 kilowatt hours of energy through energy efficiency measures. 95,416 students at 124 campuses In 2007 SCORE will enlist an additional eight to ten school districts.

SCORE is a public-private partnership and a component of TXU Electric Delivery's Energy Efficiency Program, providing viable energy efficiency and demand reduction solutions for public schools. Since its inception in 2006 this program has saved over 350 megawatts of peak demand or enough energy to power 73,500 homes. Participating school districts identify the least energy-efficient facilities and develop an energy master plan so that they can reduce the district's energy bills. Reduced energy demand lowers budget pressures, provides infrastructure improvements, and better learning environments.[498]

[494] Energy Star EEPS Resources, www.energystar.gov/index.cfm?c=reps.pt_reps, 30 November 2006.
[495] ACEEE, Steven Nadel, Toru Kubo, and Howard Geller, April, 2000, www.aceee.org/pubs/u004.htm, 30 November 2006.
[496] U.S. Department of Health and Human Services, www.sustainable.doe.gov/dereg/states/nyork.htm, 30 November 2006.
[497] New Hampshire CORE Energy Efficiency Programs, www.puc.state.nh.us/Electric/coreenergyefficiencyprograms.htm, 20 January. 2007.
[498] TXU Electric Delivery Press Release, www.oncorgroup.com/about/newsroom/detail.asp?prid=1013, 29 January 2007.

Encourage Utility Providers to Set a Minimum Commodity From Renewable Energy Purchases

When a utility has achieved all of the cost effective efficiency it can, the next best bet is often the various renewable forms of supply. Renewable energy sources include wind, solar power, geothermal, hydropower, and various forms of biomass. Increasingly, electricity customers are being given supply options, either as retail power markets open to competition or when their regulated utilities develop green energy or efficiency pricing programs. More than 50% of retail customers in the U.S. now have an option of purchasing a green power product directly from their electricity supplier.[499][500]

Utilities have created programs to help finance solar installations on customers' homes and factories. For Earth day 2005, Alameda County in California commissioned a 2.3 megawatt power plant, spread out on roofs all over the county, using county's energy bill $700,000 a solar cells. It will cut the local utility paid for half the year, and of the cost.

Since 1975, the city of Santa Clara, CA has taken a leading role in the development and promotion of the use of solar energy. That year, the city established the nation's first municipal solar utility. Under this program the city will supply, install and maintain solar water heating systems for residents and businesses within Santa Clara.[501]

Utilities across the country are offering wind electricity to their customers. Fort Collins was the first utility in Colorado and among the first in the nation to deliver wind energy to customers. Its Wind Power Program started in 1998. Strong customer demand expanded the program in 1999 and 2000.

In June 2004, the program expanded again in order to meet the goals of the City Council's Electric Energy Supply Policy. At that time, the price for wind energy dropped from 2.5¢ per kWh to 1¢ per kWh.[502]

Other utilities offering wind power include Austin, Texas, Xcel Energy, Basin Electric in Montana, Oklahoma Gas and Electric, Florida Power and Light and many others.[503]

Cities can purchase renewable energy directly. Many municipalities are realizing the benefits of diversifying their energy portfolio not only by implementing energy efficiency, but also by investing in renewable technologies (often called green power). Doing this can strengthen the local economy, have a positive impact on the local job market.[504] Using local renewable power also increases the security of the community.[505] Fossil fuel generated power generally comes from across state and even international borders, far from customer demand; whereas renewable energy sources are mostly smaller in size and locally owned and operated.[506]

Cities that purchase a green power product demonstrate increased demand for renewable technology. Such demand helps to develop further renewable energy sources, which can reduce the burning of fossil fuels.

Municipal or commercial utilities can set up green power programs for communities. In these programs residents have the opportunity to purchase renewable energy for their homes, businesses, etc.

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[499] U.S. DOE Green Power Network, www.eere.energy.gov/greenpower/buying/index.shtml, 19 September 2006.
[500] Check to see if your State offers Green Power Programs. www.eere.energy.gov/greenpower/buying/buying_power.shtml, 19 September 2006.
[501] City of Santa Clara, www.ci.santa-clara.ca.us/pub_utility/ws_muni_solar.html , 30 November 2006. For information, call the Solar Engineer at 615-2000.
[502] Fort Collins, Wind Power Program, fcgov.com/utilities/wind-history.php, 30 November 2006.
[503] U.S. DOE, www.eere.energy.gov/greenpower/resources/tables/topten.shtml, 30 November 2006.
[504] Robert Sanders, "Investment in Renewable Energy Better for Jobs As Well As the Environment," www.berkeley.edu/news/media/releases/2004/04/13_kamm.shtml, 30 November 2006.
[505] The National Renewable Energy Laboratory's web site provides an additional discussion of the benefits of renewable energy. www.nrel.gov/learning/, 19 September 2006.
[506] Interstate Renewable Energy Council, www.irecusa.org/municipal/municipal_guide.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Utilities/IREC_municipal_guide.pdf, 27 September 2006.

Such programs often charge a premium rate, although increasingly renewables such as wind power are cheaper than running existing coal plants.[507]

In a green power transaction, a utility (or power marketer) buys renewable energy from a renewable energy facility. This electricity is delivered into the power pool, where it mixes with all the other electricity being generated at the time. Finally, the power is delivered to all customers of that utility. The mix of "green" and "brown" power is actually shared by everyone while the environmental attributes are credited to the customers who have paid a premium to create that benefit.[508]

Many cities, states, federal agencies, universities and businesses have worked with their municipalities to offer green power purchasing programs.[509] [510] For more information about Renewable Energy Planning, refer to Chapter 5, Long Term Initiatives.

Renewable Energy Purchasing

CASE STUDY: Newark, DE

On January 24, 2005 the Newark, Delaware City Council unanimously approved a resolution to increase the city's purchase of renewable energy to 2% of total electricity use by 2006 or approximately 7.5 million kWh annually. The vote followed a recommendation made by the City's Conservation Advisory Commission to increase renewable energy purchases from the current level of 0.1% to 0.5% in 2005 and 2% in 2006. It is estimated that the purchase will increase the average household electric bill by 14¢ per month in 2006. The city, which operates its own electric utility and purchases power on the wholesale power market, currently uses about 373 million kWh of electricity annually.[511]

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Renewable Energy Purchasing

CASE STUDY: Boulder, CO

In November 2005 Boulder, Colorado announced that it exceeded its goals for a recent campaign designed to increase the number of residents and businesses purchasing green power. During the roughly two-month "Wind Power Challenge," 1,150 customers signed up to purchase wind power from local renewable energy suppliers, far exceeding the campaign's goal of 500 new subscribers. When combined with the more than 5,700 pre-existing green power customers, about 16% of the city's residents and businesses now purchase green power. Collectively, these purchases represent nearly 5% of the community's total electricity needs.

Due in part to the success of the challenge, which was sponsored by the city and local non-profit Western Resource Advocates,[512] the U.S. Environmental Protection Agency's

[507] In 2006, Xcel Energy was forced to rebate to its "Windsource" customers, because wind was the cheapest resource on the system. Recent documents released by the Colorado PUC show that the utility's projections that coal power would be the cheapest resource are wrong, and that limitations to rail capacity haul coal, rising coal prices and falling renewables costs are reversing the calculation.
[508] Bonneville Environmental Foundation www.greentagsusa.org/GreenTags/faq.cfm, 19 September 2006.
[509] Green Power Network www.eere.energy.gov/greenpower/buying/customers.shtml, 19 September 2006.
[510] A number of programs or initiatives have been developed in the U.S. to help address green power product credibility, such as certification programs and advertising and marketing guidelines. These programs help to verify green power marketer claims as well as to educate and inform customers about environmentally preferable competitive market choices. www.eere.energy.gov/greenpower/buying/consumer_protection.shtml, 19 September 2006.
[511] Green Power Network, Large Green Purchasers Database; www.eere.energy.gov/greenpower/buying/customers.shtml?page=1&companyid=379, 19 September 2006.
[512] Western Resource Advocates, www.westernresourceadvocates.org/, 19 September 2006.

Green Power Partnership[513] has designated the city a "Green Power Community," making Boulder the first community in Colorado to receive this distinction. The following local renewable energy suppliers participated in the city's wind power challenge: Clean and Green;[514] Community Energy, Inc.;[515] Renewable Choice Energy;[516] and Xcel Energy through its Windsource[517] program.[518]

News Releases:

Boulder exceeds goals of Wind Challenge; Becomes Green Power Community[519]

City of Boulder challenges community to increase wind power purchases[520]

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Renewable Energy Purchasing

CASE STUDY: Radnor Township, PA[521]

On February 10, the Board of Commissioners of Radnor Township,[522] a suburb of Philadelphia with about 30,000 residents, unanimously approved a resolution to purchase wind energy to meet 62% of the township's electricity needs. Under a three-year contract with Community Energy, Inc.,[523] and the Energy Cooperative of Pennsylvania (ECAP),[524] Radnor will purchase 1.4 million kilowatt-hours of wind energy annually to be supplied by the new 66-MW Mountaineer Wind Energy Center in West Virginia. The Mountaineer Wind Energy Center in West Virginia is the largest wind power project east of the Mississippi River.

The township is offsetting the added cost of the green power with energy savings from the installation of energy-efficient LED traffic lights and competitive market savings from switching its entire electric load to ECAP.

News Release:

Radnor Township Becomes National Leader With Wind Energy Purchase[525]

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[513] EPA Green Power, www.epa.gov/greenpower/, 19 September 2006.
[514] Clean and Green, www.cleanandgreen.us/map.php, 19 September 2006.
[515] New Wind Energy, www.newwindenergy.com/, 19 September 2006.
[516] Renewable Choice, www.renewablechoice.com/, 19 September 2006.
[517] Xcel Energy Windsource Program, www.xcelenergy.com/XLWEB/CDA/0,3080,1-1-2_735_16310-221-2_68_133-0,00.html, 19 September 2006.
[518] Green Power Network, Large Green Purchasers Database; www.eere.energy.gov/greenpower/buying/customers.shtml?page=1&companyid=469, 19 September 2006.
[519] City Boulder Wind Challenge, www.ci.boulder.co.us/index.php?option=com_content&task=view&id=1778&Itemid=165, 29 September 2006.
[520] City of Boulder Wind Challenge, www.bouldercolorado.gov/index.php?option=com_content&task=view&id=1273&Itemid=165, 29 September 2006.
[521] Green Power Network, Large Green Purchasers Database; www.eere.energy.gov/greenpower/buying/customers.shtml?page=1&companyid=215, 19 September 2006.
[522] Radnor Township website, www.radnor.com/, 19 September 2006.
[523] New Wind Energy, www.newwindenergy.com/, 19 September 2006.
[524] Philadelphia Energy Cooperative, www.theenergyco-op.com/index.html, 19 September 2006.
[525] U.S. DOE Energy Power Network, www.eere.energy.gov/greenpower/buying/pr/0303_radnor_pr.html, 19 September 2006.

Renewable Energy Purchasing

CASE STUDY: Los Angeles, CA

In 2003, Los Angeles Department of Water and Power LADWP decided to purchase 40 megawatts per year of renewable energy from a biomass conversion facility to be built 150 miles outside of Los Angeles in Bakersfield. Scheduled to be operational around 2008-2009, the biomass facility will provide power to up to 40,000 L.A. homes while consuming around 2,700 tons of organic waste each day in its anaerobic production facility. The organic waste will be comprised of landscaping waste materials such as grass clippings and wood chips. The overall power provided to the city of Los Angeles will be around 1.3% of its total needs and cost around $16 million every year.

The project will also create 54 permanent new jobs and around 200 construction jobs for the two and a half year building period.[526] This is a great example of closing the materials loop. The waste materials reacting in the anaerobic digestor will be supplied by the city. The facility will also provide its own power.

In 2004 the city passed a resolution approving a Renewable Portfolio Standard. The RPS mandates that 20% of the city's energy purchases come from renewable sources by 2017, with an interim of 13% by 2010.[527]

L.A.'s green power purchasing program operates via voluntary donations from customers that go toward purchasing additional renewable energy or building new renewable energy generation. With current participation, 12,000 homes are powered with renewable energy, which is enough to spare 101 million pounds of CO_2 emissions annually through the program's use of clean energy.[528]

CONTACT

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(800) GREEN LA or
(800) 473-3652

[526] Energy Vortex, www.energyvortex.com/pages/headlinedetails.cfm?id=1114&archive=1, 19 September 2006.
[527] LAWDP Green Power 2005 Annual Report, www.ladwp.com/ladwp/cms/ladwp005196.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Utilities/LADWP_2005Report.pdf, 19 September 2006.
[528] Ibid.

Renewable Energy Purchasing

CASE STUDY: Lenox, IA

The city of Lenox, Iowa (population approximately 1,401)[529] is considered one of the greenest cities in the U.S., deriving around 70% of its energy needs from renewable resources.[530]

In 2003, the city received a government grant to build a wind turbine that would supply up to 10% of the city's energy needs, on top of the already 60% that is derived from hydroelectric power. Through the city's Green Energy Program, 10% of Lenox's citizens pay an extra two dollars per month to support the renewable energy program, making it the most successful city program of its kind in the U.S. according to Patti Cale-Finnegan of the Iowa Association of Municipal Utilities.[531] Each two-dollar donation produces about 100 kWh and equals a savings of about 150 lbs of carbon dioxide and 14.6 lbs of sulfur dioxide.[532]

Lenox had been planning the wind turbine for a few years before it found funding for the project. The kick came when the Iowa Department of Economic Development began looking for a city that might qualify for a $400,000 grant for community development. In order to qualify, the city of Lenox had to have at least 51% of its population as low or moderate income, which it did.[533] It also had a viable plan for a beneficial community project at hand, a perfect match.

The turbine produces as much as 15,000 kWh per day, garnering a lot of support for renewable energy within the community. Lenox is now looking into the possibility of a biodiesel production facility, and is studying the cost-effectiveness of another wind turbine.[534]

CONTACT

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Iowa Association of Municipal Utilities
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[529] City Data, www.city-data.com/city/Lenox-Iowa.html, 19 September 2006.
[530] U.S. DOE Green Power Markets, www.eere.energy.gov/greenpower/markets/pr/1203_lenox_pr.html, 19 September 2006.
[531] Ibid.
[532] Ibid.
[533] Energy Services Bulletin, www.wapa.gov/es/pubs/esb/2004/feb/feb043.htm, 19 September 2006.
[534] Ibid.

Additional Resources

The Interstate Renewable Energy Council's website contains a wealth of useful information on municipal purchasing and implementation of renewable energy programs. www.irecusa.org/

EPA's Green Power Partner Resources is designed to help partners make the most of their green power purchase. Included are resources and information on how to:

- Partner tools
- Promoting your actions
- Communicating the environmental benefits of green power
- Communication support

These resources include purchasing guide, green power locator, communications guide, fact sheets, media tools, etc. www.epa.gov/greenpower/partner_corner/index.htm

DSIRE is a comprehensive source of information on state, local, utility, and federal incentives that promote renewable energy and energy efficiency. www.dsireusa.org

Top Ten Green Power Programs as of 2005[535]

Green Power Program Renewable Energy Sales (as of December 2005)				
Rank	**Utility**	**Resources Used**	**Sales (kWh/year)**	**Sales (Avg. MW[a])**
1	Austin Energy	Wind, landfill gas	435,140,739	49.7
2	Portland General Electric[b]	Existing geothermal and hydro, wind	339,577,170	38.8
3	PacifiCorp[cd]	Wind, biomass, solar	234,163,591	26.7
4	Florida Power & Light	Biomass, wind, solar	224,574,530	25.6
5	Sacramento Municipal Utility District[e]	Wind, landfill gas, small hydro, solar	195,081,504	22.3
6	Xcel Energy[ef]	Wind	147,674,000	16.9
7	National Grid[ghi]	Biomass, wind, small hydro, solar	127,872,457	14.6
8	Basin Electric Power Cooperative	Wind	113,957,000	13.0
9	Puget Sound Energy	Wind, solar, biogas	71,341,000	8.1
10	OG&E Electric Services	Wind	63,591,526	7.3

Source: NREL
Notes:
[a] An "average megawatt" (aMW) is a measure of continuous capacity equivalent (i.e., operating at a 100% capacity factor).
[b] Some products marketed in partnership with Green Mountain Energy Company.
[c] Includes Pacific Power and Utah Power.
[d] Some Oregon products marketed in partnership with 3 Phases Energy Services.
[e] Product is *Green-e* certified (www.green-e.org). For Xcel Energy, only the Public Service Company of Colorado product is *Green-e* certified.
[f] Includes Northern States Power, Public Service Company of Colorado, and Southwestern Public Service.
[g] Includes Niagara Mohawk, Massachusetts Electric, Narragansett Electric, and Nantucket Electric
[h] Marketed in partnership with Community Energy, EnviroGen, Green Mountain Energy Company, Mass Energy, People's Power & Light, and Sterling Planet
[i] Some products are certified by *Green-e* (www.green-e.org) or Environmental Resources Trust (www.ert.net).

[535] NREL has compiled extensive data on utility green power programs and produced the following "Top Ten" lists of program characteristics and results: total sales of renewable energy to program participants; total number of customer participants; customer participation rates; and the premium charged to support new renewable development. www.eere.energy.gov/greenpower/resources/tables/pdfs/0306_topten_pr.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Utilities/GreenPricingProgam_NREL2005.pdf, 27 September 2006.

Chapter 5: Local Action Plan Best Bets **Businesses**

DOCUMENT CONTENTS

In any city, the business sector is a major user of energy, and thus an emitter of greenhouse gases (GHGs). There is a great deal that businesses can do to reduce their emissions profitably, but businesses, especially the small businesses that are the backbone of any community's economy need help to capture these opportunities. Most small businesses give little thought to how they use energy, have few resources to help them reduce their energy bills, and are reluctant to devote scarce management time, or scarcer funds to implementing significant changes in the way they do business.

Smart communities around the country are implementing programs to help their business community become more energy efficient.

One of the easiest programs to encourage a business to implement is a lighting retrofit. The U.S. Environmental Protection Agency (EPA) offers the ENERGY STAR® program to help business people cut their use of energy.[536] *It works with local partners to help businesses implement lighting retrofits and other energy savings programs. The following example is described on the ENERGY STAR® website:*[537]

Small business owner Joel Whitaker added $800 per year to the bottom line of Whitaker Newsletters by installing more energy efficient light bulbs in the 24 fixtures in his 2,000 square foot office. The cost was partly financed by his local utility, an ENERGY STAR® Utility Ally, and partly by savings on his electric bill. The upgrades paid back in less than two years. After that even this very small office started saving almost $800 per year.

Mr. Whitaker's utility, Public Service Electric & Gas (PSE&G), sent him a flyer about energy efficient. Soon after calling the utility's 800 number, he signed a Memorandum of Understanding with EPA. Mr. Whitaker had previously called a

[536] EPA Small Business, www.energystar.gov/index.cfm?c=small_business.sb_index, 30 October 2006.
[537] EPA Small Business Success Story, www.energystar.gov/index.cfm?c=sb_success.sb_successstories_whitaker, 30 October 2006.

local electrician to learn more about lighting efficiency, but found he knew more than the electrician. EPA's Financing Directory guided Whitaker to Atlantic Lighting and Supply Co., an ENERGY STAR® Distributor Ally. Atlantic surveyed his space for free and provided specifications, a cost analysis, and an environmental analysis. This process took Atlantic less than one hour. Atlantic included PSE&G rebates in their economic analysis and predicted the payback.

Whitaker then applied for financial assistance. Atlantic agreed to finance more than half of the upgrade cost. Whitaker simply repaid Atlantic with the savings from its electric bill, including signing over the rebate check it received from PSE&G.

Once Atlantic delivered the project materials, Mr. Whitaker contracted a different electrician he found listed on a church flyer to install them. The entire upgrade process, from survey to installation, took a little over a month. "Our lighting upgrade," Mr. Whitaker explains, "was a piece of cake: the financing was easily handled, and we got a local electrician to install everything. It was really no sweat."

Before the upgrade, Whitaker Newsletter's 24 fixtures were inefficient T-12 florescent lamps with magnetic ballasts. Such fixtures are common in small businesses. The electrician had never before performed this type of lighting upgrade, but the straightforward directions make installation of 24 energy-efficient T-8 florescent lamps with electronic ballasts easy. Although the number of lamps per fixture was decreased, the employees thought the lighting was improved. And the improvement in lighting color gave the office a nice glow.

Whitaker also revamped one exit sign from incandescent to LED, an upgrade that increased the lamp life from 9 months to 50 years. This is especially important to Whitaker, since the local fire inspector had, in the past, warned the company about a burned-out exit lamp.

Mr. Whitaker was particularly impressed with the pollution prevention equivalency information supplied by EPA. His employees were impressed that he had done something good for the environment. Mr. Whitaker was so happy with the results of his lighting upgrade that he convinced a local municipality and a local school district to upgrade their facilities. He also helped PSE&G publicize energy efficiency programs by participating on the radio spots.

ENERGY STAR® helps businesses with energy efficiency information about lights and appliances, buildings and facilities, manufacturing, retail operations, and much more.

Promote Use of Energy, Water and Waste Audits by Businesses

The building sector is the major consumer of energy in the U.S, using over one third of all energy and two thirds of electricity.[538] Yet it is cost effective to fix up almost any existing building to use dramatically less energy. New buildings can be 10 times more efficient than an ordinary building, existing ones three fold more efficient. Many businesses own their own building, but the majority rent space in someone else's building. Programs to reduce the carbon footprint of buildings need to address both owner-occupied spaces and rental space.

As described in the municipal building section of this chapter, many cities have made it mandatory to perform energy, waste and water audits on their municipal buildings. Because of these audits, cities have retrofitted numerous buildings, updating technology and capturing financial savings. Many communities support their businesses in conducting their own audits and making retrofits and updates to their buildings, but all should do this.

[538] U.S. Green Building Council, www.USGBC.org, 30 October 2006.

CASE STUDY: Portland, OR

Portland's Energy Trust Building tune-up and operations program[539] operates on the premise that buildings are like cars; they run most efficiently when they are properly cared for and periodically tuned up. The Energy Trust of Oregon, Inc.[540], a public purpose organization helping Oregon citizens increase energy efficiency and renewable energy generation, enables businesses to receive subsidized tune ups by qualified technicians to help save on energy costs and ultimately, carbon emissions.

The program is available to owners of large commercial buildings, and focuses on boiler and whole building tune-ups. On average, the program saves 10% of energy costs through tune-ups. The Energy Trust expects to save about 300,000 therms and 6,700,000 kWh through this program annually, enough electricity and gas to heat about 1,000 homes in the Portland area for a year, and prevent the release of a significant amount of carbon. If a building qualifies, the city will provide the following assistance.

Phase	Incentive
Screening	Provided by Program, in collaboration with Service Provider when applicable
RCx Investigation	Custom incentive ranging from $0.05 - $0.10 per square foot, paid to Service Provider
Quick Fixes	Up to $2,000, paid to Service Provider
Implementation	Up to $0.03 per square foot, applies to measures with a simple payback of longer than one year, paid to Customer
Persistence	Up to $4,500, paid to Customer

Portland also has significant programs to encourage the use of renewable resources by businesses. For instance, the biofuels program supports businesses that seek to create energy through the use of biofuels available in the state of Oregon. These fuels include, but are not limited to landfill gas, energy crops, and solid fuels based on residual material from forestry.

Energy Trust provides 100% of operating costs for the program to make it viable for a business. In addition, they will also provide assistance with initial feasibility studies.

Energy Trust also provides incentives of 35% of the system cost for businesses to install solar energy systems. During its first year, this program provided $1.4 million in incentives for 126 different projects. Energy Trust also provides similar incentives for businesses to install solar water heaters.[541]

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[539] Energy Trust Building Tune-up and Operations, www.energytrust.org/bto/btu.html, 27 September 2006.
[540] Energy Trust website, www.energytrust.org/index.html, 27 September 2006.
[541] Energy Trust, Wind Energy, www.energytrust.org/RR/wind/index.html, 27 September 2006.

Energy, Water and Waste Audits

CASE STUDY: Anaheim, CA

Anaheim, California has developed a program to retrofit required exit signs in buildings with efficient light-emitting diode (LED) or photo luminescent (glow in the dark) technology. Estimated savings per exit sign is at least 90%. Because these signs must be on 24 hours a day, 7 days a week, and are required of all public buildings, the reduction can represent a significant energy decrease over a year.[542]

The city subsidizes the cost of retrofit at 50% of the total cost, or $30 per fixture, whichever is less, at a total cost of up to $10,000.

Savings Achieved by Converting to LED Lighting Technology

	5 Exit Signs	50 Exit Signs	100 Exit Signs
Energy Savings On Incandescent Lamps (based on 50 total watts)	$210/year	$2,095/year	$4,190/year
One-time Incentive Amount	$150	$1,500	$3,000
Total Savings	**$360**	**$3,595**	**$7,190**

Assumptions:
1. 8,740 annual operating hours for old and new exit lighting system.
2. Two watts to operate LED lighting.
3. $0.10 composite kWh cost used for purposes of this illustration; your average energy cost may vary.

CONTACT

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Provide Incentives to Encourage Energy Efficiency Standards

There are more than 76 million residential buildings and nearly five million commercial buildings in the U.S. today. By the year 2010, another 38 million buildings will be constructed. It is possible to make buildings that use little or no non-renewable energy, yet are far more comfortable and affordable.

Such buildings, called "green buildings" are healthier to live and work in, enhance the productivity of workers and enhance the security of the community.[543] Cities can encourage developers to build using energy efficiency standards, even if no regulations are in place.[544]

Many incentives to encourage developers to use best practices require little investment for the city. For example, cities can offer:

Priority permit processing for builder/ developers who propose low-carbon projects

Reduced permit fees

Advertising and recognition for developers who use energy efficient, or renewable energy technologies.

The following cases provide examples of effective incentives being utilized by municipalities to encourage businesses to increase the efficiency of their operations.

[542] Anaheim Public Utilities Exit Sign Programs, www.anaheim.net/utilities/adv_svc_prog/led_exit_sign/index.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Businesses/Anahaim_ExitSignProgram.pdf, 27 September 2006.
[543] U.S Green Building Council, www.usgbc.org, 3 October 2006.
[544] County of San Diego Building Department, www.sdcounty.ca.gov/dplu/greenbuildings.html, 3 October 2006.

Energy Efficiency Incentives

CASE STUDY: Flower Mound, TX

Flower Mound's Green Building Program offers free advertising and referrals if builders comply with the town's criteria for more energy efficient green buildings. By voluntarily complying with green building criteria set forth by the town, participating contractors can display a certification emblem in their advertising and get free publicity on the town's website.[545]

In order to qualify, participants must use a minimum of 30 best management practices from the town approved list for each project, as well as meet the following minimum practices:[546]

Building projects must be at least 25% more efficient than the guidelines set forth by current International Energy Conservation Codes.

Builders must be LEED certified and demonstrate continuous compliance of those certification requirements.

Before construction begins, builders must submit a waste reuse, recycling and reduction plan to be agreed upon by the city.

Landscaping and paving requirements not directly pertaining to carbon reductions also apply.

This program is an easy way to promote efficient building design with minimal use of public funds.

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Energy Efficiency Incentives

CASE STUDY: Scottsdale, AZ

Scottsdale, Arizona has implemented a program to promote the building of more energy efficient and solar energy fueled buildings within the municipality through a series of economically enticing incentives.[547] First, if a builder submits a qualified proposal for a green building, the permit process is expedited through the city's fast track plan review process. In other words, green building projects will receive permits in roughly half the time of regular projects, thus promoting green design from the beginning.

Builders incorporating solar energy into their projects are eligible for a 25% tax credit for the cost of the solar energy system. In addition, the city will provide signs to go up at the job site to let the surrounding community know of the project's environmental benefits.

Participating architects, designers and builders are also offered free promotional space on the city website and in green building information packets that are distributed at various events and through the mail.

CONTACT

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[545] Flower Mound Green Building website, www.flower-mound.com/env_res/env_res_green.php, 3 October 2006.
[546] Flower Mound Green Building Program brochure, www.flower-mound.com/env_res/green_building_program.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Businesses/FlowerMound_grnbuilding.pdf, 3 October 2006.
[547] City of Scottsdale Green Building Program, www.ci.scottsdale.az.us/greenbuilding/HowToJoin/Invitation.asp, 3 October 2006.

Energy Efficiency Incentives

CASE STUDY: San Diego, CA

San Diego County[548] instituted a Green Building Incentive Program[549] to increase voluntary commitments to energy and resource efficient design. The program requires compliance with at least one of three resource conservation measures. The requirements assist builders and developers in reducing GHG emissions through increased recycled content or meeting energy efficiency measures.

To qualify for the incentives, the project must comply with one of the resource conservation measures listed:

1. Natural Resource Conservation
   a. Recycled Content: A builder would be eligible for the incentive program by doing one of the following
      - Show that 20% or more of primary building materials being used contain, in aggregate, a minimum weighted average of 20% post-consumer recycled content materials (reused materials count as 100%).
      - Show that at least one primary building material (such as roofing) is 50% or more post-consumer recycled content.

   b. Straw Bale Construction: New buildings using baled straw from harvested grain for the construction of the exterior walls will qualify for the incentives
2. Water Conservation
   The installation of a graywater system in new or renovated buildings will qualify for the incentives. Graywater is the wastewater produced from bathtubs, showers, and clothes washers. In order to conserve water, it can be used for irrigation through subsurface distribution systems. A permit[550] is required from the Department of Environmental Health for the graywater system. Energy Conservation
   Energy use below California Energy Commission (CEC) Standards qualifies for the incentives. Residential projects that exceed the minimum Title 24 standards by 15% and commercial projects that exceed the standards by 25% qualify for the Green Building Incentive Program. The applicant must demonstrate to the Building Division that the project exceeds the Title 24 minimum standards by submitting compliance documentation done on a computer program approved by the CEC.

The program offers incentives of reduced review process turnaround time, saving approximately 7-10 days, a 7.5% reduction in plan check and building permit fees for projects meeting program requirements and no fees for the building permit and plan check of residential photovoltaic systems

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[548] County of San Diego Building Program, www.sdcounty.ca.gov/dplu/greenbuildings.html, 3 October 2006.
[549] Brochure on San Diego Incentive Program, www.sdcounty.ca.gov/dplu/docs/DPLU%20273.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Businesses/SanDiego_BuildGreen.pdf, 3 October 2006.
[550] CPC Title 24, Part 5, California Administrative Code, Appendix G.

Energy Efficiency Standards in Commercial Building Codes[551]

Many cities have energy efficiency standards for their own buildings and have set a good example of how energy efficiency retrofits can pay back costs. Cities should extend these standards to commercial buildings.

The types of codes used to encourage energy efficiency standards can be categorized into two categories: Prescriptive and Performance Codes.

Performance codes set a mandatory target for the building to meet. These codes drive innovation for building developers, architects, contractors, etc. by allowing them to decide how to meet set targets. For example, builders must determine the best way to meet Santa Monica's allowable energy budget for multi-family homes of 10%.

Prescriptive codes establish specific requirements for materials: for example, efficient boiler and furnace units with a minimum combustion efficiency of 80%.

The following case studies demonstrate how cities and states are setting energy efficiency standards using both prescriptive and performance codes.

Energy Efficient Commercial Building Codes

CASE STUDY: Santa Monica, CA

Santa Monica's green building requirements were designed to increase sustainability without putting excessive burdens on builders or developers. Many of the measures have some higher initial cost, though others can actually reduce first costs and operating costs. However, all of them increase the overall value of the building.[552]

The basis for the green building code is found in the following two performance based Ordinances and the Municipal Code[553]

1. Green Building Ordinance[554] This city Ordinance establishes prescriptive energy-saving measures for small residential projects, and energy performance targets beyond Title 24 for all commercial and larger residential projects.
2. Construction and Demolition Waste Recycling Ordinance:[555] This Ordinance established requirements for reducing solid waste from construction related activities.

Santa Monica provides a design adviser to assist developers in understanding the process, what they must do to comply, what they should be doing to achieve a greater design and strategies to assist in the process.[556]

CONTACT

Green Building Program Advisor
1212 5th Street, First Floor
Santa Monica, CA 90401
(310) 458-8549

[551] Sustainable Green Building Guidelines, www.ciwmb.ca.gov/GreenBuilding/Design/Guidelines.htm, 3 October 2006. Includes performance or prescriptive instructions for designers and builders to use in construction projects. These instructions address materials use, design principles and construction techniques.
[552] The U.S. Green Building Council has found that there is no evidence that there has to be a premium for building green. In studies in which an initial premium of up to 2% was found, the green measures saved 20% of the construction costs over the lifetime of the building, www.usgbc.com, 3 October 2006.
[553] Santa Monica Green Building Program, greenbuildings.santa-monica.org/requirements/projectrequirements.html, 27 September 2006.
[554] Santa Monica Green Building Ordinance, greenbuildings.santa-monica.org/whatsnew/green-building-ordinance/green-building-Ord-1-5-2002.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Businesses/SantaMonica_Ordinance.pdf, 3 October 2006.
[555] Santa Monica Waste Recycling Ordinance, greenbuildings.santa-monica.org/whatsnew/waste.ordinance.html, 30 October 2006.
[556] Santa Monica Design Adviser, greenbuildings.santa-monica.org/GBDA.htm, 27 September 2006.

Energy Efficient Commercial Building Codes

CASE STUDY: State of California

California has developed a list of possible energy efficiency and sustainable building measures that builders should use to comply with state building codes.[557] These checklists (Tier 1 and Tier 2) are updated annually and attached to the Department of General Services' Standard Contract for Architectural and Engineering Services, Exhibit C.

The items on Tier 1 have been evaluated as "cost effective" and all are recommended for inclusion in building designs. Tier 2 items may or may not be cost effective, but should be considered for inclusion in projects. Both checklists are submitted at the completion of the preliminary plan phase.

The checklists include a few performance standards, but are more prescriptive in nature. These prescriptive codes provide direction for California builders about the minimum measures needed to meet energy efficiency codes.

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Working with Power Plants and Other Significant Emitters

After reviewing the community's GHG baseline inventory, it is important to identify any businesses that emit higher levels of GHGs through their operations. If these businesses are present within the boundaries of a city, addressing these emissions is a critical means of managing emissions in the community.

In several states, power plants' emissions are already or will soon be regulated at the state level in the near future. Until recently, the state of Oregon and Massachusetts were the only states to have CO_2 standards for power plants.[558] However, several Northeast and Mid-Atlantic states have initiated a Regional Greenhouse Gas Initiative to regulate the carbon dioxide emissions of power plants in the region. Under Assembly Bill 32, California will begin regulating emissions from businesses and power plants in California and even power plants outside the state that wish to sell into California. These regulations will soon influence power plants, but not other high emitters in the region.

Communities hoping to reduce emissions without or beyond regulations can create their own incentives or encourage high GHG emitters to commit to a variety of voluntary reduction programs and networks. For example, the EPA Climate Leaders program helps, "companies to develop long-term comprehensive climate change strategies," such as developing GHG inventories and reduction plans.[559] Similarly, The Pew Center's Business Environmental Leadership Council (BELC)[560] is an association of corporations working together to address the challenges of climate change.

In addition to the resources listed below, such programs as the EPA Climate Leaders and the BELC websites, illustrate state and utility initiatives to work with large commercial emitters.

Recently, major banks have begun to put pressure on their major clients who have significant carbon footprints. JP Morgan Chase recently issued a statement to their clients that any who were significant emitters should put in place a plan to reduce emissions. This followed similar programs by Bank of America Corp and CitiBank.[561]

[557] Green Building Tiers www.ciwmb.ca.gov/GreenBuilding/Design/Tiers.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Businesses/GrnBuildingTiers.pdf, 27 September 2006.
[558] Oregon's Power plant Codes, www.newrules.org/electricity/climateor.html, 27 September 2006.
[559] EPA Climate Leaders, www.epa.gov/stateply/, 5 October 2006.
[560] Business Environmental Leadership Council, www.pewclimate.org/companies_leading_the_way_belc/company_profiles/, 5 October 2006.
[561] Bustillo, Miguel, "A Shift To Green" Los Angeles Times 12 June, 2005.

CASE STUDY: State of Oregon

In 1997, the Oregon Legislature gave the Energy Facility Siting Council authority to set carbon dioxide emissions standards for new energy facilities.[562] Under Division 24[563] of the Council's rules, beginning at OAR 345-024-0500, there are specific regulations, known as the Oregon Standard for CO_2, for base load gas plants, non-base load (peaking) power plants and non-generating energy facilities that emit carbon dioxide. These standards are as follows:

Base load gas plants	0.675 lb. CO_2 / kWh
Non-base load gas plants	0.675 lb. CO_2 / kWh
Non-generating facilities	0.504 lb. CO_2 / horsepower-hour

The standard for base load gas plants applies only to natural gas-fired plants. The standards for non-base load plants and non-generating facilities apply to all fuels. The Council has not yet set carbon dioxide emissions standards for base load power plants using other fossil fuels. Rules allow base load gas plants that have power augmentation equipment to meet both the base load and non-base load standards for the respective parts of the plant. The definitions for the facilities are in Division 1.[564]

The calculations for compliance with the standard account for the efficiency of the facility. Generating plants have the option of offsetting part or all of their excess carbon dioxide emissions through guaranteed cogeneration.

At their discretion, applicants can propose carbon dioxide offset projects they or a third party will manage, or they can provide funds via the "monetary path" to the The Climate Trust.[565] The Council recognizes The Climate Trust as a "qualified organization," as defined in statute[566] (ORS 469.503). This definition appears also in Council rules[567] (OAR 345-001-0010(45)). The Climate Trust takes responsibility for obtaining offsets when an applicant uses the "monetary path." Once a site certificate holder has provided adequate funds to The Climate Trust, it has met its obligations under the carbon dioxide standard.

CONTACT

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[562] Oregon Energy Facility standard, www.oregon.gov/ENERGY/SITING/ standards.shtml#Carbon_Dioxide_Emissions, 27 September 2006.

[563] Oregon Energy Facility standard, egov.oregon.gov/ENERGY/SITING/docs/rules/div24.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/ BestBets/Businesses/Oregon_Div24.pdf, 3 October 2006.
[564] Oregon Energy Facility standard, egov.oregon.gov/ENERGY/SITING/docs/rules/div1.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/ Businesses/Oregon_Div1.pdf, 3 October 2006.
[565] The Climate Trust, www.climatetrust.org/, 3 October 2006.
[566] Oregon Legislative, Energy; Conservation Programs; Energy Facilities, landru.leg.state.or.us/ors/469.html, 3 October 2006.
[567] Oregon Energy Facility standard, egov.oregon.gov/ENERGY/SITING/docs/rules/div1.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/ Businesses/Oregon_Div1.pdf, 3 October 2006.

CASE STUDY: Seattle, WA

While the Oregon Standard has helped the Northwest become more climate friendly at the regulatory level, Seattle, Washington's public utility, Seattle City Light demonstrates how a utility can engage in voluntary emissions reductions. The utility is on the leading edge of climate protection by managing its own emissions, as well as working with other businesses in the city to reduce emissions.

In 2005, Seattle City Light announced that it had reached its goal of becoming "carbon neutral," meaning having no "net emissions" of GHG. The utility has a natural advantage for reducing emissions; last year over 90% of its electricity came from hydroelectric dams. Another 4% of electricity originated from nuclear plants and the remaining electricity was generated from wind farms and natural gas- and coal-fired power plants.[568] Despite the high percentage of renewables in its portfolio, it is still responsible for releasing about 200,000 metric tons of carbon dioxide each year. To claim no "net emissions" of GHG Seattle City Lights pays to offset (see Chapter 5Infrastructure section) its emissions by investing in activities that reduce GHG elsewhere.

For example, the city has spent up to $756,000 purchasing offset credits generated by activities such as converting city vehicles and buses to a mix of diesel and biodiesel and concrete plants to a cleaner manufacturing process.[569] While claiming these offsets, the city notes the importance of being proactive while also "transparent and accountable."[570]

Seattle City Light also operates the Climate Wise Program, which encourages local voluntary businesses and institutions to combat global warming. According to the website:

> … partners assess their business opportunities, invest in new, more efficient equipment and practices, and share these achievements with peers and the public. As leading companies know, environmental performance provides a competitive edge.[571]

Partners in the project agree to identify and implement practices that reduce GHG; complete, update, and strive to improve upon a Climate Wise Action Plan; and inform others about Climate Wise activities.[572] Members of the Climate Wise include several companies with typically higher emissions businesses, such as Ace Galvanizing, The Boeing Company and the cement producer LaFarge Corporation.

CONTACT

Program Manager
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Climate Wise Partners
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Help Small Businesses Prosper and Protect the Climate

Controlling emissions of large corporations is essential in mitigating GHGs, but the role of smaller businesses is also important and is often neglected. As the story of Joel Wittaker at the beginning of this chapter shows, with proper incentives small businesses can save money on energy costs and significantly contribute reducing greenhouse gases in a community.

[568] Stiffler, Lisa. "No global warming at City Light." Seattle Post- Intelligent Reporter. 10 November, 2005. seattlepi.nwsource.com, 5 October 2006.
[569] Ibid.
[570] Ibid.
[571] Seattle Climate Wise Partners, www.seattle.gov/light/conserve/business/climatewise/, 5 October 2006.
[572] Ibid.

Small Business Assistance

CASE STUDY: Seattle, WA

The objective of the city run "Smart Business Program" is to encourage businesses to convert old lighting fixtures to newer, highly energy efficient technology through city rebates on retrofit costs. Interior lighting can sometimes account for up to 60% of a small business' energy bills. Replacing inefficient lighting with newer technology can thus deliver large energy savings. In addition, better lighting can promote increased worker productivity and a safer working environment.

Seattle offers the program to small businesses that are not part of an institution, chain or campus. One eligible business, a glass company, replaced their T-12 fluorescent lights with technologically superior T-8 fluorescent lights. The retrofit dramatically increased light levels, increased productivity and decreased the electricity bill, resulting in a happy businessowner and decreased reliance on grid energy. This particular client's overall bill for the retrofit was $6,291. With a smart business rebate of $4,380, the overall cost to the client came to $1,911. Given the estimated annual savings from the retrofit of $1,170, this client's retrofit is expected to pay for itself in just over a year and a half.[573]

In 2005, the Smart Business Program served 364 small businesses and achieved a yearly energy savings of 4,113,135 kWh, or 11,300 kWh per business. The ratepayers of Seattle's publicly owned power utility, Seattle City Light, fund the program. Seattle City Light seeking to diversify into other renewable energy sources in the coming years. In 2000 they sold 8% of their holdings in the Centralia coal fired plant in a step toward decreasing carbon emissions.[574]

CONTACT

Charles Valentin
(206) 684-4215
charles.valentin@seattle.gov

[573] Seattle City Light $mart Business Program, www.seattle.gov/light/conserve/business/cv5_sbiz.htm, 27 September 2006.
[574] Puget Sound Business Journal, June 2000, www.bizjournals.com/seattle/stories/2000/06/05/story1.html, 27 September 2006.

Additional Resources

California Sustainability Financial Incentives
www.dsa.dgs.ca.gov/Sustainability/incentives.htm

California Department of Energy provides information on incentives in the areas of Energy, Water, Materials, Siting, Green Building, Landscaping and Transportation. This list will be updated quarterly and does not claim to contain all existing funding options. If you know of a financial assistance program that is not on this list or should no longer be on this list then please contact: Panama.Bartholomy@dgs.ca.gov or Shweta.Bhatt@dgs.ca.gov

- Incentives relating to Energy[575], including conservation, efficiency, renewables, self-generation and commissioning.
- Incentives related to Water,[576] including conservation, effiency and re-use.
- Incentives related to Material selection and Waste management,[577] including recycled content, re-use and waste reduction.
- Incentives related to Siting,[578] including brownfield redevelopment and "Smart Growth" strategic planning.
- Incentives related to Green Building,[579] including grants for projects and programs, plan review expediency and Leadership in Energy and Environmental Design (LEED) submission cost coverage.
- Incentives related to Landscaping,[580] including education, tree-planting, mitigation and restoration.
- Incentives relating to Transportation,[581] including: bicycle and pedestrian safety and facilities construction and alternatively fueled vehicles.
- Incentives relating to Miscellaneous,[582] including: financing programs granted by private institutions.

Center for Small Business and the Environment offers an array of information for small businesses interested in climate protection. Contact:
Byron Kennard, Executive Director
The Center for Small Business and the Environment
P.O. Box 53127
Washington DC, 20009
202 – 332-6875
www.aboutcsbe.org

[575] www.dsa.dgs.ca.gov/Sustainability/energy.htm, 3 October 2006.
[576] www.dsa.dgs.ca.gov/Sustainability/water.htm, 3 October 2006.
[577] www.dsa.dgs.ca.gov/Sustainability/wastemgmt.htm, 3 October 2006.
[578] www.dsa.dgs.ca.gov/Sustainability/siting.htm, 3 October 2006.
[579] www.dsa.dgs.ca.gov/Sustainability/greenbldg.htm, 3 October 2006.
[580] www.dsa.dgs.ca.gov/Sustainability/landscaping.htm, 3 October 2006.
[581] www.dsa.dgs.ca.gov/Sustainability/transportation.htm, 3 October 2006.
[582] www.dsa.dgs.ca.gov/Sustainability/Miscellaneous.htm, 3 October 2006.

Chapter 5: Local Action Plan Best Bets **Climate Friendly Residences**

DOCUMENT CONTENTS

Residential Home Efficiency Upgrades

Residents can help cities achieve carbon-footprint reduction goals by increasing the energy efficiency of their homes. New and replacement electrical appliances are prime targets for efficiency upgrades. A number of community-owned public utilities and some investor owned utilities offer appliance rebates to help residents choose energy efficiency. The easy targets for rebates are lighting, refrigerators and water heaters. Other electrical and water-conservation targets include clothes washers and dishwashers. In some cases, special utilities create special opportunities for rebates and incentives.

Home Efficiency Upgrades

CASE STUDY: Anita, IA

Anita Municipal Utilities (AMU) is the non-profit redistribution utility in Anita, IA (pop. about 1,200). Wholesale power is purchased from a combination of sources and provided to the town. Power is purchased at an "interruptible" rate meaning that AMU must stop taking power if loads go high enough to cause problems to their supplier. There is a built-in practical incentive for energy efficiency. The city offers rebates to install or retrofit efficient space-heating equipment (when replacing gas or propane) at $10/kW saved (up to $250). There is a $50 rebate for efficient electric water heaters. They also offer rebates up to $450 on air-to-air, ground-loop and water source systems. Grants are available for geothermal heat pump systems of $500.[583]

AMU encourages customers to voluntarily contribute to a "Green Energy" program that enables the utility to burn B2 soy diesel (a mix of 2% soy diesel made in Iowa with 98% diesel). Customer contributions offset the $0.02/gal difference in cost compared to normal diesel. Each $1.50 contributed to the program would convert about 1,000 KwH to "Green Energy" which is blended in to the electrical energy provided by AMU. Customers are encouraged to commit to $1.50, $3, or $5 per month added to their bills for a 12-month minimum.

CONTACT

Anita Municipal Utilities
(712) 762-3845
amu@anitaiowa.com

Home Efficiency Upgrades

CASE STUDY: Osage, IA

Osage Municipal Utilities (Osage, IA pop. 3,600) operates an efficiency incentive program that has saved residents about $1.2 million per year in their utility bills (for a total cost to the utility of about $250,000). The program uses a range of giveaway programs, rebates and energy audits to promote energy efficiency among its customers.

Services offered include, among other things, free compact fluorescent bulb giveaways and rebates, energy audits, electrical system scans to identify line-loss, free use of electrical tester meters to locate inefficient appliances, complete energy audits and interest buy-downs for efficiency projects. When it began in 1974, the voluntary program was saving residents over $1 million each year. The program cut energy prices to half that of the state average, and unemployment to half that of the national average, as the lower bills enticed more factories to come to town. The extensive efficiency measures taken in this small town have reduced its natural gas consumption by 45% and its annual growth in electricity demand by half, from 6% to 3%. The 950 compact fluorescent bulbs in use will prevent the burning of nearly 200 tons of coal, and every year the compact fluorescent bulbs will reduce annual pollution by nearly 1,000 tons of carbon dioxide (CO_2) and 13 tons of sulfur dioxide (SO_2).[584]

CONTACT

Dennis M. Fannin
Osage Municipal Utilities
P.O. Box 207
720 Chestnut Street
Osage, IA 50461
(515) 732-3731

[583] Anita Municipal Utilities, www.anitaiowa.com/utility.html#program, 3 October 2006.
[584] "Osage Municipal Utilities Demand-Side Management" Smart Communities Network website. www.smartcommunities.ncat.org/success/osage_muni.shtml, 5 October 2006.

Home Efficiency Upgrades

CASE STUDY: Wakefield, MA

The Wakefield Municipal Gas and Light Department (Wakefield, Massachusetts, pop. 25,000), in cooperation with the Massachusetts Municipal Wholesale Electric Company[585] offers rebates on ENERGY STAR® labeled appliances. Rebates are available on programmable thermostats ($20), clothes washers ($50), dishwashers ($50) and water heaters ($100).[586]

CONTACT

(888) 333-7525 or
(888) 335-7203
energyquestions@mmwec.org

Home Efficiency Upgrades

CASE STUDY: Palo Alto, CA

The mid-sized city of Palo Alto, California (pop. about 60,000) offers an extensive rebate program on many appliances including dishwashers, refrigerators, gas furnaces, central air conditioning, boilers, attic/roof and wall insulation, pool pumps and water heaters. Rebate examples range from $50 for a dishwasher, $200 for pool pumps and up to $300 for thorough insulation, $250 for tank-less or very efficient standard tank water heaters. They have also partnered with the Santa Clara Valley Water District (SCVWD) to offer up to $150 rebates on clothes washers and currently developing an appliance recycling rebate.[587][588]

CONTACT

Utility Marketing Services
(650) 329-2241
cpauresidential@cityofpaloalto.org

Home Efficiency Upgrades

CASE STUDY: Seattle, WA

Seattle City Light, Seattle, Washington's municipal electric utility offers numerous rebates to encourage efficiency. For example, residents can get a $20 instant rebate on more efficient light fixtures (purchased from certain stores) and up to $100 on a clothes washer.[589]

The utility also offers a free Home Resource Profile, which is a detailed, customized report that shows you how your household uses energy, water and solid waste.

CONTACT

Residential & Small Business
(206) 684-3800
rescons.scl@seattle.gov

[585] Home Energy Loss Prevention Service, www.munihelps.org, 5 October 2006.
[586] ENERGY STAR® catalog for participating customers, www.energyfederation.org/estarlights/default.php, 3 October 2006.
[587] Palo Alto Appliance Rebates, www.cpau.com/programs/appliance/aplusindex.html, 3 October 2006.
[588] Palo Alto Smart Energy Program, 2006-2008. www.cpau.com/programs/smtenergy/smartenergyform.pdf, also archived at www.climatemanual.org/Cities/Chapter5/BestBets/Residential/PaloAlto_smartenergy.pdf, 3 October 2006.
[589] Seattle Residential Conservation Programs and Services, www.ci.seattle.wa.us/light/conserve/resident/, 3 October 2006.

Local Policies to Promote Renewable Energy

There are a range of challenges for residents seeking to use renewable energy in their homes, including siting restrictions, lack of understanding of the technology, and long payback periods. Municipalities can shape regulation and provide incentives to assist residents in overcoming these hurdles.

Policies to Promote Renewable Energy

CASE STUDY: Sacramento, CA

The Sacramento Municipal Utility District (SMUD)[590] offers rebates and loan financing for solar hot water system installation (city pop. about 400,000). Rebates of $1,500 per solar water heating system are available for SMUD residential customers who replace their electric water heating system. In addition, SMUD offers 100% loan financing to cover the remaining costs, with a ten-year repayment period. SMUD provides all the funding for these incentives, and free maintenance inspections after five years and again after 10 years.

SMUD also currently offers an incentive of $2.80 per watt-AC up to $14,000 to residential customers who contract directly with SMUD approved contractors for the purchase and installation of grid-connected solar electric (PV) systems. The incentive will be paid to the approved PV contractor and is intended be reflected in the contractor's bid to the customer. Both traditional PV modules and building-integrated PV "roof shingles" are available under the program.[591]

CONTACT

Mike Zannakis
Sacramento Municipal Utility District
(916) 732-6994
(888) 742-7683
mzannak@smud.org

[590] Sacramento Municipal Utility District, www.smud.org, 3 October 2006.
[591] DSIRE, California Incentives for Renewables and Efficiency, www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=CA13F&state=CA&CurrentPageID=1&RE=1&EE=1, 3 October 2006.

Policies to Promote Renewable Energy

CASE STUDY: Mahonoy Township, PA

Working with Community Environmental Legal Defense Fund (CELDF) the community of Mahoney Township, Pennsylvania, has been the first city in the state to introduce an ordinance to prohibit unsustainable energy production within the township, mandate a transition to sustainable energy systems within the township, provide for the "enforcement of the ordinance and the rights of residents and nature" and provide for financial assistance for the conversion to sustainable energy systems.[592] The township plans to finance the plan with a general revenue bond. As of October 2006, the Bill is awaiting passage.

CONTACT

Community Environmental Legal Defense Fund
675 Mower Road
Chambersburg, PA 17201
(717) 709-0457
info@celdf.org

Policies to Promote Renewable Energy

CASE STUDY: Boulder, CO

The city of Boulder, CO (pop. about 90,000) enacted an ordinance in 1991 to protect the use of solar energy.[593] The ordinance guarantees access to sunlight for homeowners and renters in the city. This is done by setting limits on the amount of permitted shading by new construction and requiring that new buildings be sited to provide good solar access.[594]

CONTACT

City of Boulder
Building Services Center
1739 Broadway
(303) 441-1880

Policies to Promote Renewable Energy

CASE STUDY: Palo Alto, CA

The city of Palo Alto Utilities offers cash rebates to residents and businesses on the installation of new photovoltaic (PV) systems. Residents are eligible for a rebate of $3 per watt-AC up to a $9,000 maximum for a 3 kilowatt system. Commercial customers are eligible for a rebate of $2 per Watt-AC up to $50,000 maximum for a 25 kilowatt system. Nonprofit and institutional customers who are not eligible for federal tax credits are eligible for a $3 per watt rebate up to a $30,000 maximum for a 10 kilowatt system.[595]

The Southern California Gas Company offers a similar rebate program for solar, but also extends rebates to other renewable and non-renewable alternative energies. The PV rebate is $2.80/ W (30kW minimum). They also offer rebates on wind turbines ($1.50/W), renewable and non-renewable fuel cells ($2.50-$4.50/W), and waste gas generators and turbines ($0.60-$0.80/W).

CONTACT

City of Palo Alto
Utilities Customer Service Center
(650) 329-2161
UtilitiesCustomerService@cityofpaloalto.org

[592] Mahoney Ordinance: www.celdf.org/Ordinances/SustainableEnergyOrdinance/tabid/256/Default.aspx, 29 September 2006.
[593] Solar Access Compliance, www.bouldercolorado.gov/files/PDS/codes/solrshad.pdf, also archived: www.climatemanual.org/Cities/Chapter5/BestBets/Residential/Boulder_SolarAccess.pdf, 5 October 2006.
[594] Boulder Planning and Development Services, www.ci.boulder.co.us/buildingservices, 3 October 2006.
[595] Palo Alto PV Partners Program, www.cpau.com/programs/pv-partners/pvindex.html, 3 October 2006.

Policies to Promote Renewable Energy

CASE STUDY: El Centro, CA

Through the PV Solutions Rebate Program, Imperial Irrigation District[596] (El Centro, CA) provides rebates to residential and commercial customers who install grid-tied PV systems. The rebate is $2.80 per Watt-AC, up to a maximum of $28,000 for residential systems and a maximum of $84,000 for commercial systems.[597]

CONTACT

IID Public Programs Office—Imperial Valley Imperial Irrigation District
(760) 339-9032
info@iid.com

Policies to Promote Renewable Energy

CASE STUDY: Aspen, CO

The Community Office for Resource Efficiency (CORE) in Aspen and the Roaring Fork Valley area of Colorado offers a similar set of incentives—grid-tied PV power buyback, and zero-interest loan financing.[598]

Residents who purchase a solar PV system receive a cash rebate from CORE based on the number of watts they install. CORE will give $2.00 per watt installed by a certified installer and tied into the electric grid. This rebate is up to $6,000. Residents may also finance that PV system with a Zero-Interest Loan. (The Loan OR the Rebate program are available but not both for the same project).[599] Purchases of a solar hot water system are eligible for cash rebates also—$1,000, $1,500, and $2,000 for a 2-3 panel, 4-5 panel, or 6 or more panel system, respectively.

CONTACT

Gary Goodson
(970) 544-9808
gary@aspencore.org

Policies to Promote Renewable Energy

CASE STUDY: State of Minnesota

Along with a 30% federal tax credit and a state sales tax exemption for solar energy systems, Minnesota excludes from (real estate) property taxation the value added by solar-electric PV systems. However, the land on which a PV or wind system is located is taxable. In addition, all real and personal property of wind-energy systems is exempt from the state's property tax[600]. The state also has a retail tax emption when purchasing PV systems. An analysis has not been conducted to determine the money saved or number of PV systems installed.

CONTACT

Lise Trudeau
Energy Information Center
Minnesota Department of Commerce, Energy Division
(651) 296-5175
lise.trudeau@state.mn.us
energy.info@state.mn.us

[596] IID Energy – Energy Saving-Tips, www.iid.com/, 3 October 2006.
[597] IID Energy - PV Solutions Rebate Program, www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=CA50F&state=CA&CurrentPageID=1&RE=1&EE=1, 3 October 2006.
[598] Aspen Community Office for Resource Efficiency, www.aspencore.org/sitepages/pid46.php, 3 October 2006.
[599] The Community Banks of Colorado is the partner for this program. Call their Aspen branch at (970) 544-8282 for more information.
[600] Minnesota Department of Commerce, www.commerce.state.mn.us, 3 October 2006.

Lower-income Weatherization Assistance

Programs to help homeowners weatherize their homes can help a city reduce its carbon footprint. This is particularly true of low to middle income homeowners, who are otherwise unlikely to participate. Numerous public utilities, and non-profit organizations, offer services that come into the home to help residents assess energy inefficiencies and remedy them. Also, in many cases there is state and federal funding administered by municipalities to cover the costs of adding insulation and increasing efficiency when repairing or remodeling a home.[601]

A 2002 report on weatherization programs, *Meeting the Challenge: The Prospect of Achieving 30% Energy Savings Through The Weatherization Assistance Program,* by the DOE, surveyed four cities, one from the Northeast (Schenectedy, NY), Midwest (Moline, IL), South (Birmingham, AL), and West (Eureka, CA).[602] The report states that "high-energy use" homes in colder climates can achieve savings over 30%, and in warmer climates savings of about 25%. Annual savings of approximately $370 to $410 are estimated for high-energy-use houses in the warmer climate regions.[603] The report's extensive data and assessments are a valuable resource for communities seeking to design successful programs. The level of energy savings achieved obviously depends on the extent of the weatherization undertaken, both in terms of cost, and which measures will be effective in each climate. Thus regional considerations are important when deciding on which steps to take.

For example, the report shows that a $2,400 weatherization package can enable a "typical" home in the Midwest to achieve energy savings of about 20% and CO_2 reductions of about 20%. A "high-energy use" house can achieve greater savings (about 22%) and CO_2 reductions (22%). An "expanded" package achieves even greater gains. Weatherization measures resulting in relatively high savings for most of the houses studied are air sealing, installing attic and wall insulation, replacing an old refrigerator with a high-efficiency unit, resetting the temperature on an existing water heater, and installing a programmable thermostat on the central heating system.

Refrigerator replacement is particularly effective at reducing electricity consumption, and delivering fuel bill savings, and CO_2 reductions).

Data reported by DOE in 1997[604] shows positive results for surveys from 1989 and 1996 and increased benefits over the years. The "installation benefit/cost ratio," reported at 2.39 (up from 1.58 in 1989), verifies the effectiveness of the programs. These increased benefits will be amplified given current energy costs. In fact, by 1996 a savings of 33% was demonstrated for gas space heat consumption. At that time, the household savings were almost $200/year, and compared with the data reported in 2002 above, savings are still on the rise.

Another report, from the American Council for an Energy Efficient Economy written in 1997,[605] discusses city, state and utility policy instruments for achieving energy efficiency in existing homes and rentals, and outlines case studies on Residential Energy Conservation Ordinances (RECO's) and Home Energy Ratings Systems (HERS).

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[601] Habitat for Humanity has a how to guide to make homes more energy efficient, www.habitat.org/env/energy_bulletins.aspx, 3 October 2006.

[602] "Meeting the Challenge: The Prospect of Achieving 30 Percent Energy Savings through the Weatherization Assistance Program", M. Schweitzer & J.F. Eisenberg, Oak Ridge National Laboratory, weatherization.ornl.gov/pdf/Con-479%20May22-FINAL.pdf. Summary of key findings, table, p. 13, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Residential/Weatherization_2002.pdf, 3 October 2006.

[603] Ibid. p. 14.

[604] Progress Report of the National Weatherization Assistance Program, 1997, ORNL, www.eere.energy.gov/weatherization/pdfs/con450.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Residential/ORNL_weatherization.pdf, 3 October 2006.

[605] American Council for an Energy Efficient Economy, Report Overview of "Policy Options for Improving Existing Housing Efficiency, 1997. www.aceee.org/pubs/a971.htm, 3 October 2006.

Weatherization Assistance

CASE STUDY: Moose Jaw, Canada

In late 2005, volunteers in Moose Jaw, Saskatchewan, organized Share the Warmth Home Energy Efficiency Program to help low-income families get ready for winter. Community volunteers and students from the Saskatchewan Institute of Applied Science and Technology helped 100 low-income families. Students applied techniques and concepts learned in the classroom. The free improvements—valued at more than $200 plus installation for each home—include preparing windows and doors for winter, replacing furnace filters, installing a working smoke detector, putting in low-flow shower heads and faucets, installing compact florescent lights and installing an ENERGY STAR® programmable thermostat.[606] The program is set to happen again in 2006, with 500 homes to be chosen. Anyone can apply, but preference is to be given to homes with annual incomes of $45,000CN or less. The average savings for each home is reported at about $150 a year on energy and water bills.[607]

CONTACT

Manager, Communications
Dave Burdeniuk
SaskEnergy
(306) 777-9842

Weatherization Assistance

CASE STUDY: Seattle, WA

The city of Seattle offers a free weatherization assessment and remedy program to qualifying homeowners as part of their HomeWise loan program. The program can weatherize low-income single family homes and in some cases apartment buildings. A "property rehabilitation specialist" comes to the home and recommends a conservation package that fits the needs of that home. Services provided include: attic and crawlspace insulation, pipe wrapping, weatherstripping doors, caulking windows and using high-efficiency lighting in common areas.[608] The cities of Berkeley, California, and Boulder, Colorado, have similar programs.[609] In Boulder, volunteers go door to door to offer residents a free efficient light bulb, and information on how to get their houses audited.

CONTACT

Seattle Contact
(206) 684-0721
Seattle.Housing@seattle.gov

Berkeley Contact
(510) 981-5434
Energy@ci.berkeley.ca.us

[606] Saskatchewan Energy Share, www.skenergyshare.com/share_the_warmth.htm, 3 October 2006.
[607] SaskEnergy Share the Warmth Media Release, www.siast.sk.ca/departments/mktgcomms/pdf05/sharethewarmthday.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Residential/MooseJaw_sharethewarmth.pdf, 3 October 2006.
[608] Seattle Office of Housing, www.seattle.gov/housing/06-HomeWise/HomeRepair&.htm, 5 October 2006.
[609] Berkeley Office of Energy and Sustainable Development, www.ci.berkeley.ca.us/sustainable/, 5 October 2006.

Weatherization Assistance

CASE STUDY: Dearborn, MI

In Dearborn, Michigan low-income home owners and renters are eligible to apply for Weatherization Program (WX) assistance through the Wayne-Metropolitan Community Action Agency (WMCAA). Examples of eligible work include sidewall insulation, weather-stripping doors and windows, broken glass repair, furnace inspection and tune-up, caulking doors and windows, attic insulation and ventilation, crawl space insulation and box sill insulation.[610] A pre-inspection and blower door test will determine the specific measures to be installed by private contractors.

CONTACT

Wayne Metropolitan Community Action Agency
(734) 246-2280

City Of Dearborn Economic and Community Development Department
(313) 943-2180

Weatherization Assistance

CASE STUDY: Portland, OR

The city of Portland offers a loan program through the Portland Development Commission (PDC) for home improvements including energy efficiency upgrades. The loans are up to $20,000 with low-interest and deferred-payment and are available for income-qualified homeowners. The Community Action Program (CAP) is a county-level program for lower-income weatherization assistance. Each county administers a CAP to offer free weatherization services to low-income households. Both single-family homes and multi-unit complexes may be eligible. Priority is given to households with young children, senior citizens and people with disabilities.[611]

The Portland Office of Sustainable Development also provides free assistance to property owners (of multifamily units) to achieve energy efficiency and financial savings through weatherization. Their customer service specialists educate the multifamily community about energy efficiency and help property owners and managers apply for valuable incentives from the Energy Trust of Oregon, Inc. and the Oregon Department of Energy. Through innovative public-private collaboration, the Office of Sustainable Development Multifamily Energy Assistance Program promotes and administers the Multifamily Home Energy Savings program for Energy Trust of Oregon. The Multifamily Home Energy Savings program provides property owners with cash incentives for purchasing and installing energy efficient weatherization measures, such as new energy efficient windows; ceiling, floor and wall insulation, low-flow showerheads and more. They also assist property owners in applying for Business Energy Tax Credits from the Oregon Department of Energy.[612]

CONTACT

Neil Fitzgerald
PDC 222 NW Fifth Ave.
Portland, OR 97209-3859
(503) 823-3200

[610] Dearborn Home Weatherization Program, www.cityofdearborn.org/departments/economicdev/wx.shtml, 5 October 2006. Program funding provided through the State of Michigan Department of Human Services.
[611] Contact each county for information:
Multnomah 503-248-3999, ext. 22816
Washington 503-648-6646
Clackamas 503-534-5500
www.portlandonline.com/osd/index.cfm?c=41816&a=111233, 3 October 2006.
[612] Portland Multi-Family Home Energy Savings, www.portlandonline.com/osd/index.cfm?&a=111266&c=41818, 3 October 2006.

Split Incentives in Renter Occupied Homes

Energy efficiency in rental homes is neglected by many parties on both sides of the owner/renter relationship since neither party has an economic incentives to make energy-efficient improvements. In most cases, rental home owners are not the ones who pay for utilities, this falls to the renters. However, the renters generally get no payback for capital improvements to the home they are renting for relatively short periods. Owners of rental property get federal tax write-offs for *repairs* made to a rental property, but not for *improvements* (the opposite is true of an owner-occupied home). Businesses and commercial real estate may benefit from local tax incentives, but local (city) taxes usually do not affect the rental homeowner significantly, making city tax incentives less attractive to that group. Thus both groups are lacking in incentives to make improvements to the home that increase energy efficiency.

Several interesting projects are attempting to address this problem. They range from business tax incentives, to performance contracting, time-of-sale efficiency standards ordinances, rebate programs and rental efficiency ratings. Also, in many larger cities a public housing authority may be the largest landlord in town. This offers an opportunity for the central municipal government to make changes to a large number of rental properties directly.

Split Incentives in Renter-Occupied Homes

CASE STUDY: State of Maine

A Maine program[613] requires landlords to fill out an "Energy Efficiency Disclosure Form"[614] that lists components, such as insulation or heating fuel types, in rental properties relevant to the amount of energy that the property is likely to use.

Landlords must submit such a form for each of their rental properties. They are not required to meet any standards. However, the energy efficiency standards provide guidance to improve the efficiency of rental properties.

CONTACT

Efficiency Maine
(866) 376-2463
efficiencymaine@maine.gov

[613] Efficiency Maine, www.efficiencymaine.com, 5 October 2006.
[614] Maine Energy Efficiency Disclosure Form www.maine.gov/mpuc/doing_business/forms/FactSheet_000.doc, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Residential/Maine_EErentals.doc, 3 October 2006.

Split Incentives in Renter-Occupied Homes

CASE STUDY: State of Vermont[615]

Performance contracting is one approach to the problem of split incentives in rental homes. Financial risk for the energy efficiency improvements is assumed by an energy services company, whose payback comes from the recipient of the improvements, out of his or her energy savings. The Vermont Energy Investment Corporation (VEIC)[616] provides financing, technical expertise, reliable information and direct installation of energy efficiency measures. They have a partnership with Vermont Housing Finance Agency.

VEIC operates an energy services company (ESCO) that has long-term relationships with building owners to implement energy efficiency measures. This works as an *energy services company*, through *performance contracting*. VEIC assumes the financial risk for projects and is paid out of the energy cost savings. Basically, the ESCO sells efficiency and clients pay for the ESCO's improvements out of the lowered energy bills. The client's payments to ESCO are based on a percentage of the measured energy cost savings.

This program uses creative financing through the Vermont Housing Finance Agency. In the 80s and 90s, this agency launched programs to help owners of subsidized multi-family housing boost the energy efficiency of their buildings. This worked by setting aside "project cost escrow funds" at the time of the original financing that were held for 7-10 years to be used for necessary repairs and improvements. The catch is that at the time of spending the money, an energy audit is required; and if energy efficiency improvements are identified, the owners are encouraged to make those repairs using the money out of the energy savings.

The split-incentive created in a rental unit is further addressed in Burlington through a time-of-sale ordinance requiring minimum energy efficiency standard be met at each sale of the property (RECOs, or residential energy conservation ordinances). At the time of sale an energy audit must be performed and the buyer or seller may bring the property into compliance. If it is the buyer, he or she has one year to bring the property into compliance. The Burlington Electric Utility administers the ordinance and also consults on financing, technical assistance and how to go beyond the minimum requirements. This is being phased in over time (only covering a portion of the city of Burlington in 2006) and will be phased in to all of Burlington in 2 years following a report to the city council.

Most tenants in the region move after one year in each residence, with over half citing high energy costs as a reason for the move. With increased efficiency (mandated by the ordinance) tenants may stay longer. Improvement costs may be passed on through higher rents, but these should be offset by lower utility bills (which in a way takes advantage of the split-incentive). This leads nicely to the next incentive, making energy efficiency transparent to the renter.

CONTACT

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beth@veic.org

[615] EPA Climate Change Solutions, yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/SHSU5BWJ4R/$File/vermonttrimsenergybills.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Residential/Vermont_climate.pdf, 3 October 2006.
[616] Vermont Energy Investment Corporation, www.veic.org/, 12 October 2006.

Split Incentives in Renter-Occupied Homes

CASE STUDY: Allegheny, PA

The idea behind the Allegheny College project[617] is to make energy efficiency visible to the renter/consumer. Beginning in 1998, The Commonwealth Community Energy Project, formerly The Meadville Community Energy Project,[618] developed a local Home Energy Ratings System. One of the first goals of the program was to evaluate the energy usage of Meadville's many rental properties. Data on houses' insulation levels, air leakage,heating system efficiency and other property features was collected and then used to determine a rating. Energy audits leading to an efficiency rating allow the prospectiverenter to shop for a rental with the best total cost—rent *and* utilities. The landlords were given suggestions on how they increase efficiency in their properties and their costs, as well as a low-interest loan program for making the improvements. An education system was designed for renters to explain what the ratings mean and simple things they can do to save energy. The program estimated that changes in the 50 properties rated over the past four years have resulted in a savings of $30,000 annually.[619]

CONTACT

Mike Maniates
(814) 332-2986

Split Incentives in Renter-Occupied Homes

CASE STUDY: Lake Champlain, VT

If renters in the Lake Champlain Valley region of Vermont qualify (low-income), the Champlain Valley Weatherization Service (CVWS) will pay for weatherization to the rental home. It ends up at little or no cost to the owner. It is part of the Champlain Valley Office of Economic Opportunity, which is "funded through a variety of grants, service contracts and donations."[620]

CONTACT

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Champlain Valley Weatherization Service
802-524-6804

[617] Meadville Community Energy Project (MCEP), based at Allegheny College homeenergy.org/archive/hem.dis.anl.gov/eehem/00/000706.html, 5 October 2006.
[618] Commonwealth Community Energy Project, energy.allegheny.edu/, 30 October 2006.
[619] Allegheny newsletter, onthehill.allegheny.edu/autumn02/mcep.html, 5 October 2006.
[620] Champlain Valley Weatherization Service www.cvoeo.org/wx/rentalpropownwx.htm, 3 October 2006.

Split Incentives in Renter-Occupied Homes

CASE STUDY: State of New York

The Assisted Multifamily Program (AMP) provides a range of incentives to owners of publicly assisted, multifamily buildings in New York State to pay for energy efficiency improvements. Services include energy assessments, financing to complete the improvements, coordination with housing authorities, contractor oversight, and 3 years of energy monitoring afterward.[621]

CONTACT[622]

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Split Incentives in Renter-Occupied Homes

CASE STUDY: San Diego, CA

San Diego Gas and Electric Multi-family rebate is a program designed to mitigate the split incentive by going directly to the owner/manager. Incentives are offered to the owner/manager directly to upgrade equipment; it offsets the incremental cost of purchasing this equipment.[623]

CONTACT

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Pacific Gas and Electric Energy Efficiency Program
Statewide Multi-family Rebates
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Home Size Restrictions, Taxing Large Residential Energy Consumers

Some communities face issues with residents building large square-footage homes. In resorts especially, these trophy homes see little use, and yet remain heated and cooled year-round. Add such amenities as heated driveways (which can double a home's energy use), outdoor pools and hot tubs, and the community's carbon footprint can soar. Even good enforcement of energy efficiency codes may lose out to the sheer size of the energy needs of such large spaces, and luxurious amenities. Large houses, defined as being in excess of 5,000 square feet, create environmental and social impacts. They require more resources to build and more energy to operate. They impact view sheds and wildlife habitats. Large, widely dispersed houses increase costs to existing taxpayers in services as well. Ordinance tactics in use include energy mitigation programs and size caps on home construction.[624]

[621] New York Energy Smart www.getenergysmart.org/WhereYouLive/AssistedHomePerformance/overview.asp, 3 October 2006.
[622] The AMP is a grant program implemented by Hamilton, Rabinovitz & Alschuler, Inc. on behalf of NYSERDA. This is the contact person listed for the AMP program and can be found at this website: www.dsireusa.org/library/includes/GenericIncentive.cfm?Incentive_Code=NY23F&currentpageid=3&EE=0&RE=0, 3 October 2006.
[623] San Diego Multifamily Rebate and Service, www.sdge.com/residential/multi_family.shtml, 3 October 2006.
[624] Discussion of these claims, relative to Gunnison County, CO, www.hccaonline.org/page.cfm?pageid=2053, 3 October 2006.

Home Size Restrictions and Energy Taxes

CASE STUDY: Aspen, CO (Pitkin County)[625]

In 2000, Aspen and Pitkin County established the Renewable Energy Mitigation Program (REMP)[626] as a way of promoting renewable energy and energy efficiency. Pitkin County and the city of Aspen building codes require new homes to meet a strict energy "budget."

The code regulates the amount of grid-tied energy used for big energy consumption in the community: melting snow, spas, swimming pools and houses over 5,000 and 10,000 square feet. The energy for these uses must fit within a prescribed energy budget, or 50% of this energy can be supplied by on-site renewable energy systems. Under the Energy Code, the REMP allows for the payment of a mitigation fee instead of installing on-site renewable energy systems. In addition, houses over 5,000 square feet are required to install a renewable energy system on site or pay a fee of $5,000. The fee for houses over 10,000 square feet is $10,000.

The Community Office for Resource Efficiency (CORE) manages the REMP funds with oversight from others.[627]

REMP Fees support an incentive program that leverages private investments in renewable energy and energy efficiency. Portions of the fees also provide funds for renewable energy and energy efficiency technologies in public buildings and affordable housing. All projects are subject to approval by the city of Aspen and Pitkin County. In its first 2 years, the fund accumulated approximately $1.5 million, ten times the expectation, and by March 2006 had collected about $5.1 million.

In 2006 Pitkin County passed a further code restricting the size of homes built there. A 15,000 sq. ft cap on homes is now in effect, with a limit on urban homes to 5,750 sq. ft. Several loopholes in the previous code were also removed.[628]

CONTACT

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Home Size Restrictions and Energy Taxes

CASE STUDY: Marin County, CA

Marin County, California passed a similar ordinance in October 2002. The goals of Ordinance 3356[629] are to reduce the annual and peak energy consumption of large homes, and to ensure that a new single family home larger than 3,500 square feet does not exceed the energy use of the Title 24 standard of the equivalent home designed at 3,500 sq. ft. This can be achieved with readily available energy efficiency measures and/or by supplementing energy use with renewable energy.[630]

CONTACT

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[625] Aspen Canary Initiative, www.aspenglobalwarming.com/, 3 October 2006.
[626] Aspen and Pitkin County REMP Program, www.newrules.org/environment/climateaspen.html, 30 October 2006.
[627] CORE, REMP Projects, www.aspencore.org/sitepages/pid56.php, 30 October 2006.
[628] Interview with Pitkin County community development director Cindy Houben: www.kcfr.org/cgi-bin/comatters/comatters_play.asx?play=2473&type=comatters.asx.
[629] Marin County Energy Efficiency Ordinance, www.caleep.com/docs/resources/greenbuildings/Marin%20County%20Res%20EE%20Ordinance.pdf#search=%22marin%20county%20home%20size%20square%20feet%22, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Residential/Marin_Ordinance3356.pdf, 5 October 2006.
[630] Marin County Community Development Agency, www.co.marin.ca.us/depts/CD/main/comdev/advance/best/dwelling.cfm, 5 October 2006.

Energy and Water Efficiency by Smart-Metering, Price Signals and Price Structuring

Energy use fluctuates throughout the day by hour, and by day of the week. Wholesale energy prices usually vary according to peak demand cycles. Allowing consumers to easily see how much energy they are using, and what the real-time prices are enables residents to vary their energy use according to demand cycles and fluctuations in price. Doing this lowers energy use, cuts consumer bills and dampens price fluctuations.

So-called "smart-meters" provide a feedback loop between customers and suppliers to regulate usage according to price signals. The aim of smart-metering is to change consumers' behavior as they become aware of how they use energy and what this is costing them.[631] Currently, consumers purchase energy for their homes unaware of the unit costs at the time of use. Most consumers can only find out the cost (on their bill), long after they could have changed their consumption patterns. Smart metering would alert consumers to peak and off-peak prices at the time they are happening, allowing them to help the utility reduce peak demand. In some cases, appliances are also programmed by the consumer to shut off according to utility system load and price signals. Many states are leading the way by recommending the development and dispersal of smart meters and removing any barriers that have previously existed.[632]

Innovative Electrical Metering

In early 2006, Pacific Northwest National Laboratory began testing the Pacific Northwest GridWise™ Demonstration project, a regional initiative to test and speed adoption of new smart grid technologies to make the power grid more resilient and efficient. About 300 volunteers in Washington's Olympic Peninsula, in Yakima and Gresham, Oregon are testing the system for a year. Approximately 200 homes will receive real-time price information through a broadband Internet connection. Automated equipment will adjust energy use based on price. In addition, some customers will have computer chips embedded in their dryers and water heaters that can sense when the power transmission system is under stress and automatically turn off certain functions briefly until the grid can be stabilized by power operators. The year-long study is part of the Pacific Northwest GridWise Demonstration, a project funded primarily by DOE. Northwest utilities, appliance manufacturers and technology companies are supporting this effort to demonstrate the devices and assess the resulting consumer response. In the pricing study, automated controls will adjust appliances and thermostats based on predetermined instructions from homeowners. The volunteers can choose to curtail or reduce energy use when prices are higher. At any point, homeowners have the ability to override even their preprogrammed preferences to achieve maximum comfort and convenience. If homeowners choose to reduce electric consumption at times of higher prices, the banked money they save becomes real as they are issued a check from the GridWise program each quarter. Price conscious participants are expected to earn about $150 during the year. Nobody will lose money during the experiment, but higher prices for peak usage could become a feature in the future.

A PNNL study shows that creating a smarter grid through information technology could save $80 billion over 20 years nationally by offsetting costs of building new electric infrastructure – the generators,

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[631] Informational articles: seattletimes.nwsource.com/html/businesstechnology/2002734592_smartgrid12.html, 5 October 2006 news.bbc.co.uk/2/hi/science/nature/4754109.stm, 5 October 2006. www.americanenergyindependence.com/smartmeters.html, 5 October 2006.

[632] On August 1st, 2006 the New York Public Service Commission issued an order to support utility investment in advanced metering technology, www3.dps.state.ny.us/pscweb/WebFileRoom.nsf/ArticlesByCategory/BDD11878B2AC5A98852571B20061CF54/$File/94e0952_ord_08_01_06.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Infrastructure/NYOrder_metering_2006.pdf, 5 December 2006.

transmission lines and substations that will be required to meet estimated load growth.[633] It would also save significant carbon emissions.[634]

Additional Resources

EnergySavers.gov information clearinghouse: www.energysavers.gov/stateagencies.html

Alliance to Save Energy: www.ase.org/section/program

Renewable energy programs for public utilities: www.dnr.mo.gov/energy/utilities/Summary%20031203BW.doc, p. 13

Sample resolution for energy efficiency: www.cabq.gov/energy/documents/Resolution329.doc

Article on cities and counties leading the energy-efficiency charge www.americancityandcounty.com/mag/government_energy_efficiency_taking/index.html

Residential high-rise in NYC www.thesolaire.com/

Habitat for Humanity partners with the Department of Energy to build energy efficient homes and improve existing homes. www.nrel.gov/docs/fy05osti/38116.pdf

Habitat for Humanity also has a program called **"Better Built Program,"** which provides contacts, materials and resources for local Habitat affiliates who seek help in building more sustainable houses www.habitat.org/env/better_built.aspx

Energy Efficient Home Article Resource Directory
Database of articles on energy efficient homes. Provides practical and clear information for the homeowner. www.energyefficienthomearticles.com/

"Creating a High Performance Workspace" G/Rated Tenant Improvement Plan, 2004. This guide has been created by the City of Portland and the City of Beaverton Solid Waste & Recycling Program to support and promote healthy, productive, durable, resource- and energy efficient workspaces. This is a good resource for commercial building owners, because it details the action strategies for the project manager, design and construction team to build an efficient and healthy workspace. www.portlandonline.com/shared/cfm/image.cfm?id=112733

ENERGY STAR® Change a Light Change a World Campaign
The ENERGY STAR® Change a Light, Change the World Campaign is a national call-to-action to encourage individuals to help change the world, one light—one energy-saving step—at a time. Individuals who already pledged in 2005 will help save more than $2 million in energy costs and prevent more than 33 million pounds of greenhouse gas emissions. The Environmental Protection Agency, Department of Energy, and Department of Housing and Urban Development are pleased to partner to sponsor the Campaign this year www.energystar.gov/index.cfm?c=change_light.changealight_about

Smart Energy Living is an informational resource provided by Colorado Energy Science Center. Smart Energy Living brings together the information, resources and tools to help you understand how to reduce your energy use and save money. We publish a semi-annual magazine, offer workshops, provide online information, and links to contractors. smartenergyliving.org/cm/Home.html

[633] Pacific Northwest National Laboratory, www.pnl.gov/news/2006/06-01.stm, 3 October 2006.
[634] For more information contact: 1-888-375-PNNL or inquiry@pnl.gov, 3 October 2006.

A Primer on Smart Metering, New York State Energy Research and Development Authority www.nyserda.org/programs/pdfs/meteringprimer.pdf

The Home Resource Profile is a detailed, customized report that shows you how your household uses energy, water and solid waste. It is available to any Seattle City Light or Seattle Public Utilities residential customer. Whether you live in a house, condominium or apartment, this free service will give you useful information about your utility bills and how to save money www.cityofseattle.net/conserve/homeprofile/

City of Seattle Energy Savings Tips Directory. These energy savings tips are from ***30 Simple Energy Things You Can Do to Save the Earth*** authored by Seattle City Light and The EarthWorks Group. www.cityofseattle.net/light/conserve/tips/

Chapter 5: Local Action Plan Best Bets **Residential Transportation**

DOCUMENT CONTENTS[635]

Most of the best practices for transportation in this section focus on how municipalities use incentives to encourage residents and businesses to modify their transportation uses.

Motor vehicles are major greenhouse gas (GHG) emitters and sources of air, noise and water pollution. Transportation represents about 27% of total U.S. energy consumption and 70% of total petroleum consumption.[636] *Transportation energy consumed by mode is summarized below. Personal transportation represents about 60%, and commercial transport about 40% of total transportation energy consumption.*

"Transportation Demand Management" (TDM) is a term used to describe strategies that result in more efficient uses of transportation resources. Below are highlighted some of the best practices that cities can use to decrease GHG emissions and increase the mobility of the community.

	Trillion BTUs	% of Total Consumption
Automobiles	9,126	34%
Light Trucks (including vans and SUVs)	6,617	25%
Trucks & Private Buses	4,563	17%
Aviation	2,546	10%
Water	1,300	4.9%
Pipeline	1,009	3.8%
Off-highway (construction and agriculture)	680	2.5%
Railroads	607	2.3%
Buses	207	0.8%
Motorcycles	26	0.1%

Table: Vehicle Energy Use[637]

[635] All of the information in this section can be found at Victoria Transportation Policy Institute, unless otherwise noted.
[636] ORNL, *Transportation Energy Book*, Oak Ridge National Laboratories, U.S. Department of Energy.

Make City Pedestrian-Friendly and Bicycle-Friendly

Improve walking and cycling conditions. Establish local walking and cycling plans and fund sidewalk and bike-lane improvements.[638]

According to some estimates, 5-10% of urban automobile trips can reasonably be shifted to non-motorized transport.[639] Shifts from automobile to non-motorized transportation can be particularly effective at energy conservation and emission reductions as short motor vehicle trips have high per-mile fuel consumption and emission rates. Each 1% shift of mileage from automobile to non-motorized modes tends to reduce energy consumption and pollution emissions by 2-4%.

Moreover, a short pedestrian or cycle trip often replaces a longer automobile trip (for example, consumers may choose between shopping at a local store or driving to a major shopping center). Non-motorized transportation improvements are also increase transit use and create more pedestrian accessible land use patterns.[640]

Studies have found that in many communities people would walk more frequently if they had suitable facilities and resources. One U.S. survey found that 38% of respondents would like to walk to work, and 80% would like to walk more for exercise.[641]

The table below summarizes a Canadian public survey indicating high levels of interest in cycling and walking.

Description	Cycle	Walk
Currently use this mode for leisure and recreation.	48%	85%
Currently use this mode for transportation.	24%	58%
Would like to use this mode more frequently.	66%	80%
Would cycle to work if there "were a dedicated bike lane which would take me to my workplace in less than 30 minutes at a comfortable pace."	70%	NA
Support for additional government spending on bicycling facilities.	82%	NA

Table: Active Transportation Survey Findings [642]

However, citizens' ability to walk or cycle depends on city planning. The Victoria Transportation Policy Institute[643] estimates that pedestrian-friendly communities have 5-10 times as many non-motorized trips compared to automobile dependent communities with otherwise similar demographic and geographic conditions.

Best practices for improving walkability and encouraging walking, include:[644]

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[637] Ibid, Table 2.5.
[638] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm92.htm, 26 September 2006.
[639] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm92.htm, 3 October 2006.
[640] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm84.htm, 3 October 2006.
[641] STPP, *Americans Attitudes Toward Walking and Creating More Walkable Communities*, Surface Transportation Policy Project (www.transact.org), 2003.
[642] Environics, *National Survey on Active Transportation*, Go for Green, (www.goforgreen.ca), 1998. *This survey indicates a high level of interest in cycling and walking.*
[643] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm100.htm, 3 October 2006.
[644] A number of guides and resources provide information about best practices:
1) ADONIS, *Best Practice to Promote Cycling and Walking* and *How to Substitute Short Car Trips by Cycling and Walking*, ADONIS Transport RTD Program, European Union (www.cordis.lu/transport/src/adonisrep.htm), 1999. This 300-page catalogue describes dozens of strategies to help improve and encourage walking and cycling, ranging from special facilities, to safety campaigns and traffic management to facilitate street crossing).
2) Todd Litman, et al., *Pedestrian and Bicycle Planning; A Guide to Best Practices*, VTPI (www.vtpi.org), 2000. Comprehensive guide with extensive references.
3) Zeeger, et al, *Pedestrian Facilities User Guide: Providing Safety and Mobility*, Pedestrian and Bicycle Information Center (www.walkinginfo.org), Highway Safety Research Center, Federal Highway Administration, Publication FHWA-RD-01-102, February 2002.
4) GDOT, *Pedestrian & Streetscape Guide*, Georgia Department of Transportation (www.dot.state.ga.us), Sept. 2003.

Integrate non-motorized transportation into all transport and land-use planning activities.

Educate city planners in non-motorized transportation planning principles.

Increase funds for non-motorized planning relative to the rates of funding for automobile infrastructure.

Insure that all roadways are suitable for walking unless it is specifically prohibited and suitable alternatives are available.

Use current planning practices and design standards, including facility designs that accommodate the widest range of potential users, including people with mobility and visual impairments (disabilities) and other special needs.

Include non-motorized travel in transportation surveys and models.

Create pedestrian-oriented centers and neighborhoods.

Perform user surveys to identify problems and barriers to pedestrian travel.

Use design features and strategies intended to reduce vehicle traffic speeds and volumes on a particular roadway, and other traffic control measures to make street environments safer and more pleasant for walking. [645]

Pedestrian & Bicycle Friendly City

CASE STUDY: Toronto, Canada

The City of Toronto adopted a Pedestrian Charter[646] in October 2002 and was the first city in North America to have such a charter. It reflects the concept that walkability is one of the most important measures of the quality of a city's public realm, its health and vitality. The Charter serves as a guide to decision-makers, both in the city and in the community at large that walking should be valued as the most sustainable of all forms of travel, and that it has enormous social, environmental and economic benefits. It outlines what pedestrians can rightfully expect from the city in terms of meeting their travel needs; to establish principles to guide the development of policies and practices that affect pedestrians; and to identify the features of an urban environment and infrastructure that encourage and support walking. The Charter consists of six principles:

1. Accessibility: Walking is a free and direct means of accessing local goods, services, community amenities and public transit.
2. Equity: Walking is the only mode of travel that is universally affordable, and allows children and youth, and people with specific medical conditions to travel independently.
3. Health and Well-being: Walking is a proven method of promoting personal health and well-being.
4. Environmental Sustainability: Walking relies on human power and has negligible environmental impact.
5. Personal and Community Safety: Walking increases community safety for all by creating an environmental in which people feel safe and comfortable.
6. Community Cohesion and Vitality: A pedestrian-friendly environment encourages and facilitates social interaction and local economic vitality.

CONTACT

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[645] For more information on 'traffic calming' techniques see: www.vtpi.org/tdm/tdm4.htm, 3 October 2006.
[646] Toronto Pedestrian Charter, www.toronto.ca/pedestrian/, 26 September 2006.

Implement School and Campus Transportation Management Programs

School and campus transportation management programs encourage parents, students and staff to use alternative transportation when traveling to school, college and universities.[647]

An increasing number of colleges and universities offer free or significantly discounted transit passes to students and staff (sometimes called a "UPASS"). UPASS programs often require students to approve a special fee to fund universal transit passes. The table below summarizes the costs and impacts of several UPASS programs.

University	Year Began	Who May Ride Free	Eligible Riders	Annual Program Cost	Annual Rides	Cost Per Eligible Person	Rides Per Eligible Person	Average Cost per Ride	Ridership Increase
			(1)	*(2)*	*(3)*	*(4)=(2)/(1)*	*(5)=(3)/(1)*	*(6)=(2)/(3)*	*(7)*
UC, San Diego	1969	Students, faculty, staff, emeritus	35,200	$177,700	296,600	$5	8	$0.60	
University of Georgia at Athens	1977	Students	30,000	$275,000	600,000	$9	20	$0.46	
Cal Poly State, San Luis Obispo	1985	Students, faculty, staff, emeritus	17,500	$169,000	531,700	$10	30	$0.32	
Appalachian State University, NC	1980	Students, faculty, staff	13,200	$251,000	361,800	$19	27	$0.69	
University of Pittsburgh, PA	1995	Students, faculty, staff	31,200	$650,000	1,536,900	$21	49	$0.42	60%
UC, Santa Barbara	1986	Students	17,400	$400,200	584,800	$23	34	$0.68	6%
Santa Barbara City College, CA	1995	Students	12,000	$277,000	525,500	$23	44	$0.53	36%
University of Massachusetts at Amherst	1969	Students, faculty, staff	39,000	$972,300	807,500	$25	21	$1.20	
Ohio State University	1997	Students	48,300	$1,400,000		$29			300%
University of Wisconsin at Madison	1996	Students	39,000	$1,200,000	1,600,000	$31	41	$0.75	
Virginia Polytechnic Institute and State University	1983	Students, faculty, staff	32,000	$1,100,000	1,400,000	$34	44	$0.79	
Auraria Higher Education Center (UC Denver)	1994	Students	31,500	$1,204,000	1,965,000	$38	62	$0.61	
UC, Davis	1990	Students	18,500	$719,000	1,800,000	$39	97	$0.40	255%
San Jose State University, CA	1993	Students	27,000	$1,060,000		$39			
UC Boulder	1991	Students, faculty, staff	24,500	$1,000,000	1,500,000	$41	61	$0.67	400%
Marquette University, WI	1995	Students	6,700	$400,000		$60			
University of Illinois at Urbana-Champaign	1989	Students	36,000	$2,200,000	5,800,000	$61	161	$0.38	370%
University of Wisconsin at Milwaukee	1994	Students	20,200	$1,247,400	2,300,000	$62	114	$0.54	27%
UC, Santa Cruz	1972	Students, faculty, staff	12,220	$1,203,800	1,253,047	$99	103	$0.96	
AVERAGES						**$32**	**56**	**$0.57**	

Table: UPASS Program Summary[648]

[647] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm5.htm, 26 September 2006.
[648] Jeffrey Brown, Daniel Hess and Donald Shoup, *Unlimited Access*, Institute of Transportation Studies, UCLA, 1998. Published in *Transportation,* Volume 28, number 3, 2001, pp. 233-267. www.vtpi.org/tdm/tdm5.htm, 18 October 2006.

Students at the following universities voted overwhelmingly (most referenda received 75% or more approval) to support many of these programs, even though it increases their fees. The table on the next page summarizes some campus UPASS programs in North America.

Some campuses use vehicle restrictions[649] and regulations to limit automobile use. For example, some colleges do not provide parking permits to freshmen who live on campus. This encourages students to become more involved in campus activities, and discourages them from taking jobs to finance a car.

Facility managers and administrators often implement campus TDM programs to address a particular problem, such as a parking shortage or traffic congestion on nearby streets. Student and employee organizations are often involved in program planning and management. Some student groups initiate programs to improve their travel options and achieve environmental or community goals.

Campus TDM programs can reduce automobile trips by 10-30%.[650] For example, a program at the University of Wisconsin-Milwaukee reduced student driving by 26%.[651] A University of Washington program reduced total vehicle trips to campus by 16% during its first year of operation.[652] A study in Bilboa, Portugal found that students are relatively sensitive to bus prices, rail frequency and overall transit service quality. A combination of increased rail service frequency and reduced bus fares can significantly increase ridership and help reduce local traffic congestion and pollution emissions at campuses.[653]

Best practices for Campus TDM programs include:

Provide a variety of alternative transportation services, including specialty services such as transport for recreational trips and special events.

Involve administrators, managers, students and staff in planning and implementing the program.

Emphasize benefits to students and staff from improved transportation services, including financial savings, expanded choice, exercise opportunities (for cycling and walking) and environmental benefits.

Improve pedestrian and bicycle conditions on campus and surrounding areas.

Pedestrian & Bicycle Friendly City

CASE STUDY: Stanford, CA[654]

Stanford University in Palo Alto, California, expanded its building capacity by 25%, adding more than 2.3 million square feet of research and teaching buildings, public facilities and housing—without increasing peak period vehicle traffic. By 2000, 1.7 million square feet of new buildings had been developed, while automobile commute trips were reduced by 500 per day.

To accomplish this the campus transportation management plan included:

A 1.5 mile transit mall

Free transit system with timed transfers to regional rail

Bicycle network

[649] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm33.htm, 3 October 2006.
[650] Ibid.
[651] James Meyer and Edward Beimborn, *Evaluation of an Innovative Transit Pass Program: the UPASS*, Wisconsin Department of Transportation (www.uwm.edu/dept/cuts/upassum.htm), 1996.
[652] (Michael E. Williams and Kathleen L. Petrait, "U-PASS: A Model Transportation Management Program that Works," *Transportation Research Record 1404*, 1993, pp. 73-81; website: www.washington.edu/upass.
[653] J. Bilbao Ubillos and A. Fernandez Sainz, "The Influence Of Quality and Price On The Demand For Urban Transport: The Case Of University Students," *Transportation Research A*, Vol. 38, No. 8 (www.elsevier.com/locate/tra), October 2004, pp. 607-614; website: www.vtpi.org/tdm/tdm5.htm, 26 October 2006.
[654] Stanford University Parking & Transportation Services, transportation.stanford.edu, 26 September 2006.

Staff parking "cash-out" (offering commuters cash equivalent if they choose not to use subsidized parking)

Ridesharing program

Other transportation demand management elements

By using this approach, the campus was able to add $500 million in new projects with minimal planning or environmental review required for individual projects. The campus also avoided significant parking and roadway costs. Planners calculate that the university saves nearly $2,000 annually for every commuter shifted out of a car and into another mode.

Public benefits included decreased congestion and improved safety on surrounding roadways and regional traffic system, reduced air, noise and water pollution, and improved local transit options. All of Stanford's transportation services are available to students, employees and the general public.

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Encourage or Require Implementation of Commute Trip Reduction Programs

Implementing commute trip reduction (CTR) programs encourages employees to use alternative modes when traveling to work.

CTR[655] programs must be able to meet employees' diverse and changeable needs. Many employees can use transportation alternatives part-time, if given suitable support and incentives. For example, many employees can carpool, telecommute or work part time two or three days a week. Some employees can bicycle commute part of the year, as well.

Some jurisdictions mandate CTR programs for certain types of employers, such as those with more than 50 daytime employees at urban worksites. These have been criticized as "laws forcing workers to give up their cars," but that is not true. Such laws only require *employers* to develop a program with suitable incentives, taking into account location and employee requirements. They do not require individual employees to change their commute pattern.

U.S. EPA's Commuter Choice program[656] has established National Standards of Excellence in Commuter Benefits, and the Commuter Choice Leadership Initiative (CCLI) awards. To meet National Standard of Excellence employers must offer:

A guaranteed ride home

Employer-paid transit/vanpool benefits - employer provides at least $30 per month in benefits or the full value of commuting costs.

Parking Cash Out - employer provides the option of cash instead of parking. CCLI requires the employer to offer at least $30 per month and at least 75% of the actual saved costs of parking to classify this option as a primary benefit.

Employer-defined benefits—allows employers to use other strategies to achieve the standards.

Employers must achieve demonstrable benefits the Federal Commuter Choice Team must agree if an option is to qualify.

Other TDM incentives are treated as supporting strategies to these primary activities. These include:

Ridesharing or carpool matching

Shuttles from transit stations

[655] Victoria Transportation Policy Institute CTR Programs, www.vtpi.org/tdm/tdm9.htm, 26 September 2006.
[656] Best Workplaces for Commuters, www.commuterchoice.gov, 3 October 2006.

Preferred parking for carpools/vanpools

Secure bicycle parking, showers and/or lockers

Financial or recognition incentives for bicyclists or walkers

Benefits and Costs

Shifting commute travel from peak period automobile trips to alternative times and modes can provide a variety of benefits

Employee Benefits

CTR programs can benefit employees by increasing their travel options, reducing travel stress and by providing financial savings. Some studies show that many workers place a high value on having commute alternatives.[657] Even people who generally enjoy driving do not necessarily want to drive to work every day. At the margin (i.e., relative to current levels of vehicle travel), many consumers would probably prefer to drive somewhat less, provided that they had good mobility alternatives with adequate comfort, convenience and prestige.

Employer Benefits[658]

CTR programs can benefit employers by reducing their parking costs or freeing up parking for customers. Programs that improve travel choices or provide financial benefits tend to improve employee morale and recruitment, and reduce employee turnover. For example, employee turnover at the Calvert Group (an investment firm) declined from 25% to 12% after a comprehensive package of commute benefits were introduced, and other surveys find that telecommuting reduces employee turnover by 16%.[659]

Community Benefits

CTR is particularly effective at reducing traffic congestion since commute trips are the largest share of peak-period travel. It can reduce road, on-street parking and traffic service costs. Along with reducing GHG emissions, it can also help reduce pollution and crash risk, and increase demand for alternative modes, providing economies of scale. By reducing road and parking facility requirements, it supports more efficient land use, compact development and more pedestrian-oriented streetscapes.

CTR costs

Costs include program administration expenses and any additional employee time requirements.[660] Administrative costs typically average $1-8 per employee per month to cover program planning, marketing, management and evaluation activities.[661] A survey by Pollution Probe found that the American employers with successful CTR programs spend an average of $156 annually per employer, with the majority spending $33 to $89.[662] However, there are also savings and benefits to businesses that may offset much of these costs.[663]

Some costs and benefits are economic transfers, in which costs to one group are offset by benefits to another. For example, charging motorists directly for using parking

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[657] Raymond Novaco and Cheryl Collier, *Commuting Stress, Ridesharing, and Gender: Analyses from the 1993 State of the Commute Study in Southern California*, University of California Transportation Center (Berkeley), Working Paper #208 (www.uctc.net), 1994.

[658] The *SMART Trip Reduction Manual* published by Pollution Probe (2001) provides information on calculating the benefits of CTR programs to employers and employees. (www.pollutionprobe.org/Publications/Air.htm), 2001.

[659] EPA, *What Employers are Saying About Commuter Benefits*, Report EPA420-F-01-013, U.S. Environmental Protection Agency, 2001.

[660] CTR Task Force, *2001 Report to the Washington State Legislature*, Washington State Department of Transportation, Transportation Demand Management Office (www.wsdot.wa.gov/tdm/tripreduction/download/CTR_Report_01.pdf), December 2001, also archived www.climatemanual.org/Cities/Chapter5/BestBets/TransportationResidential/CTR_Report_01.pdf, 26 October 2006.

[661] Ali Modarres, "Evaluating Employer-Based Transportation Demand Management Programs," *Transportation Research Record A*, Vol. 27, No. 4, 1993, pp. 291-297.
Waldo Lopez-Aqueres, "Employer Trip Reduction Programs: How Costly? Who Pays?" *TDM Review*, Association for Commuter Transportation (tmi.cob.fsu.edu/act/act.htm), 1994.

[662] The *SMART Trip Reduction Manual* published by Pollution Probe (2001) www.pollutionprobe.org/Publications/Air.htm, 26 October 2006.

[663] Phil L. Winters and Sara J. Hendricks, *Quantifying The Business Benefits of TDM*, Center for Urban Transportation Research, for the Office of Research and Special Programs, USDOT, www.nctr.usf.edu/html/416-11.htm, 2003, 26 October 2006.

facilities increases costs to automobile commuters but provides additional revenue to businesses.[664] Financial incentives for commuters that choose alternative forms of transportation represent an economic transfer from employers to employees, and often substitute for other employee benefits such as free parking.[665]

Commute Trip Reductions

CASE STUDY: Trip Reduction Ordinances[666]

Some jurisdictions have ordinances that require or encourage commute trip reduction programs. Below are some examples.

Washington State's Commute Trip Reduction Law (CTR)[667] is designed to reduce traffic congestion, pollution and fuel consumption. Employers in major urban areas with more than 100 employees at a worksite are required to develop CTR programs that encourage employees who drive alone to work to consider using an alternative commute mode such as buses, vanpools, carpools, biking, walking, telecommuting and flexible work schedules.[668]

Maricopa County, AZ [669] requires major worksites with 50 or more employees to implement trip reduction programs.[670]

Cambridge, MA[671] has an ordinance requiring businesses to implement TDM at new developments.[672]

South Notomas, CA[673] allows developers to use TDM programs, such as participation in a TMA, to help gain municipal acceptance of new developments.[674]

Bay Area, CA[675] requires all public and private employers with 100 or more employees at a work site to establish employee trip reduction targets for various locations and years, and identify various strategies to help achieve these targets.[676]

Pima County, AZ under the PIMA Association of Governments,[677] established Travel Reduction Ordinances (TRO) to improve air quality and reduce traffic congestion by increasing alternate mode usage and reducing overall motor vehicle travel for commute trips.[678]

[664] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm26.htm, 3 October 2006.
[665] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm8.htm, 3 October 2006.
[666] University of South Florida Trip Reduction Ordinances, www.nctr.usf.edu/clearinghouse/tro, 3 October 2006.
[667] Washington State Ridesharing Organization, wsro.net/, 3 October 2006
Washington State Department of Transportation Environmental Services website, www.wsdot.wa.gov/environment/, 3 October 2006.
[668] Contact: Mr. Keith Cotton, Commute Options Developer, (360) 705-7910, cottonk@wsdot.wa.gov.
[669] Valley Metro Rideshare, www.valleymetro.org/Rideshare/default.asp, 3 October 2006.
[670] Contact: 602.262.RIDE, rideshareinfo@ValleyMetro.org.
[671] Cambridge Parking and Transportation Demand Management, www.cambridgema.gov/cdd/et/tdm/index.html, 3 October 2006.
[672] Contact: Jean Clark, the City's PTDM Planning Officer, at jclark@cambridgema.gov, (617) 349-4673.
[673] South Natomas Transportation Management Association, www.SouthNatomasTMA.org, 3 October 2006.
[674] Contact: Ken Loman, Executive Director, (916) 646-0928, ken@sntma.org.
[675] Bay Area Air Quality Management District, www.baaqmd.gov/, 3 October 2006
Or to view the ordinance, www.arb.ca.gov/DRDB/BA/CURHTML/R13-1.HTM, 3 October 2006.
[676] Contact: Juan Ortellado, Manager, Grant Programs, (415) 749-5000.
[677] Pima Association of Governments Travel Reduction Program, www.pagnet.org/TRP/, 3 October 2006.
[678] Pima Travel Reduction Ordinance, www.pima.gov/cob/code/c1711.html#3796, 3 October 2006.

Implement Parking Management Programs[679]

Managing the type and number of parking lots can reduce pavement space and vehicle use in a city. A variety of techniques allow cities to incorporate GHG reduction into parking management systems. For example, implementing storm water management fees based on the amount of pavement on a lot, and per-space parking levies, act as incentives to property owners to reduce parking supply and implement transportation management programs.

Strategic parking management programs can also maximize parking space, and encourage alternative transport that reduce the number of parking spaces needed in a community. The next table summarizes these parking management strategies, and indicates the potential reduction in parking supply that they can typically provide.

Management Strategy	Description
Strategies That Result In More Efficient Use of Parking Facilities	
Shared Parking	Parking spaces are shared by more than one user allowing facilities to be used more efficiently.
Regulate Parking Facility Use	More convenient and visible parking spaces are managed and regulated to give priority to higher-value trips, increase efficiency and user convenience.
More Accurate and Flexible Standards	Reduce or adjust standards to more accurately reflect demand at a particular location, taking into account geographic, demographic and economic factors.
Parking Maximums	Establish maximum in addition or instead of minimum parking standards to avoid excessive parking supply.
Remote Parking	Encouraging longer-term parkers to use off-site or fringe parking facilities, so more convenient spaces are available for priority users.
Improving User Information and Marketing	Provide convenient and accurate information on parking availability and price, using maps, signs, brochures and electronic communication.
Smart Growth and Location Efficient Development	Encourage more clustered, mixed, multi-modal, infill development, which allows more shared parking and use of alternative modes.
Improved Walkability	Improve pedestrian conditions to allow parkers to conveniently access more parking facilities, increasing the functional supply in an area.
Transportation Management Associations	Transportation Management Associations are private, non-profit, member-controlled organizations that can provide a variety of services that encourage more efficient use of transport and parking resources in an area.
Increase Capacity of Existing Parking Facilities	More parking spaces can sometimes be provided by using currently wasted space, sizing spaces for smaller vehicles and motorcycles, and using car stackers.
Strategies That Reduce Parking Demand	
Transportation Demand Management Programs	Various strategies and programs can encourage more efficient travel patterns, which reduces automobile trips and parking demand.
Parking Pricing	Charge motorists directly for using parking facilities, and set fees to encourage efficient use of parking facilities.
Improve Parking Pricing Methods	Use of more convenient and effective parking pricing techniques to make parking pricing more acceptable and cost effective.
Commuter Financial Incentives	Parking cash out and transit benefits give commuters a financial incentives to shift modes and reduce parking demand.
Unbundle Parking	Rent or sell parking spaces separately from building space, so occupants pay for just the number of parking spaces that they use.
Tax Parking Facilities	Impose special taxes on parking facilities and commercial parking transactions.
Improve Enforcement and Control	Enforcement should be consistent, fair and friendly. Parking passes should have clear limitations regarding where, when and by whom they may be used, and these limitations should be enforced.
Bicycle Facilities	Supply bicycle parking, storage and changing facilities instead of some automobile parking spaces.

Table: Typical Parking Management Strategies

[679] Victoria Transportation Policy Institute, www.vtpi.org/park_man.pdf, also archived at, www.natcapsolutions.org//ClimateManual/Cities/Chapter5/BestBets/TransportationResidential/park_man.pdf, 26 September 2006.

Strategies that Reduce Negative Impacts	
Develop Overflow Parking Plans	Encourage use of remote parking facilities and promote use of alternative modes during peak periods, such as busy shopping times and major events.
Address Spillover Problems	Address spillover parking problems directly with management, pricing and enforcement strategies.
Parking Facility Design and Management	Improved parking facility design to address safety, stormwater management, user comfort, security and aesthetic objectives.

Table: Typical Parking Management Strategies con't.

The table below indicates the typical reductions in parking requirements provided by various parking management strategies, and indicates those that also tend to reduce vehicle traffic.

Strategy	Parking Requirement Reductions			Reduce Vehicle Traffic
	Low	Medium	High	
Shared Parking	10%	20%	30%	
Parking Regulations	10%	20%	30%	
More Accurate Standards	10%	20%	30%	
Parking Maximums	10%	20%	30%	
Remote Parking	10%	20%	30%	
Smart Growth	10%	20%	30%	✓
Walking and Cycling Improvements	5%	10%	15%	✓
Increase Capacity of Existing Facilities	5%	10%	15%	
Mobility Management	10%	20%	30%	✓
Parking Pricing	10%	20%	30%	✓
Improve Pricing Methods	NA	NA	NA	✓
Financial Incentives	10%	20%	30%	✓
Unbundle Parking	10%	20%	30%	✓
Parking Tax Reform	5%	10%	15%	✓
Bicycle Facilities	5%	10%	15%	✓
Improve User Information	5%	10%	15%	✓
Improve Enforcement and Control	NA	NA	NA	
Transportation Management Associations	NA	NA	NA	✓
Overflow Parking Plans	NA	NA	NA	
Address Spillover Problems	NA	NA	NA	
Parking Facility Design	NA	NA	NA	

Table: Typical Reductions in Parking Requirements and Vehicle Traffic

This indicates the typical reductions in parking requirements relative to conventional practices, and whether a parking management strategy tends to reduce vehicle traffic, thereby providing additional benefits. NA indicates strategies that do not directly affect parking requirements.

How to Implement

Parking management is usually implemented by local governments or individual businesses in response to specific parking and traffic problems. Some parking management programs are coordinated by regional governments. Concerns over an immediate parking problem can instigate development of a comprehensive parking planning process. Transportation engineers and planners, either within public agencies or hired as consultants, are usually responsible for performing parking studies, evaluating parking solutions and developing parking management plans. It is important, though, that parking management be included in a climate protection program, and not left to the traditional planners.

Below is the typical five-step process for developing a contingency-based[680] parking management plan:

1. Define general problems to be addressed (climate protection, parking congestion, traffic congestion, excessive parking facility costs, poor pedestrian environments, etc.) and the geographic areas to be considered.
2. Perform the following studies:
   - A parking supply inventory (how many spaces exist of each type of parking: public and private, on- and off-street, short- and long-term, free and paid, etc.) for each geographic area.
   - A parking utilization study (what portion of each type of parking is used at various time, particularly peak-periods) for each geographic area.
   - Projections of how parking supply and demand are likely to change in the future, taking into account expected changes in land use, population, commercial activity, travel patterns, etc.
   - Use this information to identify when and where parking supply is or will be inadequate or excessive.
3. Identify potential solutions.[681]
4. Work with stakeholders to evaluate the effectiveness, benefits, costs, equity impacts, feasibility and barriers of each potential solution. Use this information to prioritize these options.
5. Develop an integrated parking plan that identifies changes in policies and practices, tasks, responsibilities, budgets, schedules, etc.

Parking Management Benefits

Efficiency and Savings
A comprehensive parking management program that includes several strategies (shared parking,[682] more accurate parking requirements, pricing, cash out,[683] etc.) can often reduce parking requirements by 30-50% compared with generous minimum parking requirements, unpriced parking, and each space assigned to an individual motorist. With appropriate parking management motorists still have adequate parking, although they may need to walk somewhat farther, and pay directly rather than indirectly for parking.

The magnitude of savings that result from parking management depends on specific conditions, including the cost per parking space and how much parking can be reduced.

Parking Management Programs

CASE STUDY: Chattanooga, TN

To encourage downtown development the Chattanooga Area Regional Transit Authority developed peripheral parking garages with free shuttle service.[684] By constructing parking facilities at either end of the business district, the system intercepts commuters and visitors before they drive into the city center, reducing traffic problems. The garages' parking revenues finance the free shuttle buses. They depart from each garage every five minutes all day, every day, and pass within walking distance of most downtown destinations. The electric-powered shuttles transport approximately one million riders each year, making shuttle-served property attractive to businesses. Since 1992, when the shuttle service began, over $400 million has been invested in the downtown, including a major freshwater aquarium, over 100 retail shops and 60 restaurants.

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[680] A contingency-based strategy deals with uncertainly by identifying specific responses to possible future conditions. www.vtpi.org/tdm/tdm123.htm, 3 October 2006.
[681] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm72.htm, 3 October 2006.
[682] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm89.htm, 3 October 2006.
[683] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm8.htm, 3 October 2006.
[684] USEPA, *Parking Spaces / Community Places: Finding the Balance Through Smart Growth Solutions*, Development, Community, and Environment Division (DCED); U.S. Environmental Protection Agency, www.epa.gov/smartgrowth/parking.htm, 2006.

Better Coverage of Public Transportation[685]

Making public transportation more accessible is an important step for increased public transit usage. This can be done through information programs, business subsidies for employee use of mass transit; higher urban parking fees to encourage public transit; safer transit stations and stops and convenient fare structures and payment systems.

Transit encouragement programs are usually implemented by transit agencies, often with support from other government agencies and businesses. It is usually best to begin with a survey of potential users to determine what improvements and marketing strategies could increase ridership, before developing a transit plan. For example, one transportation user survey[686] from the greater Vancouver, Canada area found that discretionary transit riders (those that have the option of traveling by automobile):

Believe that mass transit travel can be less stressful than driving a car

Believe that mass transit travel is more convenient than driving for some trips

Believe that mass transit travel saves wear-and-tear on their car

Want transit service within convenient walking distance of their homes and destinations

Want clean transit vehicles and safe waiting areas

Want reliable, on-time service with good connections

Want fast, direct service

Stanley and Hyman (2005) identify a number of factors and strategies that tend to increase transit ridership in an area, including improved service, reduced fares, marketing, and more integrated planning and partnerships with other organizations.[687]

A study[688] comparing various European regions and cities identified the following transport policies that tend to increase public transit ridership:

Availability of adequate capital funding for public transport

Relatively low public transport fares

Integration of public transport services (timed connections, new journey opportunities etc)

Restraint of parking and reallocation of road space to more sustainable modes

Integration of regional, multimodal ticketing systems

Long-term planning and implementation of these policies. To be effective, these polices must be in place for a long time (a decade or more), which implies consistent political consensus on their efficacy

Adequate regulation of bus transit systems; the most successful systems are run on a franchised (quality contract-type) basis.

Strategies include:

Fare reductions

New fare options, particularly discounted tickets and passes

Free transit areas

More convenient routing (e.g., eliminating the need for transfers)

Regularized schedules (such as having a bus every hour and half-hour)

Special route to serve particular travel requirements, such as access to employment centers

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[685] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm112.htm, 26 September 2006.
[686] TransLink, *Regional Travel Survey - Revised*, TransLink Marketing Research Department, January 2003, www.translink.bc.ca/files/polls_surveys/regtravel.pdf also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/TransportationResidential/regtravel.pdf, 30 October 2006.
[687] Robert G. Stanley and Robert Hyman, *Evaluation Of Recent Ridership Increases*, TCRP Research Results Digest 69, Transportation Research Board (www.trb.org), 2005.
[688] Colin Buchanan and Partners, *Transferability Of Best Practice In Transport Policy Delivery*, Scottish Executive July 2003, www.scotland.gov.uk/library5/development/bpitp-00.asp, 30 October 2006.

Government agencies (such as the Federal Transit Administration) and professional organizations (such as the American Transit Association) provide resources for Transit Encouragement program planning. These include:

Survey potential users and evaluate travel trends to determine what improvements and marketing strategies are likely to increase ridership.

Consider using innovative marketing techniques, price discounts and new fare collection methods (such as "smart cards") to attract new riders.

Identify and respond to the various market segments that they can serve, including Basic Mobility for people who are transportation disadvantaged, and fast, convenient travel for urban commuters.

Public Transportation

CASE STUDY: Boulder, CO

Starting in 1989, the city of Boulder, Colorado began implementing a demonstration transit service using a fleet of small, colorfully designed buses to provide high frequency, inexpensive and direct service within the city. And thus, the first Community Transit Network bus, the HOP, was born. Today, there are six bus routes in the Community Transit Network—HOP, SKIP, JUMP, BOUND, DASH and STAMPEDE. All have a unique identity and amenities shaped with community input and direction. In 1990, Transit ridership was about 5,000 riders daily for all local and regional routes in and out of Boulder. In 2002, ridership was at a daily average of about 26,000, a 500% increase. The city of Boulder partnered with the city of Longmont and Boulder County to add another high-frequency bus route called the BOLT on a local highway in 2004. [689]

Benefits beyond GHG emission reductions of the Community Transit Network:

Provides a convenient transit alternative to the single occupancy vehicle.

Uses neighborhood-scaled vehicles to fit the context of Boulder.

Strengthens the local economy by providing easy access around Boulder and to and from surrounding communities.

Provides wheelchair accessible transportation.

Reduces air pollution by using clean-burning fuels.

Alleviates traffic congestion.

Minimizes the need for roadway expansion and provides reliable, high frequency service.

Operates clean, comfortable, human-scaled vehicles, with special amenities such as music.

Promotes a positive transit image with attractive vehicles and on-going marketing support.

Accepts Eco Passes (transit passes for students and residents of certain neighborhoods).

Includes bike racks, holding two bikes at one time, that allow for integration of travel.

In November 2000, residents of the Forest Glen neighborhood in the city of Boulder voted to form a General Improvement District (GID) to provide Eco Pass transit passes for all neighborhood residents including home owners and renters. These passes are paid for by residents in the Forest Glen as part of their annual property tax. The pass allows unlimited riding on all RTD buses, Light Rail service to Denver International Airport, downtown Denver and Eldora Mountain Resort.

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[689] City of Boulder Transportation website, www.ci.boulder.co.us/index.php?option=com_content&task=view&id=707&Itemid=1206, 26 September 2006.

Car Sharing Programs and Installation of Park and Ride Facilities[690]

Rideshare

Rideshare programs typically provide carpool matching, vanpool sponsorship, marketing programs, and incentives to reduce driving. Rideshare incentives may include giving High Occupant Vehicles (HOV) priority[691] (e.g., HOV highway lanes), preferential parking spaces, and awards. Some employers offer commuter financial incentives[692] such as a cash payment to employees who carpool, or a voucher that covers vanpool fees, provided as an alternative to a free parking space. Because they have significant economies of scale (the more people who register, the more effective they are at successfully matching riders), it is helpful if one well-publicized ride-matching program serves an entire geographic region.

Rideshare programs that include incentives such as HOV priority often reduce commute trips by 10-30%[693]. If implemented without such incentives travel impacts are usually smaller. Evans and Pratt (2005) describe several worksites where 5-20% of employees commute by vanpool. The most effective programs tend to have paid parking, subsidies for alternative modes and other incentives to encourage reduced automobile commuting.

Ridesharing can reduce peak-period vehicle trips and increase commuter's travel choices. It reduces congestion, road and parking facility costs, crash risk and pollution emissions. Ridesharing tends to have the lowest cost per passenger-mile of any motorized mode of transportation, since it makes use of a vehicle seat that would otherwise be empty. Ridesharing provides consumer financial savings (as estimated in the table below), and time savings if there are HOV priority facilities. Crash risk declines due to fewer vehicles on the road.[694] Rideshare programs improve transportation options and are particularly helpful to commuters who cannot drive or lack a reliable automobile.[695]

Organizations such as the Association for Commuter Transportation and Commuter Connections can provide advice and resources for developing an

Round Trip Miles	Drive Alone	3-Rider Car Pool	10-Rider Van Pool
30	$193	$64	$31
40	$257	$86	$37
50	$321	$107	$43
60	$386	$129	$50
70	$450	$150	$56
80	$514	$171	$63

Table: Estimated Monthly Commuting Costs

[690] Victoria Transportation Policy Institute Ridesharing, www.vtpi.org/tdm/tdm34.htm, 3October 2006.
[691] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm19.htm, 3 October 2006.
[692] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm8.htm, 3 October 2006.
[693] Philip Winters and Daniel Rudge, *Commute Alternatives Educational Outreach*, National Urban Transit Institute, Center for Urban Transportation Research, USF (Tampa; www.cutr.eng.usf.edu), 1995.
[694] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm58.htm, 3 October 2006.
[695] The *SMART Trip Reduction Manual* published by Pollution Probe (2001) provides information on calculating the benefits of ridesharing programs to employers and employees. (www.pollutionprobe.org/Publications/Air.htm), 2001, 26 October 2006.

effective ridesharing program. A study in the Seattle area identified several ways of improving and increasing vanpooling.[696]

Ride share best practices:
Should be implemented as part of a comprehensive TDM Program.

Should include ridematching services, HOV priority, and other trip reduction strategies.

Ridematching services should cover a large geographic area (such as an entire region) in order to create the largest possible pool of users.

Transportation agencies, businesses and employees should all be involved in planning Rideshare Programs.

Provide incentives to attract and retain rideshare users, such as mileage-points and vehicle insurance discounts.

Car Sharing & Park and Ride Programs

CASE STUDY: King County, WA

RideShare Online,[697] launched in 2001, was the first self-serve, regional public Internet ridematching service in the nation. RideshareOnline instantly matches commuters with carpool or vanpool partners with a similar daily commute in nine Puget Sound area counties, including King, Pierce, Snohomish, Kitsap, Thurston, Island, Mason, Skagit and Whatcom counties.

"This new service puts the power into the hands of commuters," said King County Executive Ron Sims. "Instead of sending in applications and information and waiting for a reply, you can go online anytime day or night to find names in our database of 9,000 registered commuters, e-mail them directly yourself, and within minutes you could be hearing back from a potential rideshare partner."[698]

Online registration is simple. After typing in their e-mail address and choosing a password, users enter their work location and the starting point of their commute—either a home address or a nearby intersection. To preserve privacy, home addresses are not displayed publicly. They enter their weekly work schedule and any daily variations. By return e-mail they receive a confirmation code to complete their registration. They can instantly see a list of rideshare matches to whom they may e-mail a rideshare request.

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Park and Ride

Park & Ride[699] facilities are usually implemented by regional transportation or transit agencies. In some cases, existing, underutilized parking (such as a mall parking lot) is designated for Park & Ride use. Patrols and lighting are sometimes provided to address security concerns that users may have about leaving their vehicles.

Benefits and Costs
By encouraging shifts to transit and ridesharing, Park & Ride facilities reduce urban highway traffic congestion and worksite parking demand. These benefits can be significant since Park & Ride tends to be most effective where traffic congestion and parking problems are worst. However, automobile Park & Ride only provides modest reductions in local road traffic,

[696] Bryon York and David Fabricatore (2Plus), *Puget Sound Vanpool Market Assessment*, Office of Urban Mobility, WSDOT (www.wsdot.wa.gov/Mobility/TDM/vanpoolmarket.htm), 2001.
[697] Rideshare Online, www.RideshareOnline.com, 3 October 2006.
[698] King County Department of Transportation, www.metrokc.gov/kcdot/news/picturearch/pw010319_ridematch.htm, 3 October 2006.
[699] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm27.htm, 26 September 2006.

pollution, energy use and consumer costs, since a local automobile trip is still made. Bicycle Park & Ride can provide greater economic and environmental benefits. Shopping centers adjacent to Park & Ride facilities tend to benefit from additional shopping by the commuters who park there.[700]

Costs are primarily associated with facility construction and operation. Construction costs typically average several thousand dollars per space, which is usually lower than the costs of providing parking at city centers due to lower land values.

Best Practices for Park & Ride facilities:

Facilities should be developed as part of an overall transit and rideshare improvement program.

Facilities should be located within view of businesses or homes, for the sake of security.

Facilities should include bike storage lockers, or other secure bike storage if demand exists.

Facilities should have adequate lighting, landscaping and other amenities (bus shelters, garbage cans, etc.).

It is usually best to have several smaller Park & Ride facilities in different locations, rather than one large one.

Car Sharing & Park and Ride Programs

CASE STUDY: Space Coast Area Transit, Florida

The Space Coast Area Transit system[701] was established in 1974 and has been a leader in motor transportation ever since. In 2003, SCAT was awarded the prestigious Outstanding Public Transportation System Award by the American Public Transportation Association. One of SCAT's most successful programs has been SCAT Park-and-Ride, which the agency promotes as part of its Commuter Assistance program. It identifies the following benefits to employers of using Park & Ride:

1. Reduced on-site parking
2. Employer/Employee tax credits
3. Improved Employee Recruitment and Retention
4. Improved Customer Service and Employee Morale
5. Improved Corporate Image
6. Bottom-Line, Profitability Goes Up

CONTACT

(321) 633-1878

Location Efficient Mortgages[702]

Location efficient mortgages give borrowers lower rates if they live near to public transit. The rationale is that the lower costs will make the borrower better able to meet mortgage payments, thus reducing risk. Location Efficient Mortgages (LEMs) are implemented by residential mortgage lenders, often with the support and encouragement of government agencies such as Fannie Mae and the Canadian Mortgage and Housing Corporation. Lenders use a model to determine which locations have lower transportation costs, and therefore can qualify for higher mortgage payments. The following factors can be considered in such developments:

Proximity to high quality transit (such as a rail transit station, or a bus line with frequent service)

Walking and cycling conditions

[700] Francis Wambalaba and Julie Goodwill, *Evaluation of Shared Use Park & Ride Impact on Properties*, National Center for Transit Research, University of South Florida (www.nctr.usf.edu), April 2004, 26 October 2006.
[701] Space Coast Area Transit, www.ridescat.com/aboutscat/history.php, 3 October 2006.
[702] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm22.htm, 3 October 2006.

Number of public services within convenient walking distance (schools, shops, parks, medical services, pharmacy, etc.)

Carshare services within convenient walking distance

Options for residents who do not own an automobile to not pay for parking

Location efficient developments are designed and located to improve overall accessibility and affordability of residential and commercial real estate. They are often implemented as part of "Smart Growth"[703] and "New Urbanist"[704] planning.[705] The following criteria can be used to evaluate whether a development qualifies for a location efficient mortgage:

Is it located in an urban area within a half-mile of quality public transit?

Does it include, or is it located near, commonly-used public services such as grocery stores, video stores and public schools?

Will it reduce dependency on automobiles?

Does it have a minimum density of 20 units per acre?

Does it have at least 20 units?

Is it reflect good design features?
Is it being developed with substantial community input?

Does it include a significant portion of affordable housing units?

Travel Impacts

Per capita automobile travel is often 20-50% lower in location efficient developments than in automobile-dependent, urban fringe locations. Table 1 summarizes the projected vehicle miles traveled (VMT) reduction impacts of various location-efficient, infill developments.

Location	Description	VMT Reduction
Atlanta	138-acre brownfield, mixed-use project	15-52%
Baltimore	400 housing units and 800 jobs on waterfront infill project	55%
Dallas	400 housing units and 1,500 jobs located 0.1 miles from Dallas Area Rapid Transit (DART) station	38%
Montgomery County	Infill site near major transit center	42%
San Diego	Infill development project	52%
West Palm Beach	Auto-dependent infill project	39%

Table: Infill VMT Reductions[706]

Location efficient developments and mortgages can provide several benefits:

Consumers benefit from more housing, transportation choices and financial savings. Non-drivers, in particular, benefit from having housing options designed for maximum accessibility, and financial savings from reduced parking costs.

Developers can benefit from having more design flexibility, including more opportunities for infill development, reduced parking costs, and because LEMs increase the amount a household can spend on housing. It creates new markets and financing options.

Urban neighborhoods can benefit from more opportunities for middle-class infill development, fewer motor vehicles and less vehicle traffic.

By reducing per capita vehicle ownership use, Location Efficient Development can reduce regional traffic congestion, road and parking facility costs, traffic crashes, pollution and sprawl.

Regional economies tend to benefit when consumers shift

[703] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm38.htm, 3 October 2006.
[704] Victoria Transportation Policy Institute, www.vtpi.org/tdm/tdm24.htm, 3 October 2006.
[705] Danielle Arigoni, *Affordable Housing and Smart Growth: Making the Connections*, Subgroup on Affordable Housing, Smart Growth Network (www.smartgrowth.org) and National Neighborhood Coalition (www.neighborhoodcoalition.org), 2001.
[706] CCAP, *State and Local Leadership On Transportation And Climate Change*, Center for Clean Air Policy (www.ccap.org), 2003, 26 October 2006.

their transportation expenditures from vehicles and fuel to transit services or general consumer goods.

Here are some specific recommendations for implementing Location Efficient Developments and Mortgages[707]:

A location efficient development should include a variety of land use and transportation features that improve access and mobility options, including pedestrian and cycling improvements, transit improvements, and mixed land use.

It should also include a range of housing types and prices, so that people in various lifecycle stages and income classes can choose such housing.

Parking requirements should be reduced or eliminated for location efficient housing. Rather than including parking with housing, parking should be rented separately, so households only pay for the amount of parking they actually use.

Parking should be managed to avoid spillover problems.

Location Efficient Mortgages

CASE STUDY: Denver, CO

Denver Initiative to Boost Affordable Housing Near Transit Stations[708]

The Colorado Housing and Finance Authority[709] and seven metro Denver cities will collaborate on the sale of $53 million private activity bonds (tax-exempt bonds issued by the government for the purpose of providing special financing benefits for qualified projects) to support development of low- and moderate-income rental housing near RTD transit stations along the six-line - a 150-mile rail network to be developed during the next 12 years. At least 51 of the 57 rapid-transit stations that will be built lend themselves to mixed-use development that should include affordable housing.

Affordable housing that will be eligible for assistance from the authority and the seven cities must be within 1,500 feet of a planned or existing transit station. Each project must include 50 or more dwelling units.

At least 75% of the rental units must be for individuals or families whose income is at or below the area's median income, adjusted for family size. Other provisions ensure some housing is reserved for low-income residents. Developers who participate in the transit-oriented affordable-housing program also may be eligible for low-income-housing tax credits that can generate equity for the projects.

Calling this FasTracks program[710] "the single most ambitious integrated transit solution in the history of the United States," Denver Mayor John Hickenlooper said it will lead to the formation of "small villages" around transit stations where people can live, work and shop without being overly dependent on automobiles.

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(303) 477-9985
john@civicresults.org

[707] Danielle Arigoni, *Affordable Housing and Smart Growth: Making the Connections*, Subgroup on Affordable Housing, Smart Growth Network (www.smartgrowth.org) and National Neighborhood Coalition (www.neighborhoodcoalition.org), 2001.
[708] Metro Mayor Caucus, www.metromayors.org/Housing.html, 3 October 2006.
[709] Colorado Housing and Finance, www.colohfa.org/, 3 October 2006.
[710] Denver Fastracks Plans, www.rtd-denver.com/fastracks/index.html, 3 October 2006.

Provide Incentives for Hybrid and Low Emission Vehicle Use

While the ideal (from a climate perspective) is that citizens have access to alternative transportation options to deter automobile ownership, many citizens, especially those living outside dense urban areas, still need or want to purchase their own automobiles. Municipalities can create incentives to encourage citizens to purchase vehicles that produce less GHG emissions. For example, cities such as Salt Lake City, Aspen, Baltimore, Los Angeles, Albuquerque, Hartford and New Haven already have various forms of free or discounted parking for hybrid or high efficiency drivers.[711] [712]

Incentives for Hybrid and Low Emission Vehicle Use

CASE STUDY: Ferndale, MI

Since May 2006, drivers of fuel-efficient vehicles in a suburb outside of the Motor City are saving money on more than fuel. The city of Ferndale recently passed a local ordinance, the first of its kind in Michigan, that enables drivers of cars that get 30-miles-a-gallon or better, to park for free at the city's parking meters.[713] In order to pay for the administrative costs of the program, car owners must register their vehicle and pay $8 to get a permit for the free meter parking. Craig Covey, the Ferndale council member who proposed the ordinance, explained the city's decision, "We're all hurting with the high gas prices and this is a small, symbolic step to send a message: We care about progress."[714]

CONTACT

City of Ferndale, Michigan
300 East Nine Mile Road
Ferndale, Michigan 48220
(248) 546-2360

[711] "Save on fuel, and park free, too. Councilor suggests hybrid owner perk" Boston Globe, Nov 2005, www.boston.com/news/local/articles/2005/11/03/save_on_fuel_and_park_free_too/, 15 October 2006.
[712] City of Hartford, Connecticut (www.hartford.gov/news/PR71405parking.pdf). Vehicle owners who can demonstrate that they drive a vehicle that gets at least 30 miles per gallon - both city and highway-qualify for a 50% discount for monthly parking patrons at three Downtown Hartford parking garages, www.newenglandfutures.org/issues/energy/bestpractices/, 3 October 2006.
[713] "Drive a hybrid? You don't have to feed the meter in Ferndale" Detroit Free Press, April 2006, www.freep.com/apps/pbcs.dll/article?AID=/20060829/NEWS99/60829020, 3 October 2006.
[714] Ibid.

Additional Resources

Road Tax Discount for Car-Free Households. The City of Austin, Texas has an innovative way of financing transportation infrastructure that rewards households that reduce their vehicle ownership. City utility bills include a "Transportation User Fee" that averages $30 to $40 annually for a typical household. This charge is based on the average number of daily motor vehicle trips made per property, reflecting its size and use. The city provides exemptions to residential properties with occupants that do not own or regularly use a private motor vehicle for transportation, or if they are 65 years of age or older. [715]

Commuter Choice is a nationwide partnership designed to help employers create customized solutions to their employees' commuting challenges. Commuter Choice can also include communities working with residents, schools working with students, and even developers working with future tenants to provide and promote choices for travelers. www.commuterchoice.com/index.php?page=employers

Ride Arrangers, Denver Regional Council of Governments
RideArrangers helps businesses and individuals ease traffic congestion and reduce pollution by promoting use of alternative transportation. Using the latest transportation management ideas to keep traffic moving, RideArrangers maintains air quality and preserves the quality of life that Denver metro area residents know and expect. www.drcog.org/index.cfm?page=RideArrangers

Stormwater Management Fees to reduce parking supply and instigate transportation management programs. The City of Bellingham charges stormwater fees of $3 a month for smaller buildings with 300 to 1,000 square feet of impervious surfaces and $5 per 3,000 square for larger buildings. This indicates annualized costs 2 to 5.5 cents per square foot of impervious surface. (www.vtpi.org/tca/tca0515.pdf)

Travel Matters
Includes an interactive emissions calculator, on-line emissions maps and a learning/resource center.
www.travelmatters.org

[715] See www.vtpi.org/tdm/tdm119.htm and www.ci.austin.tx.us, 30 September 2006.

Chapter 5: Develop a Local Action Plan Long Term Initiatives **Sustainable Urban Planning**

DOCUMENT CONTENTS

In the Ecology of Cities,[716] *Lester R. Brown states that, "By 2007 more than half of us will live in cities—making us, for the first time, an urban species." This means that urban planning decisions made now will have an enormous effect for a long time to come. The field of urban planning connects many topics discussed in this guide, such as, energy infrastructure; environmental and land management; construction and architecture; transportation infrastructure and much more.*

The field of sustainable city planning is a rapidly growing one, with entire organizations dedicated to it, books written about it, conferences held and professional associations forming (a Google search returns over 11 million hits). It is impossible here to describe the extent to which this global movement intersects with community efforts to implement carbon protection programs,[717] *but it is important that efforts to reduce greenhouse gas emissions be conducted with an eye to the impacts they will have on the whole system of the city.*[718]

Sustainable urban development includes planning that promotes mixed-use development (residential and commercial use in the same area), transportation alternatives, walkable/denser communities, compact building design, open/ green space and attractive/ distinctive communities. Such approaches can enable a community to fight climate change (and improve local quality of life) by reducing personal automobile dependence (See Chapter 5, Residential Transportation Section), increasing green space (See Chapter 5, Reducing the Impact of Continued Emissions Section) and providing incentives for green building (see Chapter 5, Buildings Section).

[716] Earth Policy Institute, Ecology of Cities, www.earth-policy.org/Books/Seg/PB2ch11_ss2.htm, 15 October 2006.
[717] An enormous amount of work on this topic is being done in Europe. The Scandinavians, in particular are leaders in this field. See www.emagazine.com/view/?2842, the European Commission adopted the Thematic Strategy on the Urban Environment on 11. January 2006, ec.europa.eu/environment/urban/home_en.htm. The Ministry for the environment in New Zealand also has some excellent material, www.mfe.govt.nz/issues/urban/sustainable-cities/, 5 December 2006.

Denser Communities

Several studies have linked denser communities with reduced driving and, in turn, reduced greenhouse gas (GHG) emissions. High-density urban areas utilizing mixed-use development make human powered and public transportation more practical, while decreasing emissions and encouraging exercise. For example, the book *Sustainability and Cities: Overcoming Automobile Dependence* describes the strong correlation between urban density and driving related consumption. Cities considered to have low-density development (fewer than 50 persons per hectare) were found to have fossil fuel consumption rates triple that of more densely developed cities. A study by Natural Resources Defense Council[719] notes a similarly strong correlation between density and miles driven in San Francisco, Los Angeles and Chicago. The following graph from the study demonstrates how people living in denser areas in these three cities are traveling fewer miles per year.

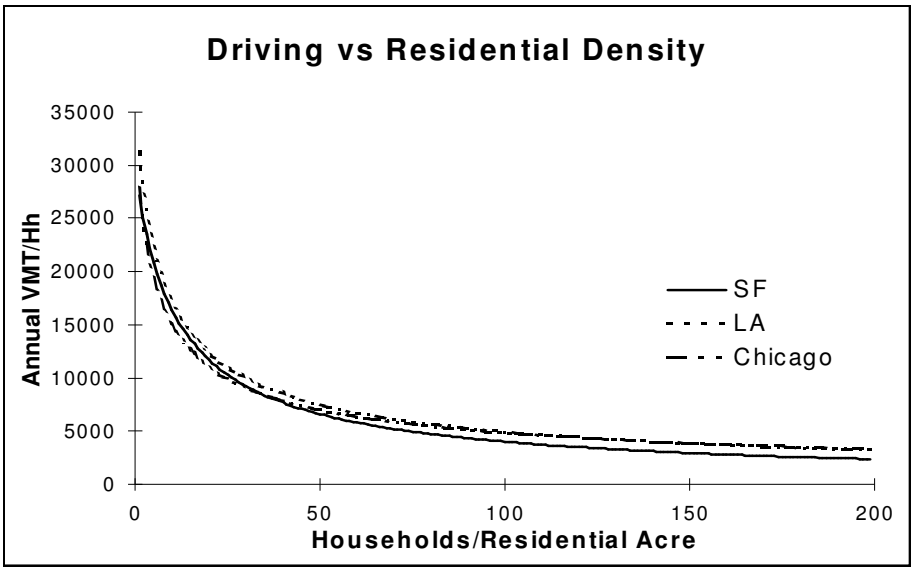

Table: Driving vs. Residential Density

The following case studies illustrate policies that different communities have taken to begin, enhance and reach their sustainable planning goals.

Sustainable Urban Planning

CASE STUDY: Eugene, OR

"Each year, the Green Guide recognizes cities across the country that are providing the healthiest, most environmentally-conscious, energy efficient and least-polluting places in which to live."[720] The Green Guide is an internationally recognized source for news and consumer information about environmental living. In 2006, the Green Guide named Eugene, Oregon the #1 Green City in America.[721]

[718] The UN Habitat Sustainable Cities Program, www.unhabitat.org/categories.asp?catid=369, 5 December 2006.
[719] National Resources Defense Council, www.arb.ca.gov/ch/presentations/nrdc.pdf, 15 October 2006.
[720] Eugene website: www.eugene-or.gov/portal/server.pt, 15 October 2006.
[721] The Green Guide Top 10 Green Cities in 2006 www.thegreenguide.com/docprint.mhtml?i=113&s=top10cities, 15 October 2006.

Political Action and Policies:[722]

The city staff began a new community-wide pedestrian and bicycle strategic planning process in 2006. The program includes public education and input activities to help direct the planning process. The goal of the planning effort is to increase the use of non-motorized transportation in Eugene.

Mixed Use Development:[723]

In 2001, the concept of mixed-use development became the official growth management policy for the city of Eugene.

The city has identified dozens of potential "centers" that can eventually be developed to have greater density, yet become desirable, pedestrian-friendly, neighborhoods, featuring shops, residences, green space and quality transportation options. "When combined with improved transit, such centers will reduce reliance on automobile travel, offset the need for costly street improvements, slow sprawl onto nearby agricultural and forest lands and provide a greater variety of housing types inside the Urban Growth Boundary."[724]

To ease the financial burden of this process, the city has applied for grants from the State of Oregon

Transportation Growth Management (TGM) program every two years since 1997. "These grants funded a demonstration of transportation-efficient land use planning focusing on the preparation and adoption of a concept design, strategies and ordinances for several potential mixed-use development sites."[725]

Transportation:[726]

By 2006, Eugene had developed 30 miles of off-street paths, 89 miles of on-street bicycle lanes and 5 bicycle/pedestrian bridges spanning the Willamette River.

Eugene holds an annual Walking and Biking Summit, providing input on ways to make the city a more "walkable and bikable" city.

Open/Green Space:[727]

Eugene has preserved over 16% of its land as green space, including athletic fields, city parks, public gardens, trails and waterfront.

The city has over 2,500 acres of publicly owned wetlands, and its West Eugene Wetlands Program has been nationally recognized as a model for resource protection and enhancement.[728]

Eugene offers 120 public parks, 45 playgrounds, 6 community gardens, 60 miles of trails and over 3,000 acres of natural areas.

Construction Techniques/Energy Efficiency:

In July 2006, the City Council unanimously adopted the city of Eugene's first formal "green building" policy, requiring city-owned and occupied buildings to be constructed and maintained in environmentally and economically sustainable ways.

Examples of the new policy include two new fire stations that incorporate day- lighting, solar hot water, highly reflective roofing, high efficiency heating and cooling systems, preference for local and renewable materials, low emission paints and laminates and 90% recycling of construction waste.

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[722] Sustainable Eugene: www.eugene-or.gov/portal/server.pt?space=Opener&control=OpenObject&cached=true&parentname=CommunityPage&parentid=0&in_hi_ClassID=514&in_hi_userid=2&in_hi_ObjectID=1553&in_hi_OpenerMode=2&, 15 October 2006.

[723] Mixed-use Development: www.eugene-or.gov/portal/server.pt?space=CommunityPage&cached=true&parentname=CommunityPage&parentid=5&in_hi_userid=2&control=SetCommunity&CommunityID=334&PageID=0, 15 October 2006.

[724] The Green Guide, www.greenguide.com, 15 October 2006.

[725] Eugene website, www.Eugene-or.gov, 15 October 2006.

[726] Eugene Transportation: www.eugene-or.gov/portal/server.pt?space=CommunityPage&cached=true&parentname=CommunityPage&parentid=2&in_hi_userid=2&control=SetCommunity&CommunityID=435&PageID=0, 15 October 2006.

[727] Parks and Open Space Planning: www.eugene-or.gov/portal/server.pt?space=CommunityPage&cached=true&parentname=CommunityPage&parentid=2&in_hi_userid=2&control=SetCommunity&CommunityID=668&PageID=0, 18 October 2006.

[728] Greener Buildings, www.greenerbuildings.com, 15 October 2006.

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Parks and Open Space Manager
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Eugene's Parks and Open Space Planning
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Sustainable Urban Planning

CASE STUDY: Saint Paul, MN[729]

Under the Urban CO_2 Reduction Project, St. Paul has already surpassed its 1997 goals for CO_2 emissions reduction and is currently planning to reach a 20% reduction of 1988 CO_2 levels by 2020. The plan includes a wide variety of activities including:

Open/Green Space:

In addition to providing great options for alternative and public transportation, St. Paul also offers commuters and pedestrians pollution-free transportation and recreation via an extensive trail system.

The city operates 101 parks, maintains 101 miles of paved off-street trails, 24 miles of dirt trails and 160 garden sites.

The city promotes "green roofs," which reduce heating and cooling costs and reduce storm water runoff.

Construction Techniques/Energy Efficiency:

The city requires every developer that uses public dollars to meet with energy design consultants to make buildings more energy-efficient and cost-effective.[730]

St. Paul also supports energy-efficient households by assisting residents to install renewable energy. The Minnesota State Department of Commerce even encourages businesses and residents to hook up solar systems to the city's grid.

CONTACT

The general number for the city of St. Paul government
(651) 266-8989

Planning and Development
(651) 266-6700

Parks and Recreation
(651) 266-6400

District Energy
(651) 297-8955

St. Paul Neighborhood Energy Consortium
(651) 221-4462

[729] Unless otherwise cited information on sustainable programs in the city of St. Paul can be found on the "Sustainable St. Paul: Initiatives and Programs" page of the city's website. This page includes links to transit and transportation; planning and development; natural resources and parks and recreation; energy conservation; and clean air: stpaul.gov/initiatives/sustainable/programs/initiatives.html, 15 October 2006.
[730] Greener Buildings, www.greenerbuildings.com, 15 October 2006.

CASE STUDY: Glenwood Park, Atlanta, GA[731]

Glenwood Park has utilized "infill" planning[732] on a former industrial site, two miles from downtown Atlanta. The 28-acre brownfield[733] redevelopment offers 350 residences in a mix of condominiums, townhouses, houses and 70,000 square feet of retail and office space.

Mixed Use Development:

Rezoned for mixed use the site was designed with narrower streets and tighter corners for qualifying "traditional neighborhood developments." This type of zoning is crucial to making Glenwood Park a pedestrian friendly, healthier and environmentally sound neighborhood.

By mixing useful retail, shops and restaurants with residences, the development has brought vitality to the streets, provided residents with walkable destinations, reducing the number of local daily driving trips. "By one estimate, Glenwood Park will save 1.6 million miles of driving per year over what residents would have driven if they instead lived in a "typical" new Atlanta development."[734]

Transportation:

Glenwood Park offers residents many public transportation and commuting options. The development is: One mile from two different Metropolitan Atlanta Rapid Transit Authority rail stops and Directly on an active bus route that leads to downtown.

On the proposed route for a trail and transit line that will loop around in-town Atlanta using old rail lines.

Open/Green Space:

The neighborhood contains three parks of varying sizes and atmosphere. The largest of the three acts as an area for community gathering and recreation. The second is a classic urban square in the heart of the commercial area. The third and smallest acts as a more intimate meeting area, featuring views of the Atlanta skyline and access to the largest park.

Construction Techniques/Energy Efficiency:

All homes and condos built in Glenwood Park meet Atlanta's EarthCraft House program standards. EarthCraft House is a voluntary green building program of the Greater Atlanta Home Builders Association, which helps educate consumers on the economic and health benefits of "green" building techniques, provides rigorous testing and inspection of homes and offers access to discounted energy mortgage programs.

CONTACT

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(404) 879- 2230

Dover, Kohl & Partners–Planning Firm
(305) 666-0446
www.doverkohl.com

Tunnell-Spangler-Walsh & Associates–Planning Firm
(404) 873-6730
www.tunspan.com/

EarthCraft Homes, a division of Southface Energy Institute
(404) 817-3549
www.southface.org/web/earthcraft_house/earthcraft_overview.htm

Greater Atlanta Home Builders Association:
(770) 938-9900

[731] For more information on Glenwood Park visit:
Terrain.org Unsprawl Case Study, www.terrain.org/unsprawl/17, 15 October 2006.
Glenwood Park homepage: www.glenwoodpark.com/glenwood/default.aspx, 15 October 2006.
[732] Developing on empty lots of land within an urban area rather than on new undeveloped land outside the city or town.
[733] Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. More Information on Brownfields: EPA Brownfields Cleanup and Redevelopment, www.epa.gov/brownfields/, 18 October 2006.
[734] Terrain.org Unsprawl Case Study, www.terrain.org/unsprawl/17/, 15 October 2006.

Sustainable Urban Planning

CASE STUDY: Civano, AZ

In 1998 President Bill Clinton named Civano Arizona one of five national pilot developments under the Partnership for Advancing Technology in Housing (PATH). These PATH pilots, selected for their highly innovative technologies, as well as for new approaches for land planning and design, were created to be models for the U.S. residential construction industry."[735]

Located in Southeast Tucson, Civano encompasses 1,145 acres. The community is planned to comprise 4 neighborhoods housing over 2,600 families, and 110 acres of commercial, industrial and retail uses. Its planners refer to it as, "an antidote to urban sprawl's five banes: loss of community, loss of open space, traffic congestion, air pollution and poor use of resources."[736]

Political Action/Policies:

Civano has adopted three tenets to guide its land use and overall physical, social and economic development: (1) Create a sense of place that fosters community and connects people to one another and their natural environments, (2) tread lighter on the land through innovative design, (3) introduce sustainable construction materials and new technologies to advance the quality of life.

Mixed Use Development:

Developers of Civano designed the neighborhoods to be pedestrian friendly, attracting foot traffic by mixing uses and activities, such as corporate offices, a café, art gallery, retail stores and a meeting hall together in the town center.

Transportation:

Developers plan to reduce automobile pollution by 40%. To reach this goal homes are designed to be within walking distance of neighborhood centers, and developers are striving to create one job onsite for every two residences.

Open/Green Space:

35% of the land is set aside specifically for natural or enhanced open space.

Community orchards, linear parks, pedestrian trails, bike paths, environmentally-friendly recreational facilities and preserved desert wild lands are all integral to the community's design.

Civano Nursery's salvage program has been replanting approximately 65% of the major trees moved during construction with a 97% success rate. The program has so far saved over 2,400plants and nearly 500 mature trees.

Construction Techniques/Energy Efficiency:

Civano's building plan requires adherence to a strict energy and building code that will result in enough energy savings to prevent 1 billion pounds of carbon emissions over the next two decades.

Homes in Civano are being designed using passive solar siting and active solar energy through photovoltaic panels and/or hot water systems on the roofs.

Buildings employ the use of super-efficient windows, "cool tower" water cooling and thermal mass of walls to help regulate indoor temperatures while relying less on heating and cooling systems.

Developers are using these resource efficient building techniques to reach their goal of a reduction in home energy consumption by 50% over 1995 levels.

[735] The Partnership for Advancing Technology in Housing (PATH) article, April 1999, www.pathnet.org/sp.asp?id=1628, 15 October 2006.
[736] Terrain.org Unsprawl Case Study, www.terrain.org/unsprawl/5/, 15 October 2006.

Water harvesting, in which water from the structure's roof is collected and stored in underground cisterns for cooling will help designers meet their goal of reducing the community's potable water consumption by 65%.[737] The community will feature xeriscaping.	Developed by Civano Development Company, city of Tucson, Fannie Mae American Communities Fund, Arizona Department of Commerce Energy Office, Congress for New Urbanism and other partners.	CONTACT Fannie Mae Colleen Haggerty (626) 396-5225 Civano Development Company Lynn Hudson (520) 889-8888 City of Tucson, Department of Architecture and Engineering (520) 791-3101 Congress for New Urbanism, a Chicago based non-profit that works with planners, developers, builders and architects to teach them how to implement the principles of New Urbanism. (312) 551-7300 cnuinfo@cnu.org

[737] For more information on the Community of Civano, visit:
City of Tucson Featured Project www.tucsonaz.gov/lv-goal11.html, 15 October 2006.

Additional Resources

LASER: Local Action for sustainable Economic Developnment. This free manual guides a community in sustainable economic development. www.global-laser.org

The Key to Sustainable Cities: Meeting Human Needs, Transforming Community Systems by Gwendolyn Hallsmith. Nov 30, 2006 – Written to help cities implement Agenda 21, the UN's approach to sustainable development, this manual is the predecessor to LASER. Both are linked to a massive data base of solutions for cities

Sustainable Cities, Best Practices for Renewable Energy and Energy Efficiency. Ken Regelson, 2005. This report documents innovative and successful programs U.S. cities are using to become more sustainable rmc.sierraclub.org/energy/library/sustainablecities.pdf

The U.S. Environmental Protection Agency has a variety of Smart Growth publications: www.smartgrowth.org/pdf/this_is_smart_growth.pdf

GreenBiz.com, Resource Center for Environmentally Responsible Building Development offers Greener Buildings www.greenbiz.com/sites/greenerbuildings/index.cfm

The USC Center for Sustainable Cities offers a multidisciplinary research program that prepares doctoral students to confront, analyze and resolve the challenges posed by cities. www.usc.edu/dept/geography/ESPE/.

Sustainable City is a non-profit organization dedicated to achieving a sustainable future for San Francisco.www.sustainable-city.org/, www.sustainable-city.org/Plan/Energy/intro.htm

In September 2005 the city of London adopted a Sustainability Policy which outlines the principles of sustainability, www.cityoflondon.gov.uk/Corporation/living_environment/sustainability/

Chapter 5: Local Action Plan Long Term Initiatives **Sustainable Agriculture**

DOCUMENT CONTENTS

The Role of Agriculture in Global Warming

Agriculture contributes an estimated 20% of the greenhouse gases (GHGs) that are responsible for global warming.[738] Plowing the soil causes the release of significant amounts of carbon previously fixed in soil structure by speeding the microbial activity that causes decomposition of the organic matter in the soil. Conventional farming activities also release substantial amounts of methane and nitrous oxide. Methane is produced by the decomposition of organic matter like crop residues and also by the digestive processes of grazing livestock like cattle. The excessive use of nitrogen fertilizer contributes to the emission of nitrous oxide.

Agriculture is responsible for about 50% of human-related methane emissions and 70% of nitrous oxide emissions.[739]

Because the average molecule of food travels 1500 miles before someone eats it, the transport of agricultural goods also releases CO_2.

Solutions: Local Sustainable Agriculture

Local governments can significantly reduce their community's contribution of GHGs by supporting local sustainable agriculture. Locally produced fruits, vegetables, dairy products and other agricultural goods require far less transportation than products shipped into the community over long distances. They can also be grown in ways that substantially reduce emissions of GHGs.

[738] International Food Policy Research Institute, www.ifpri.org/pubs/books/ufa/ufa_ch24.pdf#search=%22tilling%20and%20global%20warming%22, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/Agriculture/UFA_ch24.pdf, 3 October 2006.
[739] International Food Policy Research Institute, www.ifpri.org/pubs/books/ufa/ufa_ch24.pdf#search=%22tilling%20and%20global%20warming%22, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/Agriculture/UFA_ch24.pdf, 3 October 2006.

Low-till or no-till farming, a practice called conservation tillage, does not disrupt the soil as much as heavily mechanized tilling practices, allowing the soil to retain a much higher percentage of the carbon that is naturally fixed within it. This also reduces CO_2 emissions released from farm equipment used to till the fields. In addition to reducing the amount of carbon released, conservation tillage reduces the soil's exposure to wind and water erosion, increases options for multiple cropping, improves the soil's ability to retain moisture, and moderates the soil's temperature.[740] Farmers can even be paid, through a program conducted by Chicago Climate Exchange for converting their land to no or low-till practices.[741]

An estimated 38% of the country's total farmland (109 million acres) uses conservation tillage practices, according to the group Conservation for Agriculture's Future (Core 4).[742] It is an especially attractive practice for smaller, local operations. Organic farming reduces or eliminates the use of industrially produced agro-chemicals that require significant amounts of oil and natural gas to produce, deliver and use. Organic farming methods improve soil productivity, reduce the potentially hazardous handling of chemicals and reduce water pollution. Sustainable farming also sequesters carbon in the soil by using organic wastes as fertilizer.

Organic farming is more energy efficient than conventional farming. A study begun in 1978 and released in 2006 by the Swiss government found organic farms to be 20-56% more energy efficient than conventional farms.[743] Increased energy efficiency came in part from decreased fertilizer and pesticide use and decreased transportation of external animal feed sources.[744] A U.K. government study found that, "Organic systems had a lower energy input largely because of an absence of indirect energy inputs in the form of nitrogren fertilizer." The study estimated that large organic arable production used 35% less and organic dairy 74% less energy per unit of production when compared to conventional agriculture.[745]

Local operations are especially well suited to organic production. This can also confer significant competitive advantage to local farmers. Organic farming was a $14.6 billion dollar industry in the U.S. in 2005 and continues to grow around 17% annually.[746] By enabling local farmers to remain viable by entering this market, as well as to grow food for local consumption, a community is investing in the future of its farmers and ranchers, boosting local economic development and reducing the carbon footprint of its agricultural sector, and of its citizens as they feed their families.

A recent study by the U.S. Department of Agriculture's Agricultural Research Service (ARS)[747] concluded that Minnesota grain farmers could make more money by switching to organic grain crops. With the 130 acre Swan Lake Farm as a

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[740] A conflict has existed between the practices of organic farming and conservation tillage. Organic farmers do not use chemical herbicides to control weeds and therefore have traditionally used mildly intensive tillage practices to turn weeds under the soil. Recent developments in low-till methods and alternative weed control methods are bringing conservation tillage and organic farming closer together. However, there is growing interest in organic no-till crop production.

[741] CCX Agricultural Soil Carbon Offsets, www.chicagoclimatex.com/news/publications/pdf/CCX_Soil_Offsets.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/Agriculture/CCX_SoilOffsets.pdf, 30 October 2006.

[742] Conservation for Agriculture's Future, www2.ctic.purdue.edu/Core4/news/annc/CTfact.html, 3 October 2006.

[743] Paul Mader, et.al., "Soil Fertility and Biodiversity in Organic Farming," *Science* magazine, 31 May 2002.

[744] www.organicconsumers.org/organic/stabalize062404.cfm, 15 October 2006.

[745] Mark Shepard et al, *An Assessment of Environmental Impacts of Organic Farming* www.defra.gov.uk/farm/organic/policy/research/pdf/env-impacts2.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/Agriculture/Organic_Env-impacts.pdf, 15 October 2006.

[746] Organic Trade Association, www.ota.com/pics/documents/short%20overview%20MMS.pdf#search=%22organic%20industry%20billion%22, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/Agriculture/OTA_Survey_2006.pdf, 3 October 2006.

[747] USDA Agricultural Research Service, July 25, 2006 www.ars.usda.gov/is/pr/2006/060725.htm, 3 October 2006.

representative farm, ARS researchers used four years of trial data to predict that over 20 years organic soybeans would fetch up to $14 more per bushel, organic corn up to $3 more per bushel, and wheat up to $5 more. Another projection showed farmers netting an average of $50-60 more per acre even if organic prices were to drop by half.[748]

According to a study by the leaders of the Consortium for Agricultural Soils Mitigation of Greenhouse Gases (CASMGS), such agriculture practices that reverse the decarbonization of the soil, and increase carbon sequestration by farmers in the U.S. could reduce the expected increase in CO_2 emissions by 20% per year.[749]

Government Incentives for Climate Protection Through Local Sustainable Agriculture

Many local governments are implementing programs to encourage local food production, increased use of organic produce and preservation of farmland. Some of these programs are designed to strengthen local economies, some to increase health and some to preserve a way of life. But all have the effect of reducing global warming as well. Increasingly, local governments are linking the benefits of local production with the need for climate protection.

King County, Washington, the county that encompasses Seattle, preserves local farmland, in part to reduce the carbon footprint of agriculture, to enable residents to be more secure in their sources of food and to enhance and preserve the commercial viability of agriculture as an economic sector.[750]

Ron Sims, the visionary County Executive, described how the county's Greenprint for King County[751] would deliver many benefits beyond climate protection:

> The Greenprint gives us a powerful tool to protect an additional 100,000 acres of open space and resource lands by 2010, and strengthen a green infrastructure capable of ensuring that King County's incredible natural assets are safeguarded for generations to come. King County currently owns more than 25,000 acres of lands and more than 106,000 acres of development rights for the purpose of preserving working forests, productive farms, rivers that are managed to support salmon habitat, yet also reduce flood threats and a premier multi-modal, regional trail system.[752]

The county has partnered with national and local land protection organizations to establish this network of protected lands surrounding the urban areas of the county. It is also working with the four county region to encourage similar land protection to ensure local food security and to reduce the climate footprint of meeting its citizens' needs.

The policies needed to connect communities to local farmers are not complex or innovative. Something as simple as mandating the purchase of local and organic foods for government agencies, school districts and any other organization that use municipal funds for procurement of food will have a rippling effect on the local economy. Farmers will respond favorably to the expansion of a new market by providing more goods and more variety.

Woodbury and Cherokee County, Iowa have created policies to support local producers of organically grown agricultural products. Woodbury County instituted a Local Food

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[748] One criticism of organic agriculture is that production yields are not as high as traditional farming. Yields are often reduced as a farmer transitions from conventional production and learns the techniques of organic farming. The process of establishing healthy soil, which is the foundation of successful organic production can take as long as a few years. Once an organic system is in place, however, many organic producers have yields that are as large as or greater than those of conventional operations. According to a study by Holly Born of the National Center for Appropriate Technology (NCAT), average productivity per acre in organic systems is 90 to 93% that of conventional agriculture. With lower input costs and comparable productivity, organic agriculture can be just as profitable if not more so than conventional farms. For example, organic dairy farmers may see reduced average production in the herd, but their animals tend to live longer and require less veterinary care. www.leopold.iastate.edu/pubs/nwl/2006/2006-2-leoletter/rotations.htm, 3 October 2006.

[749] Consortium for Agriculture Soils Mitigation of Greenhouse Gases, www.casmgs.colostate.edu/, 3 October 2006.

[750] King County climate change news, www.metrokc.gov/exec/climate.htm, 30 October 2006.

[751] King County Greenprint, www.tpl.org/tier3_cd.cfm?content_item_id=18178&folder_id=262, 30 October 2006.

[752] King County News Release, dnr.metrokc.gov/dnrp/press/2005/0422Greenprint.htm, 30 October 2006.

Purchase Policy to "increase regional per capita income, provide incentives for job creation, attract economic investment, and promote the health and safety of its citizens and communities."[753] It mandates that all county agencies that regularly procure food as part of their operations purchase locally produced organic food. This includes the Woodbury County Jail, Work Release Center and the Juvenile Detention facilities.

Woodbury County also provides grants of up to $50,000 each year in real property tax rebate incentives for farms that convert from conventional farming techniques to organic farming. The "Organics Conversion Policy" is designed to offset costs associated with establishing the new techniques and losses due to the three-year conversion period that is required in order to attain organic certification.[754]

Cherokee County, Iowa, followed Woodbury County's "Organics Conversion Policy" with a county tax relief program of their own. It provides up to 100% relief of property taxes for up to five years to growers who convert from conventional farming and become certified organic growers[755]. Farmers in the program will also receive support from the Iowa Department of Agriculture and Land Stewardship, the Leopold Center for Sustainable Agriculture, the Iowa State University Extension office and a network of regional organic growers. The Whole Foods stores in the region provided additional help by promising to buy organic produce from the region indefinitely.

The program also hopes to make farming a more economically viable profession for young Iowans who want to stay in the area as farmers. An Iowa study showed that increasing consumption of locally grown produce would create an influx of an additional $302 million in sales and more than 4,000 jobs added to the Iowa economy. [756] The Environmental Quality Incentives Program (EQIP) was established within the 2002 Federal Farm Bill. EQIP is a federal program offering financial and technical assistance to implement structural and management practices on eligible agricultural land. USDA Natural Resources and Conservation Service (NRCS) offices in several states across the country, including Minnesota, Nebraska, Iowa and Montana, offer cost-share incentive programs that help farmers transition from conventional agriculture to organic agriculture.[757]

In Montana, the state helps farmers convert by sharing the cost for organic crop transition, paying $35 per acre for up to 100 acres for a maximum of three years. To help ranchers make their livestock operations organic the state pays $3.50 per acre for up to 1,000 acres for a maximum of three years.[758]

School Programs to Promote Local Sustainable Agriculture

A growing number of school districts across the country are teaming up with local farmers and organic and local produce distributors to offer schoolchildren healthier options in their food programs, while encouraging local production. Schools in Washington State and California have introduced organic food as part of healthy school lunch programs. Thanks to the popularity and lower costs

[753] Woodbury Organic Conversion Policy, www.woodbury-ia.com/departments/economicdevelopment/wc%20organics%20policyv4.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/Agriculture/Woodbury_OrganicsPolicy.pdf, 3 October 2006.
[754] Woodbury Local Food Purchase Policy, www.woodbury-ia.com/departments/economicdevelopment/WC%20LFPP%20v3.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/Agriculture/Woodbury_LocalFoodPolicy.pdf, 3 October 2006.
[755] Sioux City Journal, September 2006 www.siouxcityjournal.com/articles/2006/09/20/news/local/54322a2cf28dd753862571ef000a6c3a.txt, 3 October 2006.
[756] Iowa State, Leopold Center, www.leopold.iastate.edu/pubs/staff/files/health_0606.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/Agriculture/IowaState_economic_2006.pdf, 3 October 2006. For more information, contact: Rich Pirog, Marketing and Food Systems Initiative, (515) 294-1854, rspirog@iastate.edu or Dave Swenson, ISU Economics, (515) 294-7458, dswenson@iastate.edu or Laura Miller, Leopold Center communications, (515) 294-5272, lwmiller@iastate.edu.
[757] USDA Environmental Quality Incentives Program, www.nrcs.usda.gov/programs/eqip, 3 October 2006.
[758] Montana NRCS, www.mt.nrcs.usda.gov/news/releases/progdeadline06-4.html, 3 October 2006.

of an organic salad bar at Lincoln Elementary School in Olympia, Washington, all grade schools in the city now have one.[759] In 2004, the Seattle school district adopted a Breakfast and Lunch Program Procedure banning junk food and encouraging organic food in school cafeterias. California public school districts in Berkeley, Santa Monica and Palo Alto also have organic food programs.

Several states across the country use Farm to School programs to connect local farmers and their products with schools. Oklahoma's Farm to School Programs "provide schools with fresh and minimally processed farm commodities for inclusion in school meals and snacks, to help children develop healthy eating habits, and to improve Oklahoma farmers' incomes and direct access to markets,"[760] as described in the legislation creating the programs. The bill lists the many benefits of Farm to School Programs, including "activities that provide students with hands-on learning opportunities, such as farm visits, cooking demonstrations and school gardening and composting programs, and integrating nutrition and agriculture education into school curricula."[761] Schoolchildren can use the programs to learn about healthy living and the importance of sustainable agricultural practices. The Farm to School Programs provide guidance and resources to Oklahoma Schools so that they may partner with local farmers to provide healthy, locally grown food and the educational opportunity for schoolchildren.[762]

Protect the Climate and Strengthen Local Economies

People who eat locally grown food support local farmers and the local economy, while reducing GHG emissions from transporting food from long distances. Community initiatives that assist local farmers to make their practices more sustainable (i.e., converting to organics, attaining organic certification or implementing conservation tillage) can help the farming community significantly reduce its contribution to global warming. A community that expands its supply of sustainable and locally grown food will help protect the climate while promoting healthier lifestyles, a stronger local economy, cleaner air and water and greater community security.

[759] Grinning Planet, www.grinningplanet.com/2006/05-02/healthy-school-lunch-article.htm, 3 October 2006.
[760] Oklahoma Legislation, Farm to School Program Act www.oscn.net/applications/oscn/DeliverDocument.asp?CiteID=446211, 3 October 2006.
[761] Ibid.
[762] Farm to School Program, www.farmtoschool.org/, 3 October 2006.

Additional Resources

Leopold Center for Sustainable Agriculture
www.ag.iastate.edu/centers/leopold/

National Sustainable Agriculture Information Service
attra.ncat.org/

Stonyfield Menu for Change
www.stonyfield.com/MenuForChange/index.cfm

Organic Farming Research Foundation
www.ofrf.org/

Where does your food come from?
www.foodroutes.org/

Sustainable Food in Schools
www.sustainabletable.org/schools/dining/

Local Harvest
www.localharvest.org/

Chapter 5: Develop a Local Action Plan Long Term Initiatives **Transition to Alternative Fuels**

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This section discusses the opportunities that may exist to use fuels other than the conventional, carbon intensive ones. High levels of uncertainty and risk in the international oil market have caused a tremendous amount of volatility in domestic oil prices over the past few decades. To hedge their bets against high energy prices, many cities have begun to diversify their fuel sources. Making such a switch has advantages to communities beyond reducing carbon. Most towns now spend approximately 20% of their gross income purchasing energy from outside the community. Approximately 80% of these dollars leave the community.[763] In 2004, the United States consumed about 140 billion gallons of gasoline, or about 380 million gallons of gasoline per day in 2004, by far the highest consumption rate of any country in the world. Consumption reached 400 million gallons per day in 2006. The 2005 Energy Policy Act[764] introduced the Renewable Fuel Standard, which will nearly double the use of ethanol and biodiesel in the U.S. by 2012.[765]

Organizations such as the Post Carbon Institute work with communities to help them lay out a strategy for meeting their energy needs without reliance on imported oil.[766]

This section describes some of the strategies that communities can use to do this and lower transportation costs to consumers, achieve independence from imported oil and promote the development of a domestic fuel source industry.

[763] "The Jobs Connection: Energy Use and Local Economic Development", Cities and Counties Project, U.S. Department of Energy, National Renewable Energy Laboratory, 1996., http://www.localenergy.org/pdfs/Document%20Library/The%20Jobs%20Connection.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/FuelTransition/JobsConnection.pdf, 5 December 2006.
[764] Energy Policy Act of 2005, www.doi.gov/iepa/EnergyPolicyActof2005.pdf, 5 December 2006.
[765] Renewable Fuels Association, Federal Standards, www.ethanolrfa.org/policy/regulations/federal/standard/, 5 December 2006.
[766] The Post Carbon Institute, www.postcarbon.org/, 5 December 2006.

Biofuels

Biofuels are forms of energy derived from recently living substances such as plants and animal by-products. They can include waste to energy, ethanol, bio-diesel and others. There is a potential to replace a significant amount of our current fuel use with biofuels. For example, the U.S. Department of Energy (DOE) hopes to displace 30% of the country's 2004 levels of gasoline demand with biofuels, mostly ethanol, by the year 2030. Other analysts believe that even more petroleum use can be displaced. If combined with much more efficient vehicles, this begins to be a strategy for helping communities escape from dependence on expensive, polluting and insecure oil supplies.

The U.S. produced 3.4 billion gallons of ethanol in 2004 and around 75 million gallons of biodiesel in 2005, representing about 2% of total domestic gasoline consumption.[767] Through federal tax incentive programs and market development initiatives, the U.S. government hopes to stimulate the growth of the alternative fuels market share. Part of this strategy includes mandates that federal vehicle fleets transition from conventional fuel vehicles to any number of alternative fuel vehicles (AFVs). Although not yet required by law, many local governments have also begun to purchase AFVs for the same reasons.

This includes switching their vehicle fleets—maintenance trucks, shuttle buses, delivery vans, and other light-duty vehicles—from conventional internal combustion engine vehicles that consume only gasoline to AFVs that consume ethanol, biodiesel, electricity, gasoline or any combination therein. Since the fuels for AFV fleets can be produced domestically, there is much less volatility in price. Also, as the technology for producing alternative fuels improves, the prices should continue to go down.

Alternative Fuel Vehicles

CASE STUDY: Washington, D.C.

The Washington, D.C. metropolitan area has been classified by the U.S. EPA as an ozone non-attainment area. The primary cause of this air pollution is motor vehicle emissions. To reduce vehicle emissions, the City Administrator's Office began in 2004 requiring 90% of the city government's light-duty vehicle acquisitions to be AFVs.

Of the city's fleet of 5,500 vehicles, 329 are AFVs. Two-thirds of the light-duty AFVs are CNG vehicles, and one third are flex-fuel vehicles capable of fueling with gasoline or any mixture of gasoline and ethanol up to E85. One of the city's largest users of AFVs is the parking enforcement division, which has a fleet of light-duty vehicles, of which 90% are AFVs. The AFV fleet refuels at two Department of Public Works fueling stations. A key card system encourages drivers toonly refuel with alternative fuels at the designated stations. The city AFV fleet uses an estimated equivalent of 350,000 gasoline gallons of alternative fuels every year.[768]

The Metropolitan Council of Governments Alternative Fuels Committee has developed a "green policy" to serve as a template to assist members in implementing policies supporting alternative fuels and other environmental initiatives. The committee offers workshops on alternative fuel technology, availability of AFVs and alternative fuel legislation. The city has been successful at emphasizing the benefits of AFVs and creating positive exposure by having the AFVs be a visible part of the community. They have also aggressively pursued grants and other sources of funding to offset the costs of the AFV program. Washington obtained grants from the National Ethanol Vehicle Coalition, the U.S. Department of Energy and the Washington Energy Office to install E85 tanks

[767] U.S. Dept. of Energy Biofuels page, genomicsgtl.energy.gov/biofuels/transportation.shtml, 4 October 2006.
[768] EPAct Fleet Information and Regulations, www.eere.energy.gov/afdc/pdfs/37407.pdf#search=%22ethanol%20city%20policy%22, 4 October 2006, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/Fuel Transition/EPAact_fuel.pdf, 5 October 2006.

and equipment, a CNG fuel dispenser, and promotional materials.

Washington is currently seeking ways to expand its AFV use in heavy-duty vehicles like garbage trucks, dump trucks and street sweepers. It is also working to expand the public availability of alternative fuels by contracting with privately owned fueling stations. Increasing the use of AFVs throughout the community will decrease vehicle emissions and improve air quality in the Washington, D.C. area.

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The transition of local government vehicle fleets to AFVs facilitates the expansion of AFV demand throughout the community.[769] People see the vehicles and gain familiarity with them, and there will be increased accessibility to the vehicles in the local market and increased accessibility to publicly available, commercial refueling stations.

Although there are several different varieties of AFVs, the most common types are flex-fuel vehicles that run on a mixture of gasoline and ethanol, biodiesel vehicles, compressed natural gas vehicles and electric/hybrid vehicles. Each of these is discussed below.

Ethanol

Ethanol, or "ethyl alcohol," is 200-proof grain alcohol that can be used as an alternative to gasoline. The majority of ethanol in the U.S. is made from corn, but it can also be made from other crops including wheat, barley, sorghum, potatoes or sugarcane. New technology allows ethanol to be produced from cellulosic feedstocks, including corn stalks, oat husks, paper pulp, municipal solid waste, switchgrass and other sources.[770] Most of the 4 billion gallons of ethanol produced in 2005 came from 13% of the U.S. corn crop, an increase in production of 17% from 2004.[771]

Ethanol that is blended with unleaded gasoline at a ratio of 10% ethanol and 90% gasoline (E10) can be used in almost all vehicles without any special modifications. E85 (85% ethanol and 15% gasoline blend) is available mainly in corn-producing states and can be used as a substitute for gasoline in vehicles that are designated flex-fuel vehicles (FFVs). Because of the corrosive properties of this fuel mixture, the engine and fuel system in a flex-fuel vehicle must be specially adapted for alcohol fuels. Flex-fuel vehicles must also have a special sensor in the fuel line that analyzes the fuel mixture and controls the fuel injection and timing. Flex-fuel vehicles can use any mixture of ethanol-blended fuels up to E85 as well as conventional unleaded gasoline.

Ethanol and gasoline-ethanol blends cannot be transported by pipelines like conventional gasoline, but must be transported by train, barge or truck. Water in the pipelines can cause ethanol-gasoline blends to separate into two phases, making it difficult and expensive to remix the blend at the pumping station.

According to the Department of Energy's Argonne National Laboratory, ethanol-blended fuels reduced CO_2 equivalent greenhouse gas emissions by 7.8 million tons in 2005.[772] The study also cited the following benefits from ethanol use:

Use of E10 achieves:

6% reduction in petroleum use,

1% reduction in greenhouse gas (GHG) emissions, and

3% reduction in fossil energy use.

[769] Leiby and Ruben, The Alternative Fuel Transition, 2000, http://pzl1.ed.ornl.gov/tafv99report31a_ornltm.pdf, 5 December 2006.
[770] BioCycle, 2005 News Bulletin, www.harvestcleanenergy.org/enews/enews_0505/enews_0505_Cellulosic_Ethanol.htm, 5 December 2006.
[771] U.S. DOE, Ethanol Technologies webpage, www1.eere.energy.gov/biomass/ethanol.html, 5 December 2006.
[772] "Effects of Fuel Ethanol Use on Fuel-Cycle Energy and Greenhouse Gas Emissions", Argonne National Laboratory, www-db.research.anl.gov/db1/ttrdc/document/DDD/58.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/FuelTransition/FuelEhtanol_1999.pdf, 4 October 2006.

Use of E85 achieves:

73–75% reduction in petroleum use,

14–19% reduction in GHG emissions, and

34–35% reduction in fossil energy use.

There is debate about the net energy balance of ethanol, given current production techniques. This is a comparison of the energy derived from a gallon of ethanol with the total amount of energy needed to produce it. Critics[773] assert that it takes up to 70% more energy to fertilize, plant and harvest corn and to convert and transport the ethanol than the output energy derived from the ethanol. Supporters[774] of ethanol disagree with these claims, pointing out that Exxon funded the proponents. They present data that suggests a positive net energy balance—with only 1.3 British thermal unit (BTU) of petroleum used to produce 1 BTU of ethanol. All such debates depend on the assumptions used about the crop that supplies the feedstock, the fermentation techniques used and the overall efficiency of the process.

Biodiesel

Biodiesel, a substitute for diesel fuel, is created by chemically reacting vegetable oils or animal fats with alcohol in a process known as transesterification. The majority of biodiesel in the U.S. comes from soybean oil or restaurant greases. The big advantage of biodiesel is that it can be used in existing diesel engines with little or no modification, and can be blended at any ratio with petroleum diesel. In 2005, U.S. production of biodiesel was nearly 75 million gallons, an increase of 300% from 2004.[775] Production was expected to reach 200 to 250 million gallons in 2006.[776]

Biodiesel

CASE STUDY: Seattle and King County, WA

More than half of King County Metro Transit's public buses use a B20 biodiesel blend as a part of a Seattle City Light greenhouse gas mitigation program.[777] These 640 buses have been added to the fleet of hybrid buses, electric trolleys and clean-burning diesel vehicles. At existing diesel prices as of August 2006, King County pays an average of 34 cents a gallon less for biodiesel as compared to regular diesel fuel, which equates to about $12,000 less a week.[778] Although price fluctuations will not guarantee this differential indefinitely, the expanded use of biodiesel provides a hedge against high fuel costs.

As part of its goal to becoming "greenhouse gas neutral," the city of Seattle has made a commitment to expanding the use of AFVs in its fleet. In addition to the Metro buses, King County's solid waste fleet and its wastewater biosolids trucks also use biodiesel. They are currently working to develop a network of refueling stations across the county to facilitate the transition to a biodiesel fleet. Metro was recently honored as one of the country's top clean bus leaders by the Environmental and Energy Study Institute.

In addition to cleaner air and reductions in GHGs, King County and the Seattle City Light program hope their partnership will increase demand for

[773] "Ethanol Fuels: Energy Balance, Economics and Environmental Impacts are Negative, D. Pimentel, www.ethanol-gec.org/netenergy/neypimentel.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/FuelTransition/Ehtanol_2002.pdf, 4 October 2006.
[774] "A Rebuttal to "Ethanol Fuels: Energy, Economics and Environmental Impacts" by D. Pimentel", Graboski & McClelland, www.ncga.com/ethanol/pdfs/EthanolfFuelsRebuttal.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/FuelTransition/EthanolFuelsRebuttal.pdf, 4 October 2006.
[775] U.S. Dept. of Energy Biofuels page, genomicsgtl.energy.gov/biofuels/transportation.shtml, 3 October 2006.
[776] National Biodiesel Board, nbb.grassroots.com/07Releases/gov/, 15 November 2006
[777] Seattle City Light GHG Mitigation Program helps pay for the cost of biodiesel in local transportation fleets using trucks, buses, garbage trucks, and ferries. Partnering with large users of petroleum fuels leverages Seattle City Light's greenhouse gas mitigation efforts by helping to build demand for biodiesel. www.seattle.gov/light/conserve/globalwarming/, 30 October 2006.
[778] King County News Release, www.metrokc.gov/exec/news/2006/0817biodiesel.aspx, 3 October 2006.

biodiesel throughout the local community. The industry has grown rapidly and may reach a point where commercial-scale production is an economically viable option in the State of Washington. King County hopes its increased consumption of biodiesel will help stimulate the production of farm commodities that are used to manufacture biodiesel, creating benefits for local farmers and the local economy.

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The use of B20 (20% biodiesel mixed with 80% diesel) in a conventional diesel engine results in substantial reductions of unburned hydrocarbons, carbon monoxide, sulfur oxides and sulfates, and particulate matter compared to emissions from diesel fuel.[779] Emissions of nitrogen oxides are slightly increased. B20 reduces carbon dioxide emissions by 15%. Neat biodiesel (100% biodiesel) reduces carbon dioxide emissions by more than 75% over petroleum diesel.[780]

Advantages to biodiesel:

Reduces our dependency on fossil fuel imports

Reduction of carbon monoxide emissions of 10% (B20) and 50% (B100).

Biodegradeable

Significantly decreases net greenhouse gas inputs, because the crops soak up carbon dioxide from the atmosphere as they grow. The resulting biodiesel releases some CO_2, but some of the carbon is sequestered in the soil, especially if the feedstock is grown using poly-cultures of perennials.[781]

Only alternative fuel that requires little or no modification to the engine or fuel system

Disadvantages to biodiesel:

Biodiesel tends to gel at lower temperatures. Biodiesel vehicles can therefore have cold start problems relative to petrodiesel, but this is more of an issue for B100 than B20. B20 freezes at 3 to 5 degrees Fahrenheit, while B100 can freeze at 25 degrees Fahrenheit.

Biodiesel fuels will soften and degrade certain types of elastomers and natural rubber compounds over time.[782]

Biodiesel

CASE STUDY: Channel Island National Park

After implementing various renewable technologies at Channel Island National Park[783] throughout the year (CNG vehicles, wind, solar) Kent Bullard was faced with the reality that although the National Park was quite sustainable the coast guard and the diesel ships used to transport fuel were using almost 16,000 lbs of diesel each year. At first, Ken's solution was to bring 300 gallon fuel tanks of B20 onto the island each year to supply the various vehicles and generators. After realizing there was a greater need for biodiesel, Ken worked out a deal with a fuel dock at Ventura Harbor[784] to carry B100.

[779] National Biodiesel Board, www.biodiesel.org/pdf_files/fuelfactsheets/RegulatedFleet_QA.pdf, also archived at http://www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/FuelTransition/RegulatedFlelet_QA.pdf, 3 October 2006.
[780] DOE Alternative Fuels Data Center, www.eere.energy.gov/afdc/altfuel/bio_benefits.html, 3 October 2006.
[781] Iowa State University's Bio-economy program has shown how to do this, www.iastate.edu/~biorenew/, 5 December 2006.
[782] World Energy, Advantages of Biodiesel Use for Emissions Reductions and Regulatory Compliance, www.epa.gov/air/caaac/mstrs/ciampa.pdf#search=%22advantages%20to%20biodiesel%22, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/FuelTransition/ciampa.pdf, 5 October 2006.
[783] Renewable Energy Applications at Channel Island National Park, www.nps.gov/archive/chis/energy.htm, 29 September 2006.
[784] Ventura Harbor Marine Fuel, www.vhmf.com/, 3 October 2006.

Because Channel Island did not have enough land to establish their own facility, they had to work with a public facility. Once the fuel dock was up and running, Channel Island initially provided 98% of the dock's business. Once biodiesel was available, other businesses and ships began to come to Ventura Harbor just to access the B100 dock. Earth Race stopped by Ventura Harbor on September 5th, 2006 on its world tour to promote renewable energy.[785]

In town, a gas station also adopted B100 fuel. This station was recently shut down, but not for lack of customers. In fact, without the gas station present, vehicles can now be seen backing up to the fuel dock to fill up with B100.

Not only has the local community picked up on the new renewable technology, Kent Bullard has worked to extend his enthusiasm for biodiesel to other communities in California. In January 2006, Kent help start a LA Biodiesel Coop.[786] Originally starting with 30 members, the group provided B99 and B100 biodiesel made from California walnut oil to members through a mobile trailer. The goal of the coop was to:

Provide a renewable fuel
Educate others about the benefits of biodiesel
Show a market demand existed for biodiesel

Put themselves out of business when a stationary fueling station decided to distribute biodiesel

Within two months, the group had established a stationary supplier in Calvert City and within the first month the station pumped 4600 lbs of B100.

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Bi-Fuel and Compressed Natural Gas

A bi-fuel vehicle has two separate fuel systems, one for gasoline or diesel and another for either liquefied propane gas (LPG) or compressed natural gas (CNG). CNG and LPG are stored in pressurized tanks and therefore require special systems that increase the cost of bi-fuel vehicles and reduce overall cargo space.

CNG is one of the cleanest alternative fuels. Compared to conventional gasoline, CNG produces 90% less carbon monoxide and 60% less nitrogen oxides. It also produces 30-40% less CO_2.[787]

According to the U.S. Department of Energy, the advantages to CNG vehicles are:[788] Natural gas vehicle can be less expensive to operate than a comparable conventionally fueled vehicle depending on natural gas prices. Natural gas can cost less than gasoline and diesel (per energy equivalent gallon); however, local utility rates can vary.

Purchase prices for natural gas vehicles are somewhat higher than for similar conventional vehicles. The auto manufacturers' typical price premium for a light-duty CNG vehicle can be $1,500 to $6,000, and for heavy-duty trucks and buses it is in the range of $30,000 to $50,000. Federal and other incentives can help defray some of the increase in vehicle acquisition costs. In addition, fleets may need to purchase service and diagnostic equipment if access to commercial CNG/LNG vehicle maintenance facilities is not available. Retrofitting[789] a conventional vehicle so it can run on CNG may cost $2,000 to $4,000 per vehicle. Learn more about NGV tax incentives.[790]

[785] The Earthrace, www.earthrace.net/, 3 October 2006.
[786] Biodiesel Coop, www.biodiesel-coop.org/, 3 October 2006.
[787] DOE Alternative Fuels Data Center, Natural Gas, www.eere.energy.gov/afdc/altfuel/gas_benefits.html, 3 October 2006.
[788] DOE Alternative Fuels Data Center, Natural Gas Vehicles, www.eere.energy.gov/afdc/afv/gas_vehicles.html, 5 October 2006.
[789] DOE Alternative Fuels Data Center, Aftermarket Alternative Fuel Vehicle Conversions www.eere.energy.gov/afdc/afv/conversion.html, 5 October 2006.
[790] DOE Alternative Fuels Data Center, State and Federal Incentives, www.eere.energy.gov/afdc/laws/incen_laws.html, 5 October 2006.

Plug-In Hybrid Vehicles

Hybrid vehicles use both internal combustion engines and electricity from batteries for propulsion. A new variety of hybrid vehicle, the plug-in hybrid or PHEV, uses the battery primarily and the Internal Combustion Engine (ICE) as a supplement only when needed. The first prototypes of the PHEV were released in November 2005. There is considerable promise for the growth of the domestic market. The city of Austin, Texas and the state of California are just two of the governments promoting the use of PHEV.[791]

Plug-in Hybrids

CASE STUDY: Austin, TX

The city of Austin has begun to promote the widespread use of PHEVs as part of its commitment to reducing vehicle emissions. Initiatives currently being undertaken by the city include:

Creating an incentive program to encourage residents to purchase PHEVs

Developing and supporting policies that promote PHEVs

Requesting the help of community organizations to advocate for PHEVs

Initiating Plug-In Partners, a nationwide effort to establish similar incentive programs in the 50 largest cities in the United States

The city of Austin's municipal-owned electric utility, Austin Energy, stands to benefit from the widespread use of PHEVs. Since plug-in hybrids would mainly be plugged in during the night, Austin energy could utilize its off-peak nighttime load to supply the new PHEV market without having to increase its capacity at all. Providing the electricity to the transportation market could provide substantial revenue to Austin Energy.

Replacing conventional vehicles with PHEVs would increase the urban air quality throughout the city. Idling engines produce high levels of CO_2 and other pollutants, while PHEVs running on battery power do not idle at all in the city. The overall benefit of PHEVs could be increased by coupling the use of wind power, which is most prevalent at night, to recharge PHEVs.

Mayor Will Wynn of Austin has begun a nationwide program called Plug-In Partners, in which he hopes to create similar programs in the 50 biggest cities in the country. The idea of the program is to create a groundswell of demand for PHEVs on a magnitude sufficient enough to entice the automotive industry to begin mass production of PHEVs. As part of the Plug-In Partners campaign, potential consumers can sign a petition pledging to buy a PHEV once they are available in order to demonstrate widespread demand for the new technology.[792]

CONTACT

Plug-In Partners
c/o Daryl Slusher/ Lisa Braithwaite
721 Barton Springs Rd.
Austin, TX 78704
(512) 322-6210 or
(512) 322-6511

[791] The California Cars Initiative, www.calcars.org/, 5 December 2006.
[792] For more information on Austin

- Austin Energy Plug-In Hybrid Program www.austinenergy.com/About%20Us/Environmental%20Initiatives/Plug-in%20Hybrid%20Vehicles/index.htm, 3 October 2006.
- State Energy Alternatives, www.eere.energy.gov/states/alternatives/, 3 October 2006.
- CalCars, The California Cars Initiative, www.calcars.org/calcars-news/115.html, 3 October 2006.

PHEVs are most likely to be introduced as fleet vehicles. They can be vehicles of any size, including delivery vans, shuttle buses and maintenance vehicles, among others. With daily routes typically less than 20 miles, most PHEV fleet vehicles used by a local government may almost never need to visit a gas station. If the vehicle exceeds the limits of the battery power, the PHEV will automatically switch to its internal combustion engine/battery combination and operate as a typical hybrid.

A typical PHEV sedan can be charged through a 120-V outlet in 3-4 hours, while larger vehicles can be charged in the same amount of time on a 240-V connection.[793] Assuming a PHEV drives 20 miles a day for five days a week solely on its batteries, it will use around 2000-2500 kWh of electricity to cover 5000 miles. At current prices, total electricity costs amount to about $170-$215 annually, compared to annual fuel costs for the same amount of driving of $750-$825 (at 18 miles a gallon).[794] Assuming national average cost of electricity at 8.5 cents per kilowatt hour, a PHEV runs on an equivalent of 75 cents per gallon.[795]

Widespread use of PHEVs could significantly reduce urban emissions. Idling in urban driving situations accounts for about 10-15% of total vehicle carbon emissions[796], and PHEVs under normal conditions (short trips at moderate speeds) do not use their ICE.

PHEVs can be recharged at night when the electricity from utilities is underutilized. This could create a significant new market for off-peak electricity. Roger Duncan, deputy general manager of Austin Energy, asserts that the national power system could charge tens of millions of PHEVs without requiring any new production capacity due to the idle electricity load at night.[797] Also, wind energy that is generated mostly during the night could be coupled to PHEV charging to provide a zero-emissions source of electricity. According to the California Air Resources Board, a vehicle that runs exclusively on battery power generates only a third of the GHGs produced by an equivalent gasoline vehicle.[798]

Federal Biofuel Tax Incentives

Comprehensive Guide to Federal Biofuels Incentives[799]

Tax Incentives	Agency	Benefit	Qualified Applicant	Period
Volumetric Ethanol Excise Tax Credit	IRS	$0.51 per gallon	Blenders of ethanol with gasoline	▪ Expires 2010
Small Ethanol Producer Credit	IRS	$.10 per gallon of ethanol produced of first 15 million gallons of ethanol made by a small producer	Any producer with production capacity below 60 million gallons	▪ Expires end of 2007
Biodiesel Excise Tax Credit	IRS	$1.00 per gallon $0.50 per gallon (recycled grease)	Biodiesel producers and blenders	▪ Expires 2010
Small Producer Biodiesel Credit	IRS	$.10 per gallon of ethanol produced of first 15 million gallons of ethanol made by a small producer	Any producer with production capacity below 60 million gallons	▪ Expires end of 2007
Credit for Installation of Alternative Fueling Stations	IRS	Credit for 30% of the cost to install alternative refueling stations; E85 and B20 fueling stations would qualify	Taxpayer who places the refueling property in service	▪ Effective: Dec. 31, 2005 ▪ Expires: Dec. 31, 2009

Figure: Biofuel Tax Incentives[800]

[793] Lucy Sanna, *Driving the Solution: the Plug-In Hybrid Vehicle*, EPRI Journal, Fall 2005, p. 5, www.calcars.org/epri-driving-solution-1012885_PHEV.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/Fuel Transition/CalCars_plugin.pdf, 3 October 2006.
[794] Ibid.
[795] Ibid.
[796] Ibid.
[797] Ibid.
[798] Ibid.
[799] Federal Biofuel Incentives cantwell.senate.gov/services/Biofuels/Comprehensive_Guide_to_Federal%20Biofuel_Incentives.pdf#search=%22biofuels%20federal%22 also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/Fuel Transition/FederalBiofuel_Incentives.pdf, 3 October 2006.
[800] Ibid.

Biofuel Tax Incentives

CASE STUDY: Sarasota, FL

Sarasota County is the first community in the country to join the National Renewable Energy Laboratory's "Renewable Community" program. This demonstration project integrates the use of rooftop photovoltaic (PV) systems on super high-efficiency homes with plug-in hybrid vehicles. Zero-Energy Homes (ZEHs) must be efficient enough to consume no more power annually than a small photovoltaic system can supply. Energy from the PV system is also used to charge the batteries of plug-in hybrid vehicles.

The objective of the Renewable Community program is to showcase the potential integration of efficient buildings, renewable energy and the latest technology in clean vehicles.

Several state and federal financial incentives have contributed to the implementation of this program.

This type of integration on a community level could significantly reduce our dependence on imported oil and reduce the country's overall contribution of GHGs.[801]

The Florida Energy Act provides rebates to consumers for solar installations.

The Florida legislature appropriated $2.5 million in funding for both commercial and consumer solar incentives for 2006-2007.

The Federal Energy Bill offers a 30% tax credit to individuals for the purchase of residential solar energy systems and a $2000 tax credit to homebuilders of houses that are 50% more efficient than the national code

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[801] For more information on Sarasota

- NREL Presentation on Renewable Communities www.solar2006.org/presentations/forums/f15-penney.pdf#search=%22renewable%20community%22, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/FuelTransition/NREL_plugin.pdf, 3 October 2006.
- Sarasota County Press Release scg.co.sarasota.fl.us/Media/media_documents/scgovFACTS.pdf#search=%22renewable%20community%22, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/FuelTransition/Sarasota_plugin.pdf, 3 October 2006.
- www.floridagreenbuilding.org/news/news2006/jun2006.htm, 3 October 2006.
- National Renewable Energy Laboratory on PHEVs www.nrel.gov/vehiclesandfuels/hev/plugins.html, 3 October 2006.

Additional Resources

Alternative Fuel Vehicles
www.fueleconomy.gov/feg/current.shtml

Clean Cities
www.eere.energy.gov/cleancities/

Alternative Fuel Station Locator
afdcmap2.nrel.gov/locator/

***Driving the Solution: the Plug-In Hybrid Vehicle* by Lucy Sanna**
EPRI Journal, Fall 2005
www.calcars.org/epri-driving-solution-1012885_PHEV.pdf

Oak Ridge National Laboratory Report: The Alternative Fuel Transition: Results from the TAFV Model of Alternative Fuel Use in Light-Duty Vehicles 1996-2010
www1.eere.energy.gov/vehiclesandfuels/epact/pdfs/plf_docket/tafv99report31a_ornltm.pdf

Comprehensive Guide to Federal Biofuels Incentives
cantwell.senate.gov/services/Biofuels/Comprehensive_Guide_to_Federal%20Biofuel_Incentives.pdf#search=%22biofuels%20federal%22

Biodiesel Fact Sheet
www.biodiesel.org/resources/fuelfactsheets/

Set America Free
www.setamericafree.org/

Natural Resources Defense Council—Growing Energy: How Biofuels Can Help End America's Oil Dependence
www.nrdc.org/air/energy/biofuels/contents.asp

Powerpoint from NREL about the plug-in hybrid system.
sustainablecommunities.scgov.net/ssDocuments/1270/powerpoint/transportation.ppt

Seattle's Clean and Green Fleet Action Plan
www.seattle.gov/environment/Documents/CleanGreenFleetAP.pdf

Chapter 5: Local Action Plan Long Term Initiatives **Sustainable Energy**

DOCUMENT CONTENTS

Planning for Sustainable Energy

Every community can move toward supplying its energy in ways that are clean, secure, affordable, and that meet citizens' needs abundantly. This is called a sustainable energy system. Achieving it will mean increasing the supply of energy that comes from locally based, renewable sources. It will also mean using sources of energy more efficiently. Many communities are already moving in this direction. You can, too.

How Does Your Community Meet its Needs for Energy Now

A good first step in developing a plan to meet a community's energy needs now and into the future is to understand how the community currently gets its energy. Most citizens in a community have no idea where their energy comes from. Many have no idea that a typical community now spends as much as 20% of its gross income buying energy. Because most of this energy comes from outside the community, 80% of those dollars immediately leave the local economy. This means that most towns are slowly bleeding to death economically.

Achieving a sustainable energy future will require putting in place a very different energy supply system than most cities have now. On average for the U.S. communities use very little renewable energy. The Department of Energy (DOE) estimates that the U.S. in 2004 got only 5.7% of its energy from renewable sources. Business as usual projections forecast that the U.S would get only 1% more renewable energy by 2030.[802]

[802] U.S. DOE, U.S. Energy Information Administration, "Annual Energy Outlook 2006," p. 11. The EIA also forecasts annual world energy consumption growth by fuel to 2030 as follows (reference case IEO2006 model): Oil – 1.5%; Natural Gas – 2.5%; Coal – 2.5%; Nuclear – 0.9%; Renewable/other – 2.4%. This projects an overall annual growth of energy consumption of 2%. Source: Energy Information Administration, "International Energy Outlook 2006," June 2006. Both sources available at www.eia.doe.gov, 30 October 2006.

U.S. Primary Energy Sources	2004	2030 (projected)
Petroleum products	40.3%	40.0%
Natural Gas	23.2%	20.7%
Coal	22.6%	25.7%
Nuclear Power	8.2%	6.8%
Renewable Energy	5.7%	6.7%

Table: Business as Usual Energy Projections

The projection from the Energy Information Administration (EIA) for 2030 could also be called the "do-nothing" option. It illustrates that little progress towards using renewable energy can be expected without deliberate action on the part of cities, regions, states and the federal government. But as described throughout this manual, change is coming. The way we currently meet our energy needs will not continue.

Nearly 40% of primary energy used in the U.S. now goes to producing electricity. Most of this is coal that is burned in central station power plants, contributing to global warming and producing enormous quantities of waste heat and pollution. The resulting electricity is then shipped through massive power lines to the final customers. In the whole process, well over two thirds of the original energy is lost. These huge inefficiencies in electrical generation and distribution systems mean that electricity supplies only 16% of the energy that is delivered to customers.

The remaining 60% of primary energy is used directly in buildings, industrial processes and transportation. There are large inefficiencies in these uses as well. For instance, an automobile is approximately 1% efficient at converting the energy stored in fuel into actually moving the driver. All of the remaining energy produces heat and pollution.[803] Following the 1979 oil price increase, tougher vehicle efficiency standards reduced U.S. use of oil 15% over the five years at the same time that the economy grew by 16%. Given that there are cars now on the road getting over 60 miles per gallon, and the vehicle fleet average is 21 MPH, there obviously remains a large scope for increased efficiency.[804]

In addition, existing energy systems are vulnerable.[805] Recent estimates of the economic costs of ordinary power outages and power fluctuations in the U.S. put the cost of such disruptions as high as $188 billion annually.[806] This number would obviously be dwarfed by significant natural or terrorist disruptions.

In part because of this, many industries have moved to supply part or all of their own energy. By 2001, "non-utility" providers (an owner of electric generating capacity that is not an electric utility) were providing one-sixth of the nation's electricity. There is a rapidly expanding marketplace for distributed energy.

Enormous economic and energy security benefits can be obtained through greater use of "distributed" energy sources, meaning energy sources physically close to, and matched

[803] Because of heat and combustion losses, the engine, transmission, and tires (and other energy-consuming components such as options) of a standard automobile convert only 20% of the gasoline's energy into movement of the vehicle. The people in the car may constitute only 5% of the weight of the car that is moved forward (150 lbs of 3000 lbs). Hence, 20% efficiency to move only 5% of the car's weight means only 1% of the fuel's energy moves the people forward. See Paul Hawken, Amory B. Lovins and L. Hunter Lovins, *Natural Capitalism – Creating the Next Industrial Revolution*, Little, Brown, 1999, p. 24, and generally Chapter 2: "Reinventing the Wheels." Steve Heckeroth, a contributing editor to *Mother Earth News* and electric vehicle advocate, estimates that the lifecycle of carbon-based fuels used in internal combustion engines (the "sun to wheel efficiency of biofuels") is only 0.01% to 0.07% – see Steve Heckeroth, "Why We Need Electric Cars," *Mother Earth News*, October/November 2006.

[804] CAFÉ (Corporate Average Fuel Efficiency) standards for vehicles enabled the country to increase the fuel efficiency of new U.S.-built cars 7 mpg in six years. Europe achieved similar savings but did it through higher fuel taxes rather than efficiency standards. Between 1977 and 1985, U.S. oil imports fell 42%, depriving OPEC of one-eighth of its market. The entire world oil market shrank by one-tenth; OPEC's share was cut from 52% to 30%, driving down world oil prices. The U.S. alone accounted for one-fourth of that reduction. On average, new cars each drove 1% fewer miles, but used 20% fewer gallons. Only 4% of those savings came from making the cars smaller.

[805] For a full discussion of the vulnerability of domestic energy systems see Lovins, A and Lovins H, Brittle Power, available for free download from www.natcapsolutions.org/resources.htm#ART, 30 October 2006.

[806] Craig Morris, *Energy Switch – Proven Solutions for a Renewable Future*, New Society Publishers, 2006, p. 10, citing a report by Primen. Morris notes that power problems are much less in the EU, partly due to underground power lines.

in scale with end-uses.[807] Most of current "distributed generation" is not renewable. Much of it is gas-fired cogeneration, but increasingly new additions of distributed generation feature solar or wind power.

U.S. Department of Energy Assistant Secretary David Garman notes:

> Aside from its obvious environmental benefits, solar and other distributed energy resources can enhance our energy security. Distributed generation at many locations around the grid increases power reliability and quality while reducing the strain on the electricity transmission system.[808]

Envisioning a Sustainable Energy System

Before a town can decide what energy future it wishes to develop, its citizens need to be educated about the technologies that are available and in use in other communities. The community should also understand the costs associated with doing things in a different way and as well as the costs that inaction would impose. For all of the reasons outlined in this manual, continuing to meet our energy needs as we have in the past may not be an option. Failure to undertake an aggressive transition to the best technologies now available will actually penalize a town. For instance, an examination of one utility's reluctance to buy wind electricity instead of natural gas plants showed that the decision forced consumers to pay nearly $200 million in unnecessary electricity bills over the past five years. If the utility had purchased wind, the bills would have been lower, and the community would have been on its way to a carbon neutral future.[809]

A community that wishes to meet the energy needs of its citizens without emitting GHGs must lay out a strategy for transitioning its energy supply from fossil fuels to renewable energy.[810]

Such a plan sets forth:

A vision of a sustainable energy system that will meet the community's greenhouse gas (GHG) goals/limits and renewable energy goals;

A plan to meet the needs for vehicle fuels, electricity, and facility energy needs and production opportunities;

City/regional government's intent to take short- and long-term renewable energy actions on a local and regional scale; and

Partnerships with key stakeholders: utilities, vehicle fuel providers, other levels of government, and major employers or energy users.

Efficient Use of Energy

A sustainable energy plan will be founded on the efficient use of energy. The actions presented in this manual to reduce emissions of GHGs are an excellent starting point. When undertaking an analysis of the opportunities to save energy it is wise to disaggregate energy use so that it is clear what kinds of energy different end-uses require. Studies that aggregate information into sectors such as residential or commercial make it hard to understand what programs will work best, and then what supply measures will enable users to run vehicles, or deliver power to computers most effectively.

Based on the actual needs of a community, a plan will describe where to get additional energy supplies once all the cost effective energy savings measures have been implemented. Fortunately, many studies have shown that it is possible to meet all of the energy needs of a dynamic growing industrial society using energy efficiently and deriving it from

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[807] Amory B. Lovins et.al., Small is Profitable – The Hidden Economic Benefits of Making Electrical Resources the Right Size," Rocky Mountain Institute, 2002. Available at www.smallisprofitable.org, 30 October 2006.
[808] Lovins, *Small is Profitable*, p. 47.
[809] Jane E. Pater, "Wind On The Public Service Company of Colorado System," *North American Windpower* magazine, October 2006, p. 44. The study conducted by the Interwest Energy Alliance found that Public Service Company of Colorado's decisions to purchase 775 MW of wind power beginning 1999, which saved consumers over $251 million 1999-2005, could have been 1,038 MW instead – which would have saved over $438 million.
[810] For more on this topic, see James Kunstler, *The Long Emergency – Surviving the End of Oil, Climate Change, and Other Converging Catastrophes of the Twenty-First Century*, Grove Press, 2005.

the various renewable forms of energy.[811]

In most cases, new sources of energy are more expensive than older ones. A good strategy both for protecting the climate and for keeping your local energy bill lower is to buy enough energy efficiency to avoid the need to bring on new sources of power—for example, in the case of electricity, achieving "no load growth." This is a relatively simple equation to manage: ensure that what the community invests in energy efficiency each year is sufficient to offset any population growth, economic growth and energy-use growth unrelated to the first two. So long as energy end-uses remain unregulated and/or customers do not see effective efficiency incentives, it can be expected that consumers will add devices such as plasma televisions (which use five times the energy of a regular television) and other energy-inefficient appliances that in the aggregate are costly to the community's residents and businesses.

Proven examples of energy savings opportunities [812]:

Properly choosing office equipment and commercial and household appliances has saved over two-thirds of their energy use with the same or better service and comparable or lower cost.

Skilled retrofits have saved 70–90% of office and retail lighting energy, yet the light quality is more attractive and the occupants can see better. In most cases, the better lighting equipment lasts far longer and so more than pays for itself by costing less to maintain.

Motors use three-fourths of industrial electricity, three-fifths of all electricity, and more primary energy than highway vehicles. This use is highly concentrated: about half of all motor electricity is used in the million largest motors, three-fourths in the three million largest. Since big motors use their own capital cost's worth of electricity every few weeks, switching to more efficient motors can pay back quickly. This plus retrofitting the rest of the motor system saves about half its energy and pays back in around 16 months.

The chemical industry saved half its energy per unit of product during 1973–90 by plugging steam leaks, installing insulation, and recovering lost heat. Now it's discovered that better catalysts and matching heat to the required temperature can often save 70% or so of what's left, yet pay back within two years. Next-generation industrial plant design, now moving from the chemical industry into semiconductors, is uncovering 50–75% savings with lower capital cost, faster construction, and better performance. Early adopters will prosper.

Many of these examples illustrate a new design concept: that whole-system engineering can often make it cheaper to save a larger than a smaller fraction of energy use. This typically comes from integrating the design of an entire package of measures so they do multiple duty (such as better design saving on both energy and equipment costs), or piggyback on renovations being done anyway for other reasons, or both. Good engineers think this is fun. Most economic theorists assume it is impossible.

Efficiency opportunities expand far into the future:

Just selling "waste" heat to other users could cost-effectively save up to about 30% of U.S. and 45% of Japanese industrial energy. (America's power stations waste more heat than Japan's total energy use.)

Still largely unexploited are new kinds of heat exchangers and motors, membrane separators and smart materials, sensors and controls, rapid prototyping and ultraprecision fabrication, and radically more frugal processes using enzymes, bacteria, and **biological design principles.**

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[811] ASES, Tackling Climate Change in the U.S., www.ases.org/climatechange, 1 February 2007
NRDC, Reducing U.S. Oil Dependence A Real Energy Security Policy, www.nrdc.org/air/energy/fensec.asp, 1 February 2007
Apollo Alliance, www.fypower.org/pdf/ApolloAll_StateReport.pdf 1 February 2007
Nuclear Information and Resource Services, www.nirs.org/press/10-05-2006/1, 1 February 2007.

[812] This list is taken from Lovins, A and Lovins H, Climate Making Sense and Making Money, 1998, www.natcapsolutions.org/publications_files/climate_sense.pdf, 30 October 2006.

Saving materials also saves the energy needed to produce, process, transport, and dispose of them. Product longevity, minimum-materials design and manufacturing, recovery of any scrap not designed out, repair, reuse, remanufacturing and recycling together present a formidable menu of business opportunities that also save energy, pollution, mining, and landfilling. Japan cut its materials intensity by 40% just during 1973–84; but far more is yet to come. Americans throw away enough aluminum to rebuild the country's commercial aircraft fleet every three months, even though recycling aluminum takes 95% less energy than making it from scratch. Smart manufacturers now take their products back for profitable remanufacturing, as IBM did with computers in Japan and Xerox does with photocopiers worldwide.

Many energy savings reduce climatic threats from more gases than just CO_2. Advanced refrigerators, using vacuum insulation and helium-engine coolers, can save over 90% of the energy of a standard refrigerator, thus avoid burning enough coal to fill the refrigerator every year. They also eliminate climate-and ozone-disrupting cfcs from insulation and refrigerant. Landfill and coal-mine gas recovery turns heat-trapping and hazardous methane emissions into a valuable fuel while making electricity that displaces coal-burning (see the chapter on waste management). Recycling paper (the average person in a rich country uses as much wood for paper, mostly wasted, as the average person in a poor country uses for fuel) saves it from turning into landfill methane, and also saves the fossil-fueled used in manufacturing and transportation. These and scores more examples represent business opportunities with multiple profit streams.

Best Practice Examples of Community End-Use Strategies:

The U.S. Federal Government conducts extensive programs to reduce energy end-use at facilities, with an overall goal of 2% annual reduction in each facility. This is achieved through systematic audits through operations such as the Federal Energy Management Program of the National Renewable Energy Lab and Oak Ridge National Lab.[813] The Department of Defense's (DoD) Energy Policy includes a goal of conducting energy savings with less than a ten years payback.[814] The DoD's Energy Conservation Investment Program saves $3-4 for every $1 invested over the investment lifecycle.[815]

Leading companies pursuing best practices regarding end-use energy management include multi-national firms Interface Inc., DuPont Corp., STMicroelectronics, ALCOA, ALCAN, Wal-Mart, Honda and SC Johnson. Mid-size or small businesses include Hot Lips Pizza of Portland, OR; New Belgium Brewing of Ft. Collins, CO; the IGA Market in Sacramento, CA.[816]

Clean Air Cool Planet is a small, compelling organization dedicated to finding and promoting solutions to global warming. They're a great example of a small non-profit that is making impressive changes in the carbon emissions of all sorts of industries. They partner with companies (Timberland, Verizon, Harbec Plastics), campuses (Harvard, MIT, Yale) and communities in the Northeast to help them reduce their carbon emissions in ways that make financial sense.[817]

Leading academic institutions pursuing best practices include

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[813] For an overview of the U.S. Department of Energy's facilities program see "Department of Energy – Energy Conservation at Federal Facilities Report" at www.er.doe.gov/epic/docs/FedFacilitiesReport.pdf. Outstanding environmental management examples receive Closing the Circle awards, given annually, from the White House's Office of the Federal Environmental Executive – see www.ofee.gov, 30 October 2006.

[814] The DoD policy to implement all projects with less than a 10 yr. payback is from "The Department of Defense Energy Manager's Handbook", prepared by the Intuitive Research and Technology Corporation, August 2005, available at www.acq.osd.mil/ie/irm/Energy/Energy%20Manager%20Support/EnergyManagerSupport.htm, 30 October 2006.

[815] See Commander Rob Tomiak, "Department of Defense Energy Management Program", powerpoint presentation, 17 August 2005.

[816] For other small business examples, see the EPA Energy Star awards for small businesses at www.energystar.gov/index.cfm?c=sb_success.sb_2006winners, 30 October 2006.

[817] Clean Air- Cool Planet, www.cleanair-coolplanet.org/, 30 October 2006.

the University of Calgary, Canada; Tufts of Boston, MA.

Many utilities have programs similar to Nevada Power, which provides cash rebates for energy efficient appliances and air conditioners, and installs devices that reduce air conditioning electrical demand during summer peaks.[818]

The consumer-owned electric utility serving Gainesville, Florida decoupled profits from energy sales to help promote efficiency.[819]

Seattle adopted an energy building code in 2004 stronger than the International Energy Conservation Code standards.[820]

Berkeley requires energy saving retrofits when homes are sold or significantly upgraded.[821]

Several cities, including Ashland, Oregon provide extensive assistance to homeowners for energy audits and energy-use upgrades.[822]

Energy efficiency can be implemented very rapidly, by either or both of two quite different methods.[823] In the 1970s and '80s, as now, there were high or rising energy prices and a sense of urgency: During roughly 1975–85, most new U.S. energy-using devices—cars, buildings, refrigerators, lighting systems, etc.—doubled their efficiency, improving at an annual rate averaging around 7%.

If all Americans saved electricity as quickly and cheaply as ten million people served by Southern California Edison Company did during 1983–85, then each year they'd decrease the forecast need for power supplies a decade hence by about 7%, at a cost to the utility around one-tenth that of today's cheapest new power stations.

In the 1980s, skillful utilities captured ~70–90+% of particular efficiency markets, mainly difficult ones like retrofitting house shells, in just one or two years.

During 1990–96, utility facilitation enabled electric customers in Seattle—with the cheapest electricity of any major U.S. city—to save electric load nearly 12 times as fast as those in Chicago, and electric energy more than 3,600 times as fast, even though Seattle electricity prices are about half of Chicago's. This conclusively shows that making an informed, effective, and efficient market in energy-saving devices and practices—as Seattle City Light's efforts helped to do—can fully substitute for a bare price signal, and indeed can influence energy-saving choices even more than can price alone. That is, people can save energy faster if they have extensive ability to respond to a weak price signal than if they have little ability to respond to a strong one.

Investor-owned utilities, when rewarded for cutting bills, sold efficiency ever faster and more skillfully despite falling electricity prices. In 1990, New England Electric System captured 90% of a small-commercial pilot retrofit market in two months. Pacific Gas and Electric Company captured 25% of its entire new-commercial-construction market—150% of the year's target—in three months, so it raised its 1991 target…and captured all of it in the first nine days of January.

Renewable Energy Sources

Renewable energy generally means power that comes from natural processes such as sunlight, wind, water flows, or earth's natural heat sources (geothermal) and that are inexhaustible. These are also called clean energy sources. Whether these sources are truly *sustainable* depends on whether they take no more from the earth than can truly be renewed, whether they are produced in

[818] Apollo Alliance, "New Energy for Cities – Energy Saving and Job Creation Policies for Local Governments," p. 1:21, www.apolloalliance.org/docUploads/new%5Fenergy%5Fcities%2Epdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/SustainableEnergy/ApolloAlliance_EnergyforCities.pdf, 30 October 2006.
[819] Ibid. p. 1:24.
[820] Ibid. p. 1:13.
[821] Ibid. p. 1:15.
[822] Ibid.
[823] This list is taken from Lovins, A and Lovins H, Climate Making Sense and Making Money, 1998, www.natcapsolutions.org/publications_files/climate_sense.pdf, 30 October 2006.

ways that do not pollute and whether they are deployed in ways that respect people and nature. There are many ways to supply energy, but some, like nuclear power, are neither clean, safe nor cost-effective. Others like hydrogen are still experimental. Others like solar space satellites have unfortunate military applications, and are extremely costly. None of these are considered "clean technologies," even though they may be argued to be renewable or non-carbon.

Sustainable energy planning does not necessarily mean that the municipal government must go into the energy business using municipal enterprises. This may be a good idea, and many cities are considering "municipalizing" their energy suppliers, but a city can equally well work with existing utilities to ensure that energy efficiency and renewable energy are made available for its citizens and to future generations.[824]

Some cities find that it is useful to work with their citizens to develop a long-term vision of what sustainability can mean for their community. Such a vision can motivate people and guide community investment. Without a vision, investments for incremental improvements may not achieve the economic and social advantages of a strategic plan to meet the community's needs sustainably.

What is a realistic but aggressive vision for maximizing renewable energy for your community by, say, 2025? How much change can actually be achieved in the next 20 years? A dramatically different future from the one foreseen by the U.S. Department of Energy, is both desirable and doable. Several organizations have offered maps for increasing sustainable energy use:

The Union of Concerned Scientists offers a Clean Energy Blueprint that would achieve by 2020:[825]

Renewable sources meeting 20% of U.S. electricity needs;

Consumer savings of $105 billion per year;

Avoidance of 975 new power plants and billions of energy infrastructure costs (such as pipelines, etc.) *and* retirement of 180 old coal plants and nine major nuclear plants; and

Reduction of natural gas consumption by 18%, coal consumption by 60%, carbon dioxide emissions by 67%, sulfur dioxide emissions by 55%, and nitrogen oxide emissions by 55% from "business as usual" projections.

The Apollo Alliance plan for clean energy cities in the U.S. includes the following goals:[826]

Generate 25% of electricity from renewable sources;

Reduce oil consumption by 25% by 2025; and

Build efficient transportation systems and high-performance (green) buildings.

The Rocky Mountain Institute's "Oil End-Game"[827] plan proposes that the U.S. could eliminate its petroleum products dependence for energy through:

Highly efficient buildings and vehicles that double fuel efficiency (52% savings);

Domestic biofuels production (25%); and

Substitution of natural gas for the remaining petroleum (25%).

Numerous strategies developed both abroad and domestically illustrate proactive means of creating more sustainable energy policy. For example, the EU has adopted the Energy Intelligent Europe Initiative, tying European competitiveness and quality of life to a transition away from fossil fuels to energy efficiency and renewables.[828]

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[824] See Johnston, David Cay, Some Californians to Pick Their Utility at the Polls New York Times, 3 Nov 2006 www.nytimes.com/2006/11/03/business/03utility.html?_r=1&ref=science&oref=slogin, 30 October 2006.

[825] Union of Concerned Scientists, with the American Council for an Energy-efficient Economy and The Tellus Institute, "Clean Energy Blueprint – A Smarter National Energy Policy for Today and the Future," available at www.ucsusa.org, 30 October 2006.

[826] The Apollo Alliance, "New Energy for Cities," 2006, available at www.apolloalliance.org, 30 October 2006.

[827] Amory B. Lovins et.al., "Winning the Oil End Game – Innovation for Profits, Jobs and Security," Rocky Mountain Institute, 2004; available from www.oilendgame.com, 30 October 2006.

[828] The strategy was first laid out in Energy for the Future: Renewable Sources of Energy See p. 9, section 1.3.1. An Ambitious Target for the Union europa.eu.int/comm/energy/library/599fi_en.pdf, 30 October 2006.

The German Renewable Energy Act (2001) outlined a renewable energy strategy for that country. The German approach included the "eco-tax" *(Ökosteuer)* that raised gasoline costs by $.18/gallon by 2004.[829] The German Renewable Energy Act calls for reaching 20% of electricity and 10% of primary energy from renewable sources by 2020; and 50% of primary energy from renewable sources by 2050, through the following strategies: [830]

Fixed remuneration that gives incentives for renewable energy sources (ranging from $.055/kwhr for wind to $.574 for solar photovoltaic) that is reevaluated every two years

Simple and transparent structure

Incentives for continuous renewable energy cost reduction

High security for investors

No dependence on public budgets

Financed by energy utilities

Steps taken towards internalizing external costs

City and state governments in the U.S. are also adopting innovative strategies to promote renewable energy.

As of Spring 2006, 20 states plus the District of Columbia have adopted programs that mandate getting a certain percentage of electricity production from renewable sources.[831] These "renewable portfolio" programs encourage utilities and citizens to use more renewable energy. California and New Jersey have adopted particularly ambitious goals. Examples of U.S. renewable energy programs include:

Renewable Energy

CASE STUDY: State of California

California's Solar Initiative (2005) aims to increase the amount of installed solar capacity on rooftops by 3,000 MW by 2017 with investor-owned utilities through:[832]

$3.2 billion for photovoltaic and concentrated solar rebates;

Exempting low-income households from any rate increases associated with the program and using 10% of the funds for projects for low-income households

CONTACT

Go Solar California
www.gosolarcalifornia.ca.gov/

[829] According to Morris, following adoption of the Eco-tax, gasoline sales fell for four consecutive years and 87% of consumers want a car with higher gas mileage. Gas tax revenues were used to reduce non-wage labor costs such as health insurance.
[830] Dr. Manfred Fischedick, Wuppertal Institute, "The German Renewable Energy Act – Success and Ongoing Challenges," 2004. Available at: www.wupperinst.org/download/renewables/ICORE.pdf, 30 October 2006.
[831] See map of state systems as of 2005 provided by U.S. Department of Energy at www.eere.energy.gov/states/maps/renewable_portfolio_states.cfm, 30 October 2006.
[832] The incentives apply only to investor owned utilities because the California PUC does not have jurisdiction over municipal utilities. See www.cpuc.ca.gov/PUBLISHED/News_release/52745.htm, 30 October 2006.
www.seia.org/solarnews.php?id=93, 30 October 2006.

Renewable Energy

CASE STUDY: State of New Jersey

New Jersey's Clean Energy Program calls for 1,500 MW of solar electricity installations in the state by 2020 through:[833]

A Renewable Portfolio Standard of 6.5% by 2008 with a target of 20% by 2020.[834]

The Clean Power Choice program that offers consumers the option to purchase renewable electricity;

Financial incentives for high-performance green buildings

Creation and trading of "Solar Renewable Energy Certificates" which financially reward distributed energy producers who help utilities meet renewable portfolio requirements

Examples of renewable energy goals adopted by U.S. cities include:

Renewable Energy

CASE STUDY: Santa Monica, CA

The city of Santa Monica, California set goals and programs include:

100% renewable energy purchases by city operations

25% of community electricity from renewable energy sources by 2010, including 1% from distributed sources

Maximizing non-petroleum fuel use in city fleet vehicles (80% already achieved)

Posting "Sustainable City Progress Reports" on the internet that include pages on GHG emissions, energy use, renewable energy, and transportation

The 2006 "Community Energy Independence Initiative," which will demonstrate how "energy efficiency, solar energy and distributed generation can work together effectively and how greater energy independence provides economic benefit to the community" through 50 pilot projects on buildings. These projects will lead to a city-wide effort.[835]

[833] A report on the program found that overwhelming demand was causing significant rebate delays – see Steven Lacey, RenewableEnergyAccess.com, "The Price of Success – Inside the New Jersey Clean Energy Program, 12 October 2006, at www.renewableenergyaccess.com/rea/news/story?id=46172, 30 October 2006.
[834] See New Jersey Clean Energy website: www.njcep.com, 30 October 2006.
[835] City of Santa Monica Environmental Programs Division website, www.santa-monica.org/epd, 30 October 2006.

Renewable Energy

CASE STUDY: San Diego, CA

In 2003, the San Diego, California region adopted the "Regional Energy Strategy 2030." This program articulates nine goals to "achieve an integrated approach to meeting the energy needs and supporting the prosperity" of the region. The goals address energy security, efficiency and sources, including:[836]

In-county capacity to generate 75% of summer electrical demand peaks (to be achieved by 2020);

Supplying 40% of electricity from renewable sources of which 50% are in-county;

Supplying 30% of peak electrical demand from "clean distributed" sources;

Reducing per capita electricity peak demand and total consumption to 1980 levels; and

Reducing natural gas per capita consumption by 15%.

Renewable Energy

CASE STUDY: Chicago, IL

Chicago, Illinois programs include:

The Chicago Solar Partnership, begun in 2000, which combines solar energy unit production in the city with city purchases of solar power and various financial incentives for business and residents to install solar panels;[837]

The Bike 2015 plan which encourages Chicagoans to make at least 5% of all trips less than five miles via bicycle, and also aims to reduce bicycle accidents;[838]

A goal to generate 20% of electricity for city facilities from renewable sources by 2010;

Home weatherization for low-income families; and

City support of Spire Solar Company so that jobs from solar manufacturing will be retained in Chicago, and the city will have access to solar cells.

[836] San Diego Regional Energy Office, "Energy 2030 – the San Diego Regional Energy Strategy," 2003, available at www.sdenergy.org, 30 October 2006.
[837] The Chicago Solar Partnership web site, www.chicagosolarpartnership.com, 30 October 2006.
[838] See www.bike2015plan.org/, 30 October 2006.

Bridging the Gaps Between Alternative Energy Scenarios

At present, most energy planning is done in a disintegrated fashion. Little connection (i.e., whole-system thinking) is drawn between the planning that is done to supply vehicle fuels and planning that ensures supply to residential and commercial facilities (electricity and direct consumption). Vehicle fuel is delivered by the private sector, partially in response to state and federal government taxes/incentives and regulations.

For example, vehicle fuel planning typically takes three forms:

Fuel production and distribution planning by private energy providers (e.g., petroleum companies and, increasingly, bio-fuel companies);

Air quality planning by local air quality boards or districts;

Alternative fuel plans created by state or local governments.

Communities can intervene in these systems to ensure that energy is supplied in ways that are cost-effective and secure.

Best Renewable Energy Practices to Supply Fuel Examples

Private sector:

- As of summer 2006, 65 privately owned biodiesel manufacturing plants had opened in the U.S. with 49 more under construction.[839]

In 2005, BP launched its "low-carbon energy" business, an $8 billion investment over ten years to provide cleaner power sources.[840] Through the U.S. Department of Energy's Hydrogen Plan, BP, which produces 5,000 tons of hydrogen daily, collaborated with Ford Motor Co. and DaimlerChrysler in 2004 to build hydrogen fleet fueling stations in California, Florida and Michigan.[841] The company expects to complete engineering studies in 2006 of a hydrogen power plant in Carson, CA, using petroleum coke as a fuel. The carbon emissions from converting natural gas to hydrogen (4 million tons per year) are planned to be sequestered underground.[842]

Air quality planning:

- The South Coast Air Quality Management District serving the Los Angeles metro area has an extensive Clean Fuels program that co-funds dozens of demonstration projects annually.[843]
- British Columbia government's climate change plan includes programs of the air quality division designed to reduce GHGs and improve efficient use of vehicle fuels, including the "Scrap-it Program" that rewards demolition of older, highly polluting vehicles in exchange for rebates on cleaner vehicles and a goal for attaining 30% green vehicles in the government's fleet by 2008. The program also publishes tests of hybrid performance.[844]

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[839] Information about the growth of biodiesel through private investments is available at the website of the National Biodiesel Board; www.biodiesel.org/resources/pressreleases/gen/20060629_willienelsonpacificbiodieselopening.pdf, 30 October 2006.

[840] BP Sustainability Report 2005 "Making Energy More," www.bp.com/liveassets/bp_internet/globalbp/STAGING/global_assets/downloads/S/bp_sustainability_report_2.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/SustainableEnergy/bp_report_2005.pdf, 30 October 2006.

[841] BP corporate website, press release 27 April 2004: www.bp.com/genericarticle.do?categoryId=2012968&contentId=2017980, 30 October 2006. The first Los Angeles area hydrogen fueling station was a partnership with the South Coast Air Quality Management District. BP has also invested in several hydrogen fueling sites in the EU.

[842] BP Sustainability Report 2005, p. 43., www.bp.com/liveassets/bp_internet/globalbp/STAGING/global_assets/downloads/S/bp_sustainability_report_2.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/SustainableEnergy/bp_report_2005.pdf, 30 October 2006.

[843] In 2004, the AQMD contributed $15 million to the total of $44 million that funded 63 projects including expansion of natural gas and hydrogen fueling infrastructure and natural gas vehicles. See www.aqmd.gov/tao/Demonstration/index.htm, 30 October 2006.

[844] See "Weather, Climate and the Future – BC's Plan" at www.env.gov.bc.ca/air/climate/cc_plan/pdfs/bc_climatechange_plan.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/SustainableEnergy/bc_climatechange_plan.pdf, 30 October 2006.

Alternative fuel plans[845]:

- Plug-in hybrid vehicles may be available in the U.S. market by 2008. These vehicles represent an opportunity for vehicle fueling to help (if such vehicles are recharged during off-peak electrical production hours) or hinder community energy security (if charging boosts existing peak demands). Both the State of California and the city of Austin, Texas have programs underway to encourage the use of plug-in hybrids.
- Hydrogen fuel-cell hybrid vehicles represent an opportunity for distributed power generation. The vehicles are small electric powerplants on wheels that could generate power for a facility or the electrical grid while parked, if a connection were supplied that delivered hydrogen, and delivered the resulting electricity to the larger electric grid.
- The "Hydrogen Highway Network Action Plan" project of the California Air Resources Board (2004) aims "to support and catalyze a rapid transition to a clean, hydrogen transportation economy" specifically co-funding for three hydrogen fueling stations and the state lease of hydrogen-fueled vehicles [846]

Residential and commercial facility energy planning differs by states. Sometimes it is highly regulated by agencies (e.g. public utility commissions or the Federal Energy Regulatory Commission). In other locales it is a function of the private sector's handling of fuels.

Community-level facility energy end-use planning typically involves education and/or incentives that affect choices by end-users. Programs to encourage customers to use energy wisely this are described in this Manual's Chapter 5, Residential Section.

Without such programs electric utilities are vulnerable to major system problems when the utility's projection (guess) of total potential electrical demand falls short of actual demand. This happened to Los Angeles Water and Power in the summer of 2006 when it underestimated electrical demand during a summer heat wave by 500 MW and blackouts resulted.[847] Had LA's energy planning enabled customers to live in buildings that kept inhabitants comfortable without air conditioning, this problem would not have arisen, everyone's bills would have been lower and far less carbon would have been emitted.

Programs to integrate the use of energy efficiency and renewable energy can deliver significant value to a community.

Sacramento Municipal Utility District. In 1989, Sacramento, California shut down its 1,000-megawatt nuclear plant. Rather than invest in any conventional centralized fossil fuel plant, the local utility met its citizens' needs by investing in energy efficiency and such renewable supply technologies as wind, solar, biofuels and distributed technologies like co-generation, fuel cells, etc. In 2000, an econometric study showed that the program has increased the regional economic health by over $180 million, compared to just running the existing nuclear plant. The utility was able to hold rates level for a decade, retaining 2,000 jobs in factories that would have been lost under the 80% increase in rates that just operating the power plant would have caused. The program generated 880 new jobs, and enabled the utility to pay off all of its debt.

Fort Carson Mountain Post in Colorado has set forth a plan to meet 100% of its energy needs with renewable energy by 2027[848]

[845] For more information on alternative fuel vehicles see: autos.yahoo.com/green_center/.
[846] See Executive Order S-7-04 of California Governor Schwarzenegger at www.hydrogenhighway.ca.gov/media/execorder_s704.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/SustainableEnergy/CA_execorder_s704.pdf, 30 October 2006.
[847] The utility's response to the blackouts was to increase its planning assumptions about the peak demands from its residential customers – shifting from one megawatt of power being able to serve 750 homes to only 650 homes. (For energy planning in the late 20th century, the general assumption was one megawatt for 1000 homes). Source: Sharon Bernstein and Amanda Covarrubias, "Heat Wave Caught DWP Unprepared," *Los Angeles Times*, July 28, 2006.
[848] Fort Carson sustainability program website, sems.carson.army.mil, 30 October 2006.

Delivering a Sustainable Energy Plan

Delivering cost-effective sustainable energy involves two essential tasks:

1. Moving the existing energy marketplace away from the business-as-usual scenario by reducing various market failures
2. Progressing on an investment path towards a sustainable energy future

In undertaking these tasks, it is good to solicit input from such community partners as utilities, vehicle fuel providers, other levels of government, and major employers or energy users

Balancing the Existing Marketplace Away from Business-as-Usual

Environmental economists have long noted a fundamental flaw in market prices: Most prices fall short of capturing the full costs of producing the product or service being offered.

Costs such as the impact of releasing carbon into the atmosphere, the cost of vulnerabilities of central electricity generation, and the various subsidies that the Federal government gives to make historic forms of energy like coal or oil look cheaper, are called "externalities." These impacts are massive, but are not reflected in the market prices of energy. One study estimated the externalities of coal-fired electricity to be approximately four times the market price—meaning that in a truthful marketplace, coal-fired electricity would be closer to $0.21/kwhr instead of the present $.04-$.06 cents. For nuclear power, externalities are estimated at nine cents per kilowatt hour—nearly double the market cost of running existing plants.[849]

According to the U.S. Department of Energy, coal-fired electricity externalities include acid rain, urban ozone and global climate change.[850] Other externalities include mercury pollution, radioactivity, pollution from mining, milling, transport and waste disposal, externalities from the use of water, and habitat losses or other ecosystem damage incurred during the coal lifecycle. In the past four decades, governments have slightly reduced price externalities by implementing regulations to protect the environment and reduce damage to human health. Even so, the majority of externalities listed above remain unresolved.

A case can be made that another externality of non-renewable resources is the denial of that resource to future generations. Interface Inc. CEO Ray Anderson, one of many business leaders dismayed by the consequences of externalities, notes that externalities mean that the market alone cannot provide sufficient constraints on corporations' tendency to cause harm. A true market, he argues, would force companies to include externalities in the price of their offerings.[851]

In contrast, solar electricity is estimated to have externality costs of one cent per kilowatt hour, in addition to its current estimated costs of 15 to 20 cents. Wind energy is presently cost competitive with coal and nuclear, with similarly few externalities.[852]

To achieve a more balanced marketplace, communities can:

1. Use regulations and/or taxes/fees to increase the price of non-renewable energy and provide incentives to providers of clean energy sources of all kinds (e.g., to make solar energy panels with fewer toxic materials)
2. Use regulations and financial mechanisms to

- Reduce the effective costs of renewable and in distributed energy

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[849] Externality estimates by Thomas Sundqvist, "Power Generation Choice in the Presence of Environmental Externalities," Lulea University of Technology, 2002, at epubl.ltu.se/1402-1544/2002/26/index-en.html, 30 October 2006. See also Thomas Sundqvist, Patrik Soderholm and and Andrew Stirling, "Electric Power Generation: Valuation of Environmental Costs" in Enclyclopedia of Energy, Vol. 2, Elsevier Ltd., 2004, pp. 229-243. Mr. Sundqvist estimated coal-fired electricity externalities at $.16/kwhr, nuclear power at $.09/kwhr, and $.01/kwhr for solar power. Current price of coal-fired electricity from Daniel M. Kammen, "the Rise of Renewable Energy," Scientific American, September 2006, p. 86.

[850] See John Carlin, "Environmental Externalities in Electric Power Markets: Acid Rain, Urban Ozone and Climate Change," U.S. Department of Energy website: www.eia.doe.gov/cneaf/pubs_html/rea/feature1.html, 30 October 2006.

[851] For a cogent explanation of the set-up for corporations in the modern marketplace, including externalities, see Joel Bakan, *The Corporation – The Pathological Pursuit of Profit and Power*, Viking Canada, 2004. Anderson quotes from p. 72; also see DVD of the same name.

[852] See Renewable sources of energy, with special emphasis on wind energy, Report of the Secretary General, Committee on New and Renewable Sources of Energy and on Energy for Development, 1998, at www.uneprisoe.org/WindEnergy/UNreportwind.pdf, 30 October 2006.

- Increase the incentives for energy utilities and community citizens/organizations to invest in energy efficiency and renewable energy

Examples of leading-edge actions include:

Seattle City Light, the city of Seattle's public utility, has committed to be carbon-neutral. This utility is reducing its carbon footprint through use of renewable energy sources and purchasing carbon credits to achieve carbon neutrality. The scheme effectively prices its energy as if it had few externalities.[853] Seattle City Light achieved zero net greenhouse gas emissions in 2005 and 2006.[854]

Thief River Falls, Minnesota, offers low interest loans and incentives to customers who install ground-source heat pumps—a less electricity intensive system for heating and cooling buildings.[855]

Santa Clara, California, rents solar hot water systems to citizens and businesses.[856]

Honolulu, Hawaii, offers 0-2% loans to homeowners to install solar hot water systems.[857]

The municipal utility in Bowling Green, Ohio, led a collaborative effort among ten municipal utilities to finance a wind-energy farm.[858]

Mason City, Iowa, changed zoning ordinances to allow appropriately sized wind turbines to be installed in residential zones.[859]

The city of Chicago and 47 other local government agencies formed the Local Government Power Alliance. Through it, they negotiated lower-cost electrical service that includes higher levels of renewable energy. [860]

For additional examples, see:
The Apollo Alliance, "New Energy for Cities—Energy Saving and Job Creation Policies for Local Government." [861]

ICLEI, the International Council for Local Environmental Initiatives.[862]

The U.S. Department of Energy's Energy Efficiency and Renewable Energy home page.[863]

The National Renewable Energy Laboratory's home page.[864]

Sustainable Energy Investing

Energy is almost entirely produced and consumed by what accountants call "capital" goods—long-term investments in such energy producing devices as power plants, wind turbines, solar cells and the infrastructure like power lines to support them.[865] Energy is usually consumed by other capital goods—the heating, cooling, and lighting systems in buildings, transit options like cars, and industrial equipment. Capital goods are meant to have a multi-year life, and are often paid for over the item's lifetime. Large energy producing or consuming systems are expected to last several decades.

Setting and delivering on short-term goals to replace wasteful, fossil fuel energy systems generates excitement, demonstrates commitment and builds institutional momentum towards sustainable strategies, but requires a plan to finance these alternative capital investments.

The success of renewable power efforts will be partly determined by whether such efforts are given consistent support by local and regional governments. Some local governments will be

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[853] Seattle City Light: www.seattle.gov/light/, 30 October 2006.
[854] City of Seattle, www.seattle.gov/light/conserve/globalwarming/default.asp, 5 December 2006.
[855] Apollo Alliance, "New Energy for Cities – Energy Saving and Job Creation Policies for Local Governments," p..6, www.apolloalliance.org/docUploads/new%5Fenergy%5Fcities%2Epdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/SustainableEnergy/ApolloAlliance_EnergyforCities.pdf, 30 October 2006.
[856] Ibid. p. 4.
[857] Ibid. p. 5.
[858] Ibid. p. 7.
[859] Ibid. p. 7.
[860] "Customer Aggregation: An Opportunity for Green Power?" by Edward Holt of Ed Holt & Associates, and Lori Bird of the National Renewable Energy Laboratory, 2001: www.eere.energy.gov/greenpower/resources/pdfs/lb29408.pdf, 30 October 2006.
[861] The Apollo Alliance, "New Energy for Cities – Energy Saving and Job Creation Policies for Local Government, www.apolloalliance.org/ and www.apolloalliance.org/docUploads/new_energy_cities.pdf, 30 October 2006.
[862] ICLEI's web site: www.iclei.org, 30 October 2006.
[863] The Department of Energy, www.eere.energy.gov/, 30 October 2006.
[864] National Renewable Energy Laboratory, www.nrel.gov/, 30 October 2006.

hesitant to take on a leadership role if increased short-term costs threaten to temporarily dampen their business climate.

The solar energy industry in California hailed the California Solar Initiative because it created an 11-year certainty of support for the industry through rebates. This long-term approach will allow the industry to give investors a stable planning horizon that will give them the confidence to change from the business-as-usual course.

The city utility in Burlington, Vermont has invested heavily in renewable generation:

> Over 46% of Burlington Electric Department (BED)'s power mix was from renewable sources in fiscal year 2005. This was up from 42% in 2004. BED is continuing to pursue additional renewable sources of power such as wind energy in an effort to add fuel diversity and to stabilize power costs for Burlington consumers. With fossil fuel prices at record highs, renewables act as a means to balance the high cost of fossil fuel based energy. The cost of generating renewable energy, especially in-state renewable energy, is level and generally predictable; unlike fossil fuel its price is not influenced by international and market forces beyond our control and it does not contribute to global warming. We look forward to increasing Burlington's supply of renewables such as wind energy not only as a way of providing the citizens and business owners of Burlington with clean electricity but also providing them with an affordable and reliable supply. Renewable energy is part of a sustainable and fiscally sound power supply portfolio.[866]

The city of San Francisco boasts one of the nation's most comprehensive sustainable energy programs. It required the use of B20 biodiesel in all city diesel vehicles in 2006, moving to the use of B100 (100% biodlesel) in 2007. All city buildings must meet the U.S. Green Building Council's LEED Silver criteria for green buildings. The city passed a bond to fund putting solar electric systems on residential buildings, and will replace its payroll tax with a green tax credit for solar energy.

Community leaders need to realize that every day new capital investment decisions are made that will affect energy production and consumption patterns for decades to come. To minimize energy needs a community will need to invest in different equipment choices that provides lasting value because it uses less energy. For example, investing in high performance green buildings that can be expected to be 50% less costly to operate is a good deal, even if there are higher initial design costs.[867]

Every time a community chooses inefficient options like centralized energy supplies, it locks citizens into years of being less competitive. It is important to articulate a sustainable energy future that looks two decades or so into the future, that maximizes your chances for widespread use of distributed, renewable energy, and that uses energy efficiently to help avoid long-term investments that will be uncompetitive or environmentally untenable in the future.

Primer on Sustainable Energy Sources

The primer below is offered as a guide. It obviously cannot address current or specific market conditions, since these are constantly changing. Renewable technologies are evolving rapidly as well. Every community should undertake an up-to-date investigation at the time of a sustainable energy planning process.

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[865] Former Oregon Governor John Kitzhaber, on launching a more sustainable energy future, said that "digging, drilling and burning" is a 19th century technology.

[866] Burlington Electric Department Sources of Power, www.burlingtonelectric.com/sourcepower.htm, 30 October 2006.

[867] The US Green Building Council has documented that good green buildings typically cost no more to build than ordinary, energy wasting structures. Even if there are an up-front costs, green buildings will typically result in a lifetime savings of up to 20% of total building cost. www.USGBC.org, 30 October 2006.

The following renewable energy sources will be explored further:

Wind-generated electricity;

Solar-generated electricity and hot water;

Biomass-generation;

Waste-generated electricity;

Hydro-generation;

Earth-generation;

Hydrogen power; and

Nuclear power.

Wind-Generated Electricity

Examples: Wind

- Horizontal-axis wind turbines (the most common type of turbine).
- Vertical-axis wind turbines (designed for capturing wind closer to the ground or tops of buildings).[868]
- Wind-capturing devices in the atmosphere e.g. floating wind turbines.[869]

Sustainability Attributes: Wind

- Wind energy can be used in a decentralized network but can also be used in a conventional grid system; wind has no ongoing emissions; requires minimal toxic or hazardous materials for construction and operations. Its costs are competitive to coal and natural gas, meaning that taking externalities into account, it may be several times less expensive than nuclear or fossil electricity that require ongoing fueling and avoidance of full-costs.

Sustainability Challenges: Wind

- Include potential wildlife impacts, other ecological impacts,[870] visual impacts, maintenance challenges.[871]

Market Challenges: Wind

- Include educating government leaders and customers about wind energy's potential, siting and regulatory challenges,[872] evolving technology, wind's intermittency, and challenges (given intermittency) in integrating with traditional electrical grid management. Getting power lines built to accommodate intermittent wind resources is a challenge in the current structure of U.S. power grids.

Potential Community Support Actions: Wind

- Begin with giving priority to building wind energy infrastructure, and giving incentives to utilities and customers to buy wind and transition away from coal.

Solar-Generated Electricity and Hot Water

Examples: Solar

- Active or passive solar energy used to heat water, which may be used directly or used to heat buildings.
- Solar lighting design.
- Photovoltaics used to generate electricity directly from sunlight.

Sustainability Attributes: Solar

- Sunlight is the ultimate energy resource; it needs no fuel, in most parts of the world it is reliable (some of the largest recent solar photovoltaic installations are in cloudy Bavaria, Germany), and it is able to operate for long periods without maintenance, making it optimal for "off-the-grid" and dispersed applications.

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[868] Companies developing and marketing vertical axis wind turbines include Aerotecture International Inc., (Chicago, IL – see www.aerotecture.com) and Quiet Revolution Ltd., (UK – see www.quietrevolution.co.uk).

[869] Such devices are held aloft in the atmosphere where wind speeds are higher by various means including balloons or virtual kites – for more see www.magenn.com, 30 October 2006.

[870] For a summary of the current environmental challenges and solutions with offshore installations, see James O. Jones and Christine Love, "Bringing Offshore Wind Energy to Shore," *North American Windpower* magazine, October 2006, p. 16.

[871] Gearboxes have been a trouble spot for older wind turbines – given the expense of downtime and of gearbox repairs.

[872] Regarding offshore siting challenges, see John S. Hingtgen, "Shorelines Might Welcome Wind – From a Distance," *North American Windpower* magazine, October 2006, p. 25.

Sustainability Challenges: Solar

- Use of toxics in manufacturing; siting challenges; net energy contribution concerns.[873]

Market Challenges: Solar

- The cost (15+ cents per kilowatt hour for solar electricity) makes some solar options a difficult choice. More people will buy solar as the costs will decrease. About a dozen new companies promise to have competitive solar electricity within four years.

Potential Community Support Actions: Solar

- Homeowners and businesses have shown themselves to be enthusiastic buyers of solar when incentives are great enough to reduce up-front costs.

Biomass-Generated Electricity

Examples: Biomass

- Bio-gas (a substitute for natural gas or propane) generated from biomass. Biomass can either be specially grown or derived from waste streams—either prior to or after landfilling. Agricultural biomass is used directly or for electrical generation.
- Wood-generated energy—wood-fired electrical power plants; direct burning of wood for electricity and/ or process heat; wood can also be converted to hydrogen fuel. Biofuels for vehicles and other users of portable liquid high-energy-density fuels, including ethanol and biodiesel from agricultural products, agricultural wastes and food wastes.

Sustainability Attributes: Biomass

- Biomass generated waste is carbon-neutral in that the biomass stored carbon during growth that is released during combustion (though not at the same rate).

Sustainability Challenges: Biomass

- Though technically carbon-neutral, biomass is nevertheless carbon-based and does not necessarily contribute to the dramatic reductions in carbon emissions needed for climate stabilization.[874]
- Market challenges include potentially fluctuating prices and supply.[875]
- Potential community support actions.
  - Separate collection of biomass from other wastes.
  - Incentives for use of local agricultural products or wastes in biofuel development, including public support of small business development to supply local wastes or other biofuels to processing plants and/or convert vehicles to better use biofuels.[876]
  - Support (such as economic development tax or financial incentives) for pioneering biofuel retail outlets and/or distribution systems.

Waste-Generated Electricity

Examples: Waste

- Waste to energy systems – using landfill-destined materials to generate electricity and/or process heat.
- Waste biomass to energy (see biomass section).

Sustainability Attributes: Waste

- Can reduce impacts of waste hauling and management.
- Can reduce market and hauling/shipping challenges of recycling markets.
- Support local energy production enhancing energy security.

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[873] Author David Kimble found six studies of the energy returned for the energy input of existing solar PV electricity cells – the results ranged from .86 to 1.4 (1.4 means 40% more energy returned than invested). See www.energybulletin.net/14849.html, 30 October 2006. A solar installer in California states that in California, solar cells provide more energy than was required to make them after three years – see www.solarexpert.com/future2.html, 30 October 2006.

[874] For more on this see US Department of Energy, "Our Changing Earth, Our Changing Climate – Biofuels: A Solution for Climate Change", 1999, available at www.nrel.gov/docs/fy99osti/24052.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/SustainableEnergy/BiofuelsSolution.pdf, 30 October 2006.

[875] Christopher Juniper of Natural Capitalism Solutions interview with Burlington VT's municipal utility that operates a wood-fired power plant – wood cutters were leaving the market due to closure of paper mills, causing a shortage of wood for the power plant in 2004.

[876] For example, a small Florida company has developed an efficient way to convert water into a clean burning fuel akin to hydrogen, and is developing auto conversion kits that boost gas mileage and use of cleaner fuels. See website of Hydrogen Technology Applications, Inc., www.hytechapps.com, 30 October 2006.

Sustainability Challenges: Waste

- Waste to energy plants can release toxics into the biosphere—the amount and type depending on the plant's design and operation and the waste inputs.[877]
- Diverts waste to energy uses rather than reuse or recycling.

Market Challenges: Waste

- High infrastructure costs up front require dedication of waste streams to energy production rather than progressively more recycling.

Potential Community Support Actions: Waste

- Examine legislative definitions of toxic or hazardous waste to ensure they do not interfere with economical and sustainable recycling of such wastes through incineration or other energy-generating means.
- Ensure that landfill costs nearly always exceed the costs of recycling, reusing or incinerating wastes.[878]

Hydro-Generation Electricity

Examples: Hydro

- Freshwater storage power systems (dams).
- Wave-power electrical generation.
- Tidal-power electrical generation.

Sustainability Attributes: Hydro

- Essentially a solar-powered and infinite resource.
- Uses mechanical systems that require few toxic materials although coatings are likely toxic-based to withstand water damage.
- Operations have low ecological impact though are removing energy from an ecological system.

Sustainability Challenges: Hydro

- Power production not proximate to electrical demand–leading to materials and potential ecological damage from transmissions system installation and maintenance.
- Dams flood ecological systems and human land-uses (including villages/towns) and are difficult for migrating fish to navigate.

Market Challenges: Hydro

- A limited number of sustainable hydro opportunities
- Potentially long permitting processes–often for good reason since hydro can easily cause long-lasting damage to riverine ecosystems and hydro sites are not often close to where the power will be consumed.

Potential Community Support Actions: Hydro

- Land use and permitting regulations that facilitate power generation at low-head or other hydro sites that are less ecologically destructive than big dam projects.

Earth-Generation

Examples: Earth

- Geo-thermal heat converted to steam and/or electricity.
- Earth-based heat pumps that more efficiently heat or cool buildings using the earth's ambient temperature.
- Passive earth berming systems that moderate building temperature swings—reducing heating/cooling loads—including thick earth-based walls of buildings.

Sustainability Attributes: Earth

- Perhaps the least damaging to ecosystems, unless critical habitats or unique areas are damaged by the loss of heat to human uses.

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[877] Waste to energy plants are highly controversial – knowledgeable experts are not yet convinced that burning temperatures will *always* be high enough to break down all potential toxics prior to air emission. For more on this technology – see the Waste to Energy Research and Technology Council website at Columbia University www.seas.columbia.edu./earth/wtert/, 30 October 2006. "Pollution from Waste-to-Energy Incinerators," October 2006, at Alternative Energy website: www.alternative-energy-news.info/pollution-from-waste-to-energy-incinerators/, 30 October 2006.

[878] This fundamental strategy is at the heart of highly successful waste reduction systems such as those of Portland, OR; Seattle, WA; and Alameda County, CA.

Sustainability Challenges: Earth

- Ecosystem damage from development and heat removal.

Market Challenges: Earth

- Relatively few sites available for active geothermal.
- Building codes can intentionally or accidentally interfere with innovative earth berming or heat pump systems.

Potential Community Support Actions: Earth

- Facilitate use of earth-based energy sources through friendly zone and development processes.
- Support studies and pilot projects demonstrating efficacy of new technologies.

A sustainable energy primer is not complete without briefly addressing the sustainable attributes of a promising new energy carrier, hydrogen, and the continued controversy regarding whether nuclear energy can be considered a sustainable technology for generating energy.

Hydrogen

Hydrogen, like electricity, is an energy carrier. Though a natural element, on earth hydrogen is bound with oxygen in the very strong bonds of water. To "liberate" hydrogen takes energy. Once liberated, the hydrogen is attracted to rebond with oxygen to again form water. The flow of electrons generated by this process is the basis for the electricity produced by fuel cells.

Critical questions regarding whether and how the U.S. should adopt hydrogen as a preferred carrier of its energy future include:

Is hydrogen a more efficient carrier of energy than electricity—enough so to justify massive investments in hydrogen carrying infrastructure?

How easily can existing fleets be adapted to use hydrogen, if at all?

What storage technologies will emerge as the standards for the marketplace – facilitating investments in fueling infrastructure?[879]

Can fuel cells that convert hydrogen to electricity both come down in price and find alternatives to premium metals as the catalyst?

Auto companies expect technology debates regarding hydrogen vehicle technology to continue until about 2015. Meanwhile, the question for your community is whether there are cost-effective ways to support the development of a hydrogen infrastructure as this technology develops.

Nuclear Power

Nuclear electricity can substitute for coal-fired generation as a utility baseload resource. Because the fissioning of nuclear material does not release GHG emissions (though the nuclear lifecycle releases large amounts), nuclear advocates claim that the technology is carbon neutral.

While some people are concerned enough about climate change to advocate using nuclear power as a coal substitute, most advocates do not consider nuclear to be a cost-effective substitute, a sustainable technology, or a viable solution. The first challenge with nuclear is its cost. New nuclear plants rival solar electric in price. Advocates claim that new varieties of reactors will be cheaper, but the past history of nuclear went, in the words of the Economist Magazine, "from too cheap to meter to too costly to matter."[880] Nuclear technology is also strongly proliferative of nuclear bombs. Spreading the domestic power technology around the world would certainly encourage more nations to develop weapons capability.[881]

The multi-generation liability of toxic waste still plagues the nuclear fuel cycle, even after a half-century of determined research. A litmus test: would

[879] Three distinct fuel systems continue to compete to become the preferred system for vehicles: pressurized hydrogen gas, hydrogen cooled to a liquid (becoming denser), and solid hydrogen fuel packs. For information on the latter, visit the website of Uni-Solar, which demonstrated solid hydrogen fuel packs in 2005: www.uni-solar.com, 30 October 2006.
[880] Economist magazine, August 27th, 2001.
[881] Lovins, A, Lovins, H, *Energy/ War: Breaking the Nuclear Link*, Friends of the Earth 1980.

your community be willing to site a new nuclear plant or waste dump nearby? New reactor designs may hold promise of reducing the likelihood of catastrophic accidents, but such accidents are only the tip of the iceberg of the unsustainable aspects of nuclear power. Given that few communities would undertake to construct a reactor on their own, this debate is likely to be irrelevant to a community energy plan.[882]

Primary Barriers to Address

There are hundreds of barriers that inhibit people from implementing energy systems that are preferable to what are in place now. The 1998 analysis of climate protecting opportunities, Climate Making Sense and Making Money[883] listed 60–80 specific market failures of 8 types:

1. Capital misallocation
2. Organizational failures
3. Informational failures
4. Regulatory failures
5. Value-chain risks
6. Perverse incentives
7. False or absent price signals
8. Absent markets

These include such market imperfections as:

Lack of clarity of benefits to local community

Lack of confidence in the numbers (payback, lifecycle costs) both with city departments and private businesses

Misalignment of the incentives that electric utilities see with the boader interests of the community

The lack of "communicators" who can help all stakeholders understand the benefits of renewable energy

Failure to acknowledge people's perceptions of risks and how those risks can be mitigated, or how risk perceptions can be reduced

Conservatism of banks and hesitancy to deal with renewable energy investment/loan opportunities.

Some local municipalities have zoning rules against solar panels & wind turbines

Three barriers are particular challenges:

The hassle factor
Things are working fine, why change them? Margaret Mead said that the only person who likes change is a wet baby. The challenges posed by climate change will dictate change. Cities that undertake such programs on their own timeline will enjoy a significant advantage. But overcoming the basic hassle factor will take inspired leadership.

The complexity factor
Why should the city government get involved in a complex field full of experts at utility and energy service companies? As this Manual has shown, utilities can be slow to move slowly towards a sustainable energy future for a variety of reasons, primarily including institutional momentum or skepticism, regulatory systems and their financial incentive structures. Utilities are critical economic development partners and can be encouraged to embrace the economic advantages of distributed and sustainable energy as part of rate-reduction strategy that will help your businesses become more globally competitive. Unless your utilities are taking a leadership role in sustainable energy, they will benefit from prompting – the nearly four-decade history of environmental activism with utilities demonstrates that not all the best ideas come from the "experts." In short, the issues are complex but can be grasped by talented citizen's committees for a sustainable energy future that will empower a community to take on matching production with end-uses, and maximizing the economic development benefits of keeping power generation dollars in the local economy.

The market challenges of distributed power (sustainable or not).

Distributed power generation located near the people who will use the power, and scaled to the size of consumption is a new concept for nearly all Americans. Key barriers to overcome through sustainable energy planning include:

[882] For more on the challenges of nuclear see Nuclear Information and Resource Service www.nirs.org, 30 October 2006.
[883] For a systematic discussion of such barriers and how to clear them see Lovins, A, Lovins H, Climate: Making Sense and Making Money, 1998, www.natcapsolutions.org/publications_files/climate_sense.pdf, 30 October 2006.

Reluctance of citizens or organizations to enter the power production business themselves and/or make long term utility-type investments

Reluctance of financial institutions to fund utility-type investments at competitive interest rates – especially of new technologies with little collateral value

Lack of information flow to all but highly motivated citizens

All of these barriers can be reduced through visionary planning that helps the community understand that its energy future should be in its own hands; that the experts do not have all the answers; and that the energy security and other benefits of a more sustainable approach are serious economic development advantages.

Early sustainable power technologies systems gained a reputation, (deserved or not) for poor performance/ excessive maintenance, safety, cost, aesthetics and provider reliability/ stability.

Like most pioneering technologies, sustainable energy efforts have suffered from some ideas being ahead of available materials, design or maintenance capabilities. Too many people remain stuck in that past rather than observing the almost daily maturation of sustainable energy systems. Modern renewable energy is a far cry from early systems. Public education is the remedy. Many communities sponsor sustainable living fairs or events that help citizens understand and welcome sustainable technologies.[884]

Conclusion

Cities and regions can plan for a sustainable energy future: maximizing renewable energy sources; using market forces to balance energy prices through inclusion of externalities in energy prices; and supporting renewable investments through favorable regulations and financing.

While much research and experimentation to determine the right strategy for your community, a significant community of sustainable energy planning practitioners and proven practices is already available to guide the efforts of your community. Modern technologies to save energy and generate renewable energy communities can profitably protect the climate and the economy.

[884] A leading example is the annual Community Sustainability Conference and Expo produced with multiple community partners by Fort Carson Mountain Post of the US Army in the three county Pikes Peak region of south-central Colorado, sems.carson.army.mil, 30 October 2006. Numerous other conference formats have been developed – such conferences are also strong economic development opportunities.

Additional Resources

Race to the Top: The expanding role of U.S. State Renewable Portfolio Standards, Prepared for the Pew Center on Global Climate Change, June 2006, Author: *Barry G. Rabe, University of Michigan*

This report builds on earlier Pew Center analyses of the evolving state role in climate policy development, placing a particular focus on the RPS experience to date. It presents an overview of this policy tool and examines key factors in both policy formation and implementation. This work considers the experience of all RPS states but devotes particular attention to five case studies: Texas, Massachusetts, Pennsylvania, Nevada and Colorado that illustrate both common themes and points of divergence among individual state programs. The analysis concludes with an examination of RPS performance to date and some of the leading opportunities and challenges facing future development.
www.pewclimate.org/global-warming-in-depth/all_reports/race_to_the_top/index.cfm

American Energy Initiative Report "The American Energy Initiative is a joint project of the Worldwatch Institute and the Center for American Progress focused on educating and inspiring the public and policymakers on the importance of renewable energy to the economic, environmental and national security of the United States. The report, American Energy: The Renewable Path to Energy Security, demonstrates the potential of renewable energy and energy efficiency and presents a practical policy agenda for achieving them."

A copy of the report is available on the web at:
http://americanenergynow.org/about/

Funding Opportunity - U.S. Department of Energy Grant, Solar America Initiative (SAI) Market Transformation: Solar City Strategic Partnerships. For incorporated cities with populations greater than 100,000. Application deadline: January 10, 2007
tinyurl.com/yyyxja, 2 November, 2006

Prince Edward Island Renewable Portfolio—Prince Edward Island is planning to produce 30% of its total energy needs from local, renewable resources by 2016.
www.nawindpower.com/naw/print.php?plugin:content.175

BioTown, USA—this project's long term goal is to meet all the energy needs of Reynolds, Indiana via biorenewable resources, including electricity, natural gas replacement, and transportation fuel
http://www.biotownusa.com/

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Chapter 5: Develop a Local Action Plan Long Term Initiatives **Education**

DOCUMENT CONTENTS

Education is one of the most important long-term initiatives that a city can use to address its greenhouse gas (GHG) emissions. Through education, a city gains greater engagement and support from the community to reduce carbon emissions. At the same time, education fosters critical thinking and nurtures the environmental leaders and experts of the future.

There is no right way a city should go about creating an education initiative, but many cities are trying different programs with great success. A few will be highlighted in case studies below. The most important thing to remember is that in order to create a successful education initiative, people must be interested, engaged and feel that they can take steps in their own lives to make a difference.

Community Education Initiatives

Initiatives to educate communities on climate change and GHG reduction include:

School Initiatives

Create a challenge for local schools to meet, such as reducing their school's energy use or reducing waste. Give the winning school or class a prize (such as a field trip, school event, award or prize related to reducing emissions). Some schools have offered faculty and students a share of the savings they achieved by shutting off unneeded lights and otherwise reducing energy waste. They have often been surprised by the size of the resulting savings. Similar programs can be offered to the facilities staff. Resulting awards can be used to increase staff salaries, hold a party or buy needed equipment for programs. Or even better, the savings can go into a fund to capitalize further savings.

School Curriculum

Develop a curriculum for schools focused on a specific grade, specific class or a course section for all grades. The curriculum can be either optional or mandatory. Focus on making the curriculum engaging and interactive.[885] The electric utility BC Hydro worked with schools in the Vancouver area to create a software program that students could use in their school to identify and capture energy savings, and another that they could take home to do an audit of their own houses.

Community Emissions Reduction Challenges

Create a community-wide goal. For example, Burlington, Vermont challenged the community to reduce carbon emissions 10% by 2010. Provide incentives, education and resources for participants. The more people know about the climate reduction program, the greater its likely success.

Distribute Educational Materials

Make educational materials widely accessible and engaging to all ages and groups.

Museum and Science Centers

Encourage local museums and science centers to include interactive, hand-on displays on climate change and its relation to energy use. Encourage and provide incentives to local schools to take students to visit.[886]

Engage Community Stakeholders

Successful education programs incorporate local groups, experts and activists in all stages of the planning and implementation processes. Refer to Chapter 5, Stakeholder Engagement section for more information and resources.

Community Education

CASE STUDY: Burlington, VT

In May of 2000, the City Council of Burlington adopted a Climate Action Plan aimed at reversing the steady growth of GHG emissions in the city of Burlington. In April of 2002, the 10% Challenge program was launched as a joint effort between the Mayor's task force and community leaders. The goal of the program was to encourage individuals, households and businesses to reduce GHG emissions and to educate communities in and around Vermont on the threat of global climate change to the environment and the economy. The program's goal is to reduce GHG emissions by 10% below 1997 emissions levels by 2010.[887]

Since the program's launch, 93 businesses and 1,200 residences have begun to reduce their global warming pollution. Many cities near Burlington have also joined the 10% Challenge. Employees in municipalities are encouraged to create energy saving initiatives such as making thoughtful decisions regarding consumption of office products, turning office equipment on to "sleep" mode when not in use, purchasing Energy Star equipment and buying office supplies in bulk whenever possible. [888]

The 10% Challenge provides the tools and the information people need to conserve energy at home and at work.

An online emissions calculator helps businesses and residence calculate their current annual greenhouse gas emissions and their target emissions. Resources on the website give participants ideas on how they can meet their goals. The program also provides incentives and awards for participants who meet their 10% goal.

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[885] For ideas on school curriculum see resources at end of this document.
[886] For more information and ideas for museum and science center displays see, globalwarmingcalifornia.net/museums.htm, 5 October 2006.
[887] Clean Air—Cool Planet, www.cleanair-coolplanet.org/for_communities/behavior_change.php, 29 September, 2006.
[888] The 10% Challenge. www.10percentchallenge.org/, 5 October 2006.

Community Education

CASE STUDY: Telluride, CO

The Town of Telluride, Colorado launched the "Telluride Unplugged" Initiative in 2006. Telluride Unplugged was a 6-week campaign focused on educating and engaging the public about what they can do to reduce carbon emissions. As a signer of the U.S. Mayor's Climate Protection Agreement, Telluride's initiative is part of its effort to reduce GHG emissions 7% by 2012.[889]

Each week of the event focuses on a different area, with themes ranging from energy efficient lighting to food to transportation.

The first week's introduction began with a free screening of Al Gore's "An Inconvenient Truth" and a call for residents to calculate their carbon footprint to provide each person with a baseline for setting individual reduction goals. Carbon footprint calculation worksheets were made available at the public library, town hall and the local farmer's market, as well as online.

According to Karen Guglielmone, a Telluride public works official, "Telluride Unplugged is the beginning of Telluride government trying to engage the broader community in its efforts to reduce our carbon footprint."[890]

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Community Education

CASE STUDY: SYNERGY, Actus Lend Lease

SYNERGY, which stands for Saving Your Nation's Energy, is an Actus Lend Lease[891] program that strives to reduce energy consumption through community-based education efforts, portfolio-wide technological solutions and symbiotic partnerships with our stakeholders. SYNERGY is the only program in the real estate industry to take this kind of comprehensive approach to the reduction of energy usage—with a focus on both building efficiency and behavioral modification.

SYNERGY has helped residents, businesses and organizations throughout the country make substantial savings in energy use.

At Fort Campbell (Kentucky) and Fort Hood (Texas), SYNERGY has assisted in reducing energy consumption by as much as 12% over the same month the prior year. At Fort Drum (New York), electricity costs plummeted $13,000 (or 14%) from May 2006 to June 2006 as SYNERGY community programs and educational efforts got underway.[892]

Sample efforts include:

Distributing and reviewing conservation tips with all new residents

Making all resident activities "green" (see the EPA's Guide to Green Events)
Financially rewarding consumption below the DOE's normalized baseline

[889] Town of Telluride, www.town.telluride.co.us/home/index.asp?page=2, 5 October 2006.
[890] Katie Klingsporn, "Town Launches Unplugged Campaign." Telluride Daily Planet, Oct. 1, 2006. www.telluridegateway.com/articles/2006/10/02/news/news01.txt, 5 October 2006.
[891] Actus Lend Lease, www.actuslendlease.com/, 5 October 2006.
[892] Full Case Study archived, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/Education/ActusLendLease_Synergy.pdf, 5 October 2006.

Providing children's activity books, complete with energy conservation checklists and prizes for completion

Partnering with national zoo educational staff to use characters in activity books that promote endangered species awareness and protection

Providing free technology, like COSMEO from Discovery Learning, to residents to test energy management behavior modification

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Community Education

CASE STUDY: State of Maine

The Maine Energy Education Program (MEEP)[893] is a non-profit organization begun in 1985 with the goal of helping citizens understand energy concepts so that they will be capable of making informed energy decisions. MEEP has developed various free projects and workshops for 4th through 12th grade teachers to implement in the classroom. MEEP's Green Schools Program gives students the chance to monitor the energy use of their school. Classrooms are given incentives to win energy challenges and to save their school's energy and money.

For example, in the Vending Mi$er Challenge, classes are lent a "Vending Miser" which saves energy by cycling down vending machines compressor when it is not in use. The class monitors the amount of energy used by the vending machine without the miser and with the miser and then calculates the energy savings (usually around 50%). If the class presents their findings to the administration or facilities, MEEP will donate a Vending Miser to the school.

Another one of MEEP's most popular projects is the Model Solar Car Competition where students actually build their own solar cars and then race them in a competition. As of 2006, eight to ten communities in Maine are involved in MEEP.

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[893] MEEP Homepage, www.meepnews.org, 5 October 2006.

Community Education

CASE STUDY: Albuquerque, NM

Albuquerque's education for a sustainable community[894] was a concept developed in 1975 due to growing concern over the city's explosive growth and the effects such expansion could have on the quality and supply of water, open space, waste disposal community as well as by schools. The hands-on interpretive approach of the book is designed systems, the built environment and the general quality of life. The city of Albuquerque, Albuquerque Public Schools and local volunteers produced a teacher's resource book on environmental education. The final product, *Albuquerque's Environmental Story* (AES), was first printed in 1978.

AES quickly became more than a teachers' resource book, and served as a basis for a unique environmental education program for use by the general adult to heighten readers' awareness, enhance their capacity to enjoy the beauty surrounding them and to develop a sense of social and environmental stewardship in readers. AES is interdisciplinary and stresses critical thinking. It is structured to add relevance to and augment the teaching of basic skills for young students.

The authors deal with the basic problem of adding environmental education to an already crowded curriculum by making it possible to infuse these materials easily into the existing required curriculum. Educators who have used the book have found this to be an approach that promotes awareness, knowledge, valuing and responsibility, while making the prescribed curriculum more interesting.

The second and third editions of AES were published in 1985and1996. Even though there are no newer published editions, the online version is frequently updated and many local schools still use AES as a part of their curriculum. In addition, the AES has served as a model for many other cities and has been replicated with success in southern Florida in *The Dade County Environmental Story* and *The Florida Key's Environmental Story*. Albuquerque's website provides information on how to replicate a resource book in your community and allows you to view the text of *Albuquerque's Environmental Story.*[895]

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djones@cabq.gov

[894] Albuquerque's Environmental Story, www.cabq.gov/aes/index.html, 5 October 2006.
[895] How to Create your own Community's Environmental Story, www.cabq.gov/aes/process/index.html, 5 October 2006.

Additional Resources

School Initiatives and Curriculum:

- California Climate Change and Energy, Education Resources Catalog globalwarmingcalifornia.net/k12.htm
- Clean Air Kids www.clean-air-kids.org.uk/information.html
- Climate Change Education.Org. Website dedicated to education on global warming and climate change. Offers science, solutions, curriculum and resource directory www.climatechangeeducation.org

Hike & Bike Challenge
www.environmentalsociety.ca/hikebike/how-to.html

The Sierra Club has released a guide, "Cool Cities: Solving Global Warming One City at a Time." The guide explains the steps toward making cities "cool" and tells success stories from a broad range of cities, from greening municipal vehicle fleets with hybrid cars in Houston and Charlotte; energy efficient street lights and buildings in Salt Lake City and Scottsdale, Arizona; to renewable energy investments in Waverly, Iowa and Columbia, Missouri. The guide is available online at www.sierraclub.org/globalwarming/coolcities.

Maine Energy Education Program
home.psouth.net/~meep/

Community-Based Projects to Help Reduce Greenhouse Gas Emissions
www.mb.ec.gc.ca/info/news/cc01s43.en.html
www.on.ec.gc.ca/announce.cfm?ID=679&Lang=e

Texas State Energy Conservation Office, Energy Education Links
www.seco.cpa.state.tx.us/sch-gov_ed-links.htm

Museum and Science Center Resources:
Marian Koshland Science Museum, Washington, D.C.
www.koshland-science-museum.org/exhibitgcc/index.jsp

Alliance to Save Energy, Green Schools Program
www.ase.org/section/program/greenschl

Students Leading the Way 2004-2005: Energy Saving Success Stories from California's Schools
www.ase.org/images/lib/educators/Success%20Book%2005.pdf. Also archived: www.natcapsolutions.org/ClimateManual/Cities/Chapter5/LongTermInitiatives/Education/CASchools_energysavings.pdf, 5 October 2006

Science Museum of Virginia
virginia.science.museum/Education/MiniMarine.html

The Colorado Energy Science Center School Program teaches students about the sources of energy and the economics and environmental issues associated with energy use. For the 2006-2007 school year, CESC offers the following programs to students, teachers and schools:

- **Energy Hog Traveling Road Show**—interactive school assembly program that teaches 3rd-6th grade students about the sources of energy, how we waste energy and how to conserve energy www.energyscience.org/education/EnergyHog/index1.htm
- **Energy Science in the Home:** Hands-on Activities for the Middle Grades—inquiry-based program that helps students explore the dynamics of home energy use through investigations that integrate math, science and economics
- **Home Energy Investigation Contest** event for middle and high school students which is a project-based learning experience to investigate home energy use; home energy efficiency, and; improvements in home energy efficiency www.energyscience.org/education/homeenergy/index.html
- **Special Projects** for 2006-2007 www.energyscience.org/education/Special.Projects.html
- www.energyscience.org/education/index.html

Chapter 5: Develop a Local Action Plan Long Term Initiatives **Waste Management**

DOCUMENT CONTENTS

This process of generating garbage and what becomes of it when it is thrown away produces greenhouse gases (GHGs) in a variety of ways. There is an enormous amount that a community can do to reduce the waste that it produces. Helping citizens reduce waste is part of a program to protect the climate.

In 2003 the U.S produced more than 236 million tons of Municipal Solid Waste (MSW), or trash. This is equal to approximately 4.5 pounds of waste per person per day.[896] *The sources of waste generation break down as follows*[897]*:*

- *Paper: 35.2%*
- *Yard Trimmings: 12.1%*
- *Food Scraps: 11.7%*
- *Plastics: 11.3%*
- *Metals: 8.0%*
- *Rubber, Leather, and Textiles: 7.4%*
- *Glass: 5.3%*
- *Wood: 5.8%*
- *Other: 3.4%*

The United States Environmental Protection Agency (EPA) website explains:

The anaerobic decomposition of waste in landfills produces methane.

The incineration of waste produces CO_2 as a by-product.

The transportation of waste to disposal sites produces GHGs from the equipment's fuel combustion.

The disposal of materials indicates that new products are being produced as replacements; this production often requires the use of fossil fuels to obtain raw materials and manufacture the items."[898]

EPA describes four main stages of product life-cycle (raw material acquisition, manufacturing, recycling, and waste management) and illustrates how they connect with GHG emissions. Similarly,

[896] If all forms of the materials flow required to produce what Americans use are counted, including all of the water, gasses and mine tailings, it amounts to 20 times your body weight for every American every day. Yet of all of this stuff, less that 1% is ever embodied in a product and is still there six months after sales. All the rest is waste. For more information on the staggering amounts that we waste, see Hawken, Lovins and Lovins, Natural Capitalism, P52, Little Brown, 1999.
[897] These are 2003 numbers courtesy of EPA Municipal Solid Waste Facts www.epa.gov/msw/facts.htm, 30 September 2006.
[898] U.S. EPA Global Warming, yosemite.epa.gov/oar/globalwarming.nsf/content/ActionsWasteBasicInfoGeneral.html, 5 October 2006.

reducing this waste (through source reduction, recycling and composting) can reduce the methane emitted from landfills, GHG emissions from incinerators, and carbon dioxide emitted from energy consumption. Using fewer wood and paper products decreases deforestation and can result in increased capacity of forests to sequester carbon.[899]

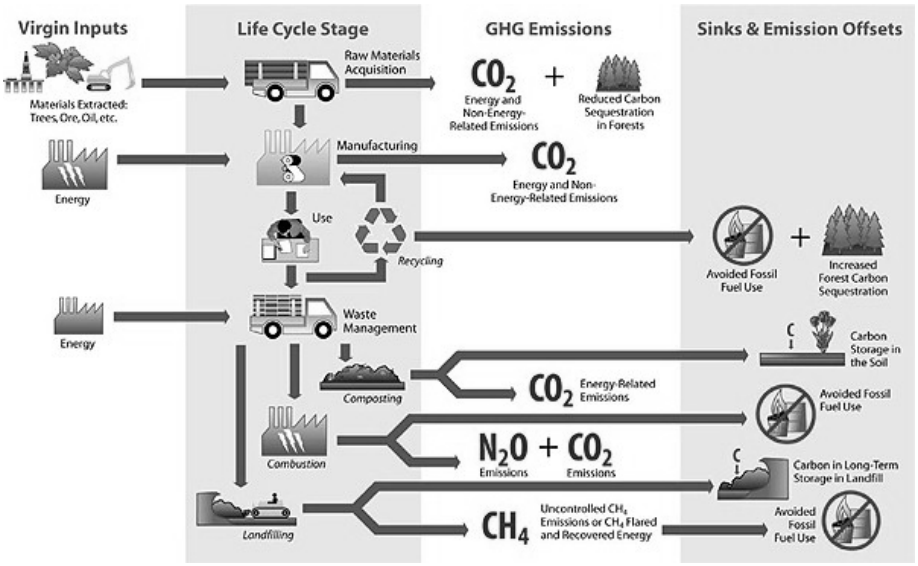

Figure: United States Environmental Protection Agency[900]

Strategies for Municipal Solid Waste Management

There are several management strategies for cities to consider in reducing their waste generation:[901]

Source Reduction

Recycling/ Composting

Incineration/ Combustion

Landfill

Source Reduction

Source reduction is a management strategy to reduce the amount of waste generated from the beginning. These initiatives include altering the design, manufacture and use of materials to decrease the amount of materials that are sent to the landfill. Although cities cannot dictate these practices throughout the community, there are ways to educate businesses and residents to enable them to institute practices that eliminate waste before it is created. One approach is to implement environmental purchasing policies. These policies and practices for municipal operations are described in the Best Bets Section of Chapter 5. Cities can also encourage local businesses to create products in more environmentally friendly ways. Approaches like Design for Environment, and lean manufacturing are gaining in popularity, in part because they reduce the cost of producing goods.[902]

Recycling/ Composting

Much of the focus of MSW management is on diverting waste that is sent to the landfill after it has already been created or disposed of. According to the EPA, recycling and composting diverted 72 million tons of material away from disposal in 2003 - up from 15 million tons in 1980, when the recycle rate was just 10% and 90% of MSW was being landfilled.

[899] U.S. EPA, yosemite.epa.gov/oar/globalwarming.nsf/content/ActionsWasteBasicInfoGeneral.html, 6 October 2006.
[900] U.S. EPA, yosemite.epa.gov/oar/globalwarming.nsf/content/ActionsWasteBasicInfoGeneralLifeCycle.html, 6 October 2006.
[901] EPA Municipal Solid Waste Facts www.epa.gov/msw/facts.htm, 30 September 2006.
[902] For more information on Design for Environment see: www.epa.gov/dfe/. For more information on lean manufacturing see: www.sme.org/leandirections and www.isixsigma.com/me/lean_manufacturing/, 15 January 2007.

Recycling

Materials that are recycled include batteries, recycled at a rate of 93%, paper and paperboard at 48%, and yard trimmings at 56%. Some cities provide curbside recycling programs drop-off centers, buy-back programs and deposit systems.[903] Recycling reduces GHG emissions at two levels: emissions from landfill or incineration and emissions saved from avoiding further need for the virgin material. Energy savings that can be achieved from recycling depend in part on energy intensity of virgin versus recycled material, but range as illustrated by the table below.

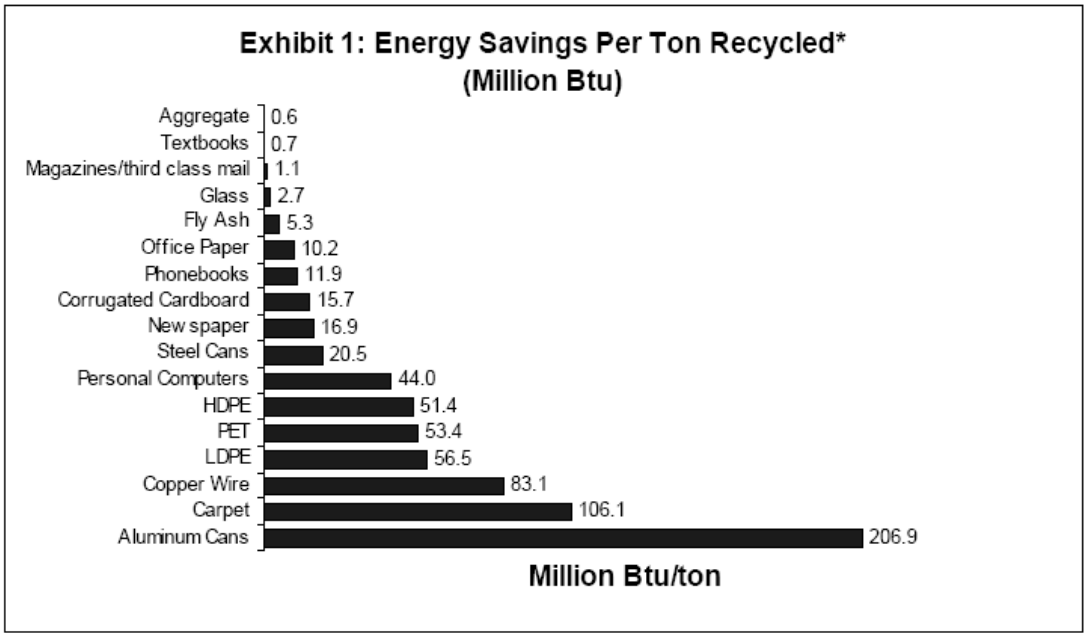

Table: EPA Waste Management and Energy Savings: Benefits by the Numbers[904]

Composting

Composting is the process of diverting organic waste from the landfill, enabling it to be converted to a soil amendment and using it as fertilizer. Not only does this keep the material from rotting in the landfill and releasing methane, but it reintroduces the carbon to the soil where it can be held for years. Since 1997 the city of Clifton, New Jersey has been actively engaged in educating citizens about waste reduction and climate change. As part of this, the city promotes backyard composting and leaving grass clippings on the lawn. An education campaign explains that, "for every 7.4 tons of materials the city composts, it decreases greenhouse gas emissions by an amount equal to the annual emissions of one car." Due to composting grass and food waste, the city estimates citizens have reduced GHG emissions equivalent to 582 cars' annual emissions.[905]

Yard trimmings and food residuals together constitute 23% of the U.S. municipal solid waste stream.[906] Compostable material includes[907]:

[903] Ibid.
[904] Choate,A., Pederson, L. ,Scharfenberg, J. (ICF Consulting) & Ferland, H,(U.S. Environmental Protection Agency). "Waste Management and Energy Savings: Benefits by the Numbers." yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/TMAL6GDR3K/$File/Energy%20Savings.pdf, 6 October 2006.
[905] "City of Clifton: Education is Key to Reducing Climate Change" www.epa.gov/wastewise/pubs/clifton.pdf#search=%22climate%20change%20composting%22, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/WasteManagement/Clifton_WasteWise.pdf, 19 October 2006.
[906] EPA Composting website, www.epa.gov/epaoswer/non-hw/composting/index.htm, 4 October 2006.
[907] EPA Composting website, www.epa.gov/epaoswer/non-hw/composting/basic.htm, 4 October 2006.

- Animal manure
- Cardboard rolls
- Clean paper
- Coffee grounds and filters
- Cotton rags
- Dryer and vacuum cleaner lint
- Eggshells
- Fireplace ashes
- Fruits and vegetables
- Grass clippings
- Hair and fur
- Hay and straw
- Houseplants
- Leaves
- Nut shells
- Sawdust
- Shredded newspaper
- Tea bags
- Wood chips
- Wool rags
- Yard trimmings

Compost programs can be carried out differently depending upon the cities' needs. Common composting methods include source separation of organic compostables done by residents or businesses and separation of mixed waste streams at a centralized location. Major concerns in any composting program include the quality of the compost produced, the cost, and residential involvement.

According to Cornell Waste Management Institute Fact Sheets on Composting:

> There are several trade-offs between source separation and centralized separation of compostables. It is clear that source separation can produce a higher quality, less contaminated compost, as well as maximize the recycling of glass and paper. And while source separation is generally less convenient for the waste generator, pilot programs are finding that many generators like to do it. However, two other important factors, the overall system cost and the quantities of materials recovered for recycling and composting, have not yet been adequately researched or evaluated.[908]

Although it is generally believed that mixed waste collection leads to in increased participation, the results are not conclusive. A few pilot studies have shown that programs requiring separated compostables can have high participation rates as well. For example, projections for materials diverted from landfills for separated streams usually range from 25-50%. Fillmore County in Minnesota has exceeded these projections with 50% compostable diversion rate with an additional 15-20% for recycled material.[909]

Obtaining residential and business involvement is clearly important to maximize the success of composting programs. To educate and encourage participation, the city of Santa Clara offers a master composter training course. The program started in 1995 to educate residents in starting and maintaining home compost. Upon completing the program, master composters are required to volunteer 50 hours to conduct composting workshops and educational outreach in their community. In the past 10 years, the program has trained 275 people, who have collectively donated over 24,000 hours of volunteer time.[910]

Incineration/ Combustion

According to EPA, "To reduce waste volume, local governments or private operators can implement a controlled burning process called combustion or incineration. In addition to reducing volume, combustors, when properly equipped, can convert water into steam to fuel heating systems or generate electricity. Materials can be removed for recycling prior to incineration facilities."[911]

Burning MSW can generate energy while reducing the amount of waste by up to 90% in volume and 75% in weight. In 2001, there were 97 combustors in the United States with energy recovery with the capacity to burn up to 95,000 tons of MSW per day.

While scrubbers and filters can reduce pollutants emitted into the air, incineration still produces carbon dioxide as a by-product, as well as other harmful emissions.

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[908] Tom Richard, Municipal Solid Waste Composting Fact Sheet, Cornell Waste Management Institute, compost.css.cornell.edu/MSWFactSheets/msw.fs1.html, 4 October 2006.
[909] Tom Richard, Municipal Solid Waste Composting Fact Sheet, Cornell Waste Management Institute, compost.css.cornell.edu/MSWFactSheets/msw.fs3.html, 4 October 2006.
[910] Santa Clara County Composting, www.sccgov.org/portal/site/iwm/menuitem.244564f66e6d425580b558bb35cda429/?path=%2Fv7%2FIntegrated%20Waste%20Management%20%28DIV%29%2FHome%20Composting, 4 October 2006.
[911] EPA Waste, www.epa.gov/epaoswer/non-hw/muncpl/landfill/sw_combst.htm, 5 October 2006.

Environmental impacts of MSW-fired power generation plants include:

- Air emission impacts[912]
- Water Resources
- Water Discharge
- Solid Waste
- Land Use Resources

Types of incinerators include:[913]
Modular incinerators, which burn 15-100 tons per day, are small mass burn plants. The main advantage to this system is flexibility - if more capacity is needed, more units can be added onto existing ones. Costs limit the use of this technology because the payback in terms of energy produced over time is much lower than in mass burn plants.

Mass Burning Systems, which burn 200-750 tons per day per unit. The resulting steam can be used for industrial uses or generating electricity. These can combust without any preprocessing or separation, although most mass burn plants can remove non-combustible steel and iron for recycling before combustion using magnetic separation processes. Other non-ferrous metals can be recovered from the leftover ash.

Refuse-derived fuel systems process solid waste before it is burned. A typical plant will remove non-combustible items, such as glass, metals and other recyclable materials. The remaining solid waste is then shredded into smaller pieces for burning. RDF plants require significantly more sorting and handling than mass burn, but can recover recyclables and remove potentially environmentally harmful materials prior to combustion. RDF can be burned in power boilers at factories or even at large housing complexes.

Landfill

The number of landfills in the United States is steadily decreasing—from 8,000 in 1988 to 1,767 in 2002. The capacity, however, has remained relatively constant. New landfills are much larger than in the past.[914]

According to the EPA, MSW landfills are the largest source of human-related methane emissions in the United States, accounting for about 25% of these emissions in 2004. These methane emissions from landfills represent a lost opportunity to capture and use a significant energy resource. Landfill gas (LFG) is created as organic solid waste decomposes in a landfill. This gas consists of about 50% methane (CH_4), the primary component of natural gas, about 50% carbon dioxide (CO_2), and a small amount of non-methane organic compounds.[915] [916] [917] Projects to capture and use landfill gas are explained and examples provided in Chapter 5, Best Bets, Municipal Infrastructure Section.

[912] The average air emission rates in the United States from municipal solid waste-fired generation are: 2988 lbs/MWh of CO2, (it is estimated that the fossil fuel-derived portion of carbon dioxide emissions represent approximately one-third of the total carbon emissions) 0.8 lbs/MWh of sulfur dioxide, and 5.4 lbs/MWh of nitrogen oxides. U.S. EPA, *Compilation of Air Pollutant Emission Factors (AP-42)*, taken from the www.epa.gov/ttn/chief/ap42/, 15 October 2006.
[913] Keep America Beautiful, www.kab.org/partners.asp?id=538&rid=539#MB, 15 October 2006.
[914] To learn more about methane emissions from landfills in the U.S., visit EPA's methane emissions and sources page, www.epa.gov/methane/sources.html, 4 October 2006.
[915] EPA Methane, www.epa.gov/methane/sources.html, 4 October 2006.
[916] For more information on methane emissions from landfills internationally, visit EPA's International Analyses, www.epa.gov/nonco2/econ-inv/international.html, 4 October 2006.
[917] EPA LMOP, www.epa.gov/outreach/lmop/overview.htm, 4 October 2006.

Municipal Solid Waste Management

CASE STUDY: Rapid City, SD

With the realization that their landfills were quickly filling Rapid City, South Dakota, initiated an aggressive composting and recycling programs. A Solid Waste Plan was first passed by the City Council in 1992, but it was not until 2003 that the plan became fully operational.[918] According to Barbara Petroff, project manager for USFilter's IPS Composting System, which was used in the facility, these efforts will extend the life of the landfill by 30 years and enable the city to avoid the purchase of over 1,000 additional acres.

The system composts wastewater biosolids, food, paper, yard waste and other organic residuals and is designed to convert 213 tons of waste into compost per day. A chemical scrubber and biofilter treat the processed air generated at the composting building to remove odors. The city sells the compost for use in golf courses, nursery potting soil, reclaiming land and other applications, for about $20-30 yard. These sales help pay for operating the compost facility, which uses no tax dollars to maintain operations.[919]

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Municipal Solid Waste Management

CASE STUDY: Northwest Indiana

In 2004, the Northwest Indiana Solid Waste District Board[920] began offering education grants for schools in the six-county district. The funds are available for schools to support waste reduction education and recycling. $30,000 is appropriated each year with each county receiving up to $5,000. This augments funding the district has had available for cities and towns since 1997.

Each year, the District Board allocates $120,000 for the Cities and Towns Grant Program to implement or expand waste management programs that coincide with the District's objectives for waste reduction.[921] The purpose of the grant is to support integrated waste management programs around source reduction, recycling, composting and education. $20,000 is allotted for division among the successful applicants from each county. Cities and towns must match grants given by the board by 25%; however, education grants given to schools do not have a matching requirement.

The Board is involved in outreach and education projects throughout the district. Funding for the Board and for grants comes from landfill tipping fees collected in the district. The District encourages creativity and

[918] Rapid City Solid Waste Operations, www.rcgov.com/pubworks/solidwaste/04_solidwaste_report.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/WasteManagement/RapidCity_solidwaste_report.pdf, 19 October 2006.
[919] Turning Cash into Trash, www.dnrec.delaware.gov/NR/rdonlyres/BB472D80-ECCC-4397-9EAF-B7BE6A544A9E/63/RapidCitySDTurningTrashIntoCashcomposting.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/WasteManagement/RapidCity_TurningTrashIntoCash.pdf, 4 October 2006.
[920] Northwest Indiana Solid Waste District, www.nwiswd.org, 5 October 2006.
[921] Northwest Indiana Solid Waste District Grants, www.nwiswd.org/grants/citiesandtowns.pdf#search=%22cities%20waste%20reduction%20goals%22, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/WasteManagement/NorthwestIndiana_grants.pdf, 4 October 2006.

unique planning for projects. A short list of some suggestions is provided here:

Starting a curbside recycling program–purchasing bins and promotion

Starting a drop-off recycling program–purchasing equipment and promotion

Starting a yardwaste collection program–purchasing equipment and promotion

Starting a backyard composting program–organizing a sale of bins and education

Equipment purchases–to expand current recycling or waste reduction programs

Market enhancement activities–organizing events to promote recycled items

Educational or promotional activities–fairs, festivals, etc.

Buying recycled products–large items for public places to promote recycled items

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Municipal Solid Waste Management

CASE STUDY: Palo Alto, CA

The city of Palo Alto, California adopted a Zero Waste Resolution in 2005. The goal is to divert 73% of their waste by 2011 and 100% by 2021.[922] The Council also adopted the Zero Waste Strategic Plan as guidance for city staff to achieve the goals.[923]

In 2003, the total tons generated were 166,548. The current city diversion rate of 57% equals about 95,000 tons per year. To achieve its goals for 73% diversion by 2011 as part of a Zero Waste Strategic Plan, the city needs to divert an additional 26,000 tons per year of materials.

Current processing, transfer and disposal costs are about $82.50/ton. On that basis, the avoided costs of processing, transfer and disposal for this additional 26,000 tons would be approximately $2.1 million/year.

Based on assumptions detailed in its strategic management plan, the city estimates that diverting this amount will result in an overall savings of over $800,000 per year.

The Strategic Management Plan suggests city programs, policies, rates, and financial and contractual commitments should be adjusted to help achieve the Zero Waste goal as follows:

Encourage All Sectors to Implement Zero Waste.

Develop Infrastructure Beyond Recycling.

Lead by Example and Advocate Zero Waste.

Update Waste Data and Develop Zero Waste Operational Plan.

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[922] Palo Alto Zero Waste Resolution, www.city.palo-alto.ca.us/zerowaste/documents/zw-Palo_Alto_ZW_Resolution.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/WasteManagement/Palo_Alto_ZW_Resolution.pdf, 4 October 2006.
[923] Palo Alto, Zero Waste Strategic Plan, www.city.palo-alto.ca.us/zerowaste/documents/Strategic_Plan_FInal_100405.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/LongTermInitiatives/WasteManagement/PaloAlto_Strategic_Plan.pdf, 4 October 2006.

CASE STUDY: San Jose, CA

San Jose has been one of the leaders in creating incentives for reducing waste by implementing "pay as you throw"[924] policies. Citizens are charged to dispose of garbage and the rate is based on the size of garbage carts. Recycling is unlimited at no charge.

As San Jose website states "By recycling as much as you can, you will be able to use the smaller garbage cart sizes, which cost less."[925]

San Jose is one of the few cities that recycles more than 64% of their solid waste. Since the curbside recycling started the city has recycled:

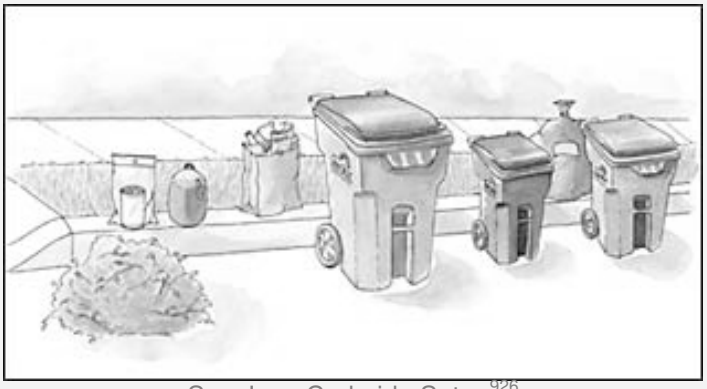
372,000 tons of newspaper

277,000 tons of mixed paper

132,000 tons of glass

135,000 tons of mixed recyclables

1,900,000 tons of yard trimmings



San Jose Curbside Setup[926]

CONTACT

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CleanNGreen@sanjoseca.gov

Tools for Community Waste Prevention

The community waste prevention toolkit was created by INFORM to help a city walk through eight key questions: [927]

1. **Who is responsible for waste disposal, recycling, and waste prevention in your area?**
   - Which political subdivision (e.g., the city, town, county, etc.) is responsible for solid waste prevention, recycling, and disposal policies and programs? What role does the state play in solid waste regulation, funding, etc?
   - Which specific agency or office is responsible for overseeing solid waste prevention, recycling, and disposal? Who heads it? To whom does this agency report on its operation? Are any other governing bodies involved in an

[924] EPA Pay as You Throw Program www.epa.gov/payt/, 4 October 2006.
[925] San Jose Pay as you Throw Program, www.epa.gov/epaoswer/non-hw/payt/tools/ssanjose.htm, 5 October 2006.
[926] San Jose Curbside Setup, www.recycleplus.org/images/curb_setout_lg.jpg, 4 October 2006.
[927] INFORM, www.informinc.org/cwp_03.php, 4 October 2006.

oversight or funding capacity?
- Who is the community (and state) waste prevention program manager? If there is no such position, who is the recycling coordinator? Is promoting waste prevention officially part of his or her job responsibility? Does the community have any additional staff devoted to waste prevention programs and policy development? What are their responsibilities?

2. **What is the size of the waste challenge?**
   - How much waste does the community/state generate each year, either by weight (tonnage) or volume (cubic yards)? Are waste generation rates increasing, as they are nationally? Where is this information published? How much waste did the community/state generate in the most recent year? What is the trend in generation over the last five years? Absolute waste and waste per capita? What is projected for the next five? Absolute and per capita?

3. **What goals have been set for waste generation, disposal, recycling, and waste prevention?**
   Do specific goals for waste prevention exist? Are they distinct from goals for recycling? How do the goals compare to other state or municipal goals? Have the recycling and waste prevention goals been met? How much waste prevention is projected over the next five years?

4. **How does the community handle its waste?**
   - Is it collected by the municipality or by private carters? Is waste generated by residents, institutions and businesses handled differently? How much waste goes to landfill, to incineration, and to recycling? What are the landfill, incineration and recycling trends over the last five years? What is projected for the next five years?

5. **What waste prevention strategies are being used?**
   - Does the community operate or fund any materials reuse programs, such as drop-off sites, a telephone hotline or a web site facilitating donations and/or exchanges of furniture, appliances, office equipment, art supplies and other items that can be reused?
   - Has the community or state banned curbside collection or disposal of certain items such as tires, batteries, yard waste, appliances and computer monitors in order to promote reuse and recycling?
   - Does the community operate or fund on-site composting, "leave-it-on-the-lawn," or other waste prevention programs for grass, leaves, food scraps, and other types of organic materials? Does it help residents to set up their own backyard composting systems? Do any public offices or institutions compost their own waste?
   - Does the local government have a program to send surplus items to other public offices or institutions for reuse? Does it operate a surplus warehouse? How does the government agency in charge of the surplus program publicize the availability of reusable items to potential recipients? Is the warehouse easily accessible to government employees? Are available items listed on the Internet?
   - Do local schools and other public institutions with food service facilities use reusable dishes and/or cutlery? If not, do they have access to (and space for) dishwashing equipment? How much are they paying to buy and dispose of single-use items?
   - Are leftover paint, carpet, fixtures and other items from construction projects diverted to other community projects?

6. **How does the community educate the public about waste prevention and recycling?**
   - Are there any ad campaigns devoted specifically to waste prevention? Are any written materials provided to residents, businesses and public institutions? How are they disseminated?

7. **What is the waste economic picture?**
   - How much of the community's budget is used to pay for solid waste collection, processing, and disposal (tipping fees)? What is the budget for waste prevention (beyond what is available to promote recycling)? Is the waste prevention budget commensurate with the portion of waste it is expected to address? What is the cost per ton of the community's waste prevention, recycling and disposal programs?
   - Does the community provide residents, businesses, and/or public institutions with economic incentives to reduce their generation of waste? For example, do residents, businesses or public institutions pay for disposal based on the amount of waste they generate?

8. **What laws and public policies promote waste prevention?**
   - Has the local or state government adopted any goals or mandates for reducing the amount of waste generated (in addition to recycling goals and mandates)? What are the respective timeframes for reaching these goals or mandates? How does the community plan to measure whether waste reduction goals or mandates have been met?
   - Has the community or state passed any legislation promoting waste prevention, such as mandatory bottle deposits or requirements that product manufacturers collect electronics, batteries, carpeting or other items for reuse or recycling (considered to be "extended producer responsibility" requirements).
   - Has the locality enacted any executive orders or laws directing government agencies to practice waste prevention and/or environmentally preferable purchasing? Are public agencies encouraged to use products powered by alternatives to batteries or to use rechargeable batteries?
   - Do public agencies use duplexing copiers and printers, remanufactured laser toner cartridges and other waste-reducing products? Who is in charge of the community's EPP program?
   - Does the local government encourage vendors to practice waste prevention? For example, have government contracts been written to give preference to or require vendors to ship their products in bulk or reusable containers?
   - Does the local government or state provide incentives for businesses to practice waste prevention? For example, does it provide financial support to businesses that want to acquire dishwashing equipment? Is technical support available to facilitate waste prevention among businesses? Does the community reward or publicize companies that encourage waste prevention (for example, by taking back hangers and packaging material for reuse)?

Additional Resources

List of **Waste Management Resources**
www.dnrec.delaware.gov/SWMTWG/Documents.htm

EPA WasteWise Program
WasteWise is a free, voluntary, EPA program through which organizations eliminate costly municipal solid waste and select industrial wastes, benefiting their bottom line and the environment. WasteWise is a flexible program that allows partners to design their own waste reduction programs tailored to their needs.
www.epa.gov/wastewise/

EPA Waste Reduction Model (WARM)
EPA online calculator created to help solid waste planners and organizations track and voluntarily report greenhouse gas emissions reductions from several different waste management practices.
yosemite.epa.gov/oar/globalwarming.nsf/content/ActionsWasteWARM.html

U.S. Composting Council
The USCC is a trade and professional organization promoting compost. They are involved in research, public education, composting and compost standards, expansion of compost markets and the enlistment of public support.
www.compostingcouncil.org/index.cfm

Grassroots Recycling Network Zero waste Briefing Kit,
www.grrn.org/zerowaste/kit/briefing/index.html

Conversion facility, fermentation to methane
www.jgpress.com/archives/_free/000479.html

Gasification for Power Generation
www.alamedapt.com/newsroom/reports/finalgasification.html

Toronto Study on New Technologies—good brief descriptions
www.toronto.ca/wes/techservices/involved/swm/net/pdf/overview_net.pdf

UC Davis Review of New Technology
biomass.ucdavis.edu/pages/reports/Conversion-PhaseI_IWM-C0172.pdf

City of Berkeley Resolution
No. 62,849–N.S, Adopted March 22, 2005
Reaffirming the city's zero waste goal and referring the issue to the solid waste commission.
www.ci.berkeley.ca.us/sustainable/government/62849.pdf
For more resources, check the footnotes of this document.

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Chapter 5: Local Action Plan **Reducing the Impact of Continuing Emissions**

DOCUMENT CONTENTS

Carbon Offsets

In the summer of 2006, Ballard, Washington announced its goal to become the United States' first "Climate Neutral City," producing net zero greenhouse gas (GHG) emissions .The cities plan includes both reducing emissions as much as it can and then 'offsetting' the remainder.

The city's program to eliminate its carbon footprint includes encouraging citizens and businesses to reduce their emissions and, as well as purchasing carbon offsets from the state chartered non-profit The Climate Trust. The city's efforts follow in the 'low carbon' footprints of numerous businesses and organizations.

For example, both the Republican and Democratic 2004 Conventions in New York City offset the emissions that their meetings caused, and were declared carbon neutral. The National Football League offset the 2006 Super Bowl in Detroit. Nike has a partnership with Delta Airlines to ensure that carbon credits are purchased for all employee flights.[928] Likewise numerous cities, including Vail, Colorado; Chicago, Illinois; and Berkley, California, have used carbon credits or renewable energy credits to offset some of their emissions.

The Carbon Offset Concept

A carbon offset is designed to 'cancel out' emissions of one

[928] Hamilton, Katherine (2006) Master's Thesis. Yale School of Forestry and Environmental Studies. (Available December 2006) Archived at: www.climatemanual.org/Cities/Chapter5/Mitigating/Hamilton_USVoluntaryMarket_DRAFT.pdf, 5 December 2006.

activity by causing equivalent GHG reductions from another activity. The unit of trade is a 'carbon credit,' which represents the equivalent of one metric ton of carbon dioxide (CO_2). Various GHGs' global warming potentials are used as conversion factors. For example, methane is estimated to have a global warming potential (GWP) 23 times higher than CO_2. Thus one ton of methane equals about 23 carbon credits.[929]

Carbon offsets can be created through "project-based transactions" or "allowance-based transactions."

Project based transactions create credits through projects to reduce GHG emissions. These projects are financed by funds from offset purchases. For example, when students at the Yale School of Forestry and Environmental Studies decided to offset some of the emissions resulting from their graduation, they purchased two different types of project based credits: forestry-based offset credits from a native tree-planting project in the Mississippi River Valley and credits generated from the replacement of diesel generators with solar panels in a Nigerian village. By purchasing third party verified credits from these project developers the school claimed the offsets and the projects received additional funding.

Allowance-based transactions involve credits created through 'cap and trade' regimes. Most cap and trade regimes around the world are created by government regulations, which "cap" the quantity of emissions that participants are permitted to emit. The government then issues tradable allowances, which allow participants who have not been able to meet the caps to buy the allowances. These allowances can be bought and sold between participants with the goal of cost effectively reducing net emissions. The largest carbon trading scheme is the European Union Greenhouse Gas Emission Trading Scheme.

The most significant exception to this approach is the Chicago Climate Exchange (CCX, see below). It is a trading system in which members voluntary agree to what then become for them a legally binding commitments to reduce emissions. Members are then able to trade reductions that exceed their reductions obligations. All voluntary offset purchases, with the exception of CCX transactions, and credits permanently retired from a regulatory market, are based on project- based transactions.[930] Institutions claiming to have offset their GHG emissions must retire credits purchased.

Institutions and cities voluntarily purchasing credits often set their own operations reductions goals, such as matching Kyoto Protocol goals. They frequently use offsets to help reach these goals.

Others choose to offset the GHG emissions from a particular activity, such as an event or transportation. For example, Chicago's Bike Chicago festival and Boulevard Lakefront Tour, a partnership with the Metropolitan Mayors Caucus initiative, the non- profit Clean Air Counts, and the company CLIF BAR, Inc. was declared a 'carbon neutral event' because they used a zero carbon bike transportation system and because CLIF BAR, Inc donated Renewable Energy Credits (RECs) to offset energy use. (For more information on RECs see below).

Carbon offset credits allow actors to indirectly reduce emissions that cannot practically be reduced at the moment. Buyers of carbon offset credits should always first investigate means of directly reducing their own emissions before investing in other project's emission reductions.

The Regulatory Context

Since the U.S. does not have national climate change regulation, the majority of U.S. based purchases of carbon offsets are voluntary. However, it is important to note that several state level initiatives have created regulated cap and trade systems that are currently in place or will be operating soon. For example, in 1997, Oregon created the first regulated CO_2 market in the U.S. by capping the

[929] Source: Bayon, R., Hawn, A., and K. Hamilton (December 2006) Voluntary Carbon Markets: An International Business Guide to What they are and How they Work, Earthscan.
[930] Hamilton, Katherine (2006) Master's Thesis. Yale School of Forestry and Environmental Studies. Archived at www.climatemanual.org/Cities/Chapter5/Mitigating/Hamilton_USVoluntaryMarket_DRAFT.pdf, 5 December 2006.

emissions of new power plants. Oregon plants that do not meet this cap may propose their own carbon offset projects or purchase carbon credits from The Climate Trust.

A larger greenhouse gas market is being created by the Regional Greenhouse Gas Initiative. This agreement between Maine, New Hampshire, Vermont, Connecticut, New Jersey, New York, Delaware, and most recently, Massachusetts will utilize a cap and trade program to regulate the CO_2 emissions of power plants. Credits will be created via allowance based and project based transactions.[931]

In addition to this carbon dioxide regulation in the Northeast and Mid-Atlantic states, it is probable that a cap and trade system will also develop in the West. California recently set the target of reducing emissions to 1990 emissions levels by 2020. The "AB 32: Global Warming Solutions Act" bill mandates that by 2012 the state will cap emissions from major industries, including utilities, oil and gas refineries and cement manufacturers.[932]

In signing the bill, Governor Schwarzenegger stated, "We can now move forward with developing a market-based system that makes California a world leader in the effort to reduce carbon emission. The success of our system will be an example for other states and nations to follow as the fight against climate change continues. AB 32 strengthens our economy, cleans our environment and, once again, establishes California as the leader in environmental protection."[933]

As with many initiatives that begin in California, it is likely that this trend will reach other states soon. Within a week of the California announcement, the Governor of Arizona issued a similar executive order. In 2006 the Governors of Arizona and New Mexico Governor signed an agreement launching the Southwest Climate Change Initiative, which establishes a framework for the two states to collaborate on strategies to address the impacts of climate change in the Southwest and reduce greenhouse gas emissions in the region. New Mexico has also joined the Chicago Climate Exchange, becoming the first state in the nation to sign up for this greenhouse gas emission reduction and trading program.[934]

The United States Voluntary Market

Cities interested in offsetting their emissions have two main options. The first is joining the Chicago Climate Exchange (CCX). CCX is "the world's first and North America's only legally binding, multi-sector, rule-based and integrated GHG registry, trading and reduction system."[935] A second option is purchasing and retiring carbon offset credits or renewable energy credits (RECs) from a range of suppliers in the broader voluntary market.

Chicago Climate Exchange: Membership for Cities

CCX currently has over 200 Members that range from large US corporations like Ford and Motorola, to universities such as Tufts and University of Minnesota, to small businesses like Natural Capitalism, to farmers in Iowa and Nebraska and the Iowa Farm Bureau. Member Municipalities include Chicago, Illinois; Oakland, California; Boulder, Colorado; Aspen, Colorado and Portland, Oregon.

In Phase I, CCX Members made a voluntary but legally binding commitment to reduce GHG emissions 1% per year for each of years 2003 through 2006, below an average baseline period 1998-2001. Phase II parameters extend the reduction period through 2010, with an additional 2% reduction commitment for current Members and a total of 6% reduction commitment by 2010 for new Members below baseline. CCX Members that reduce emissions beyond their targets can sell the surplus allowances on the Exchange or bank them for later use. Members that do not achieve the annual reduction target must

[931] Point Carbon "Carbon Market Analyst: Carbon Trading in the U.S.: The Hibernating Giant." 13 September, 2006, www.pointcarbon.com/, 5 October 2006.
[932] Ibid.
[933] Judy Li "Governor, Democrats reach pact" The Sacramento Bee, Thursday, August 31, 2006, Page A1.

meet their compliance commitment by purchasing emission allowances from seller Members. The NASD, the largest private-sector financial regulators, independently reviews emissions. [936]

Goals of CCX are

To establish GHG emissions trading with transparency, design excellence and environmental integrity

To build the skills and institutions needed to cost-effectively manage GHGs in both public and private sectors

To strengthen the intellectual framework required for cost-effective and valid GHG reduction

To incorporate a diverse portfolio of credible GHG emissions offsets from forestry, agriculture and other products

To help inform the public debate on managing the risks of global climate change

Becoming a Municipal Member of CCX
Membership for cities in CCX covers emissions from operations of city government only (buildings, vehicle fleets, etc.). Direct emissions result from the on-site burning of fossil fuels such as natural gas to heat city buildings and gasoline to operate the municipal vehicle fleet. Indirect emissions result from the purchase of power, such as electricity, and its corresponding emissions.

To become a member, a city must:

Assemble inventory and baseline—energy consumption data for city operations

Submit baseline data to CCX—CCX will provide preliminary analysis

Weigh reduction trends planned, establish reduction schedule

Make a legally binding reduction commitment. This entails joining CCX

Demonstrate progress through annual true-up of actual emissions with predicted reductions. This will then enable a member to buy credits if necessary, sell extra reductions, or trade them

Participate in CCX governance committees (optional)

Benefits of CCX Membership for Municipalities

Ability to take action now—for citizens and future generations

Achieve a first mover role in GHG mitigation efforts—CCX is synergistic with all policy and precludes none, whether state, regional, national, mandatory or voluntary

Contribute to shaping environmental policy by joining a leading group of organizations proactively building the institutions to solve climate change

Increase visibility as a leader and innovator

Develop employee capacities in GHG emissions calculation and trading

Master municipal GHG data, which is essential to achieving any climate change goal

Acquire a state-of-the art, turn-key greenhouse gas emissions management system

Lead by example—setting standards, increase understanding in business and residential community

Reduce cost effectively—while technologies and policies advance, buying allowances may be the most cost effective option for reducing GHG emissions

Earn possible revenue through emission reductions

Have confidence through "gold standard" of NASD independent verification.

Range of Offset Credit Options
CCX is a popular means for cities to offset emissions. However, municipalities and institutions may choose to purchase credits outside of the

[934] Press conference at the National Governors' Association Meeting Feb 2006, 216.239.59.104/search?q=cache:Rq87W1n0RsMJ:www.governor.state.nm.us/press/2006/feb/022806_01.pdf+New+Mexico+climate+initiative&hl=en&ct=clnk&cd=6&gl=us&client=safari, 15 January 2007.
[935] Chicago Climate Exchange, www.chicagoclimatex.com, 5 October 2006.
[936] NASD, www.nasd.com/index.htm, 10 October 2006.

CCX system. Some municipalities may not yet be willing to commit to CCX. Others are interested in encouraging citizens to offset their own emissions (which is not possible via CCX), wish to offset only a specific activity, or want to invest in specific offset projects. For example, the city of Boulder is a member of CCX, but employees in the Office of Environmental Affairs use a variety of retail offset providers to purchase credits to offset the GHG resulting from office travel. Cities may choose to purchase directly from offset project managers, seek out a broker to facilitate the transaction or simply purchase credits from the numerous offset retailers now entering the market.[937]

Offset credits evolve from a variety of sources. As illustrated by the diagram below, project types can be categorized by whether they abate or sequester greenhouse gases. Abatement means reducing the amount of GHGs emitted into the atmosphere. Sequestration means taking GHGs that would otherwise have been emitted and locking them up either in trees, soil or deep geological formations. The most common project type for sequestering is forestry. Trees, and other plants (especially grasses), absorb CO_2 from the air as they grow, and convert it to woody material. Conversely, when they die or are burned, they release the CO_2. Sequestration programs must ensure that the trees planted actually grow to maturity, and that the resulting wood is not burned on fast rotation.

CCX has also begun offering credits generated from forestry, no-till farming and conversion from conventional farming to organic farming. These techniques build carbon in the soil instead of stripping it out, and thus count as a program to remove carbon from the air durably. Technological sequestration (for example, capturing waste CO_2 that otherwise would have been vented into the atmosphere, injecting it into oil fields to pressurize hard to reach oil reserves and then trapping the gas in the underlying bedrock) is less common in the voluntary market. However, one organization, Blue Source, in partnership with Natsource, is selling retail level credits from such geological sequestration. For more information on sequestration see below.

Emissions reductions can be further divided into two other categories: fossil fuel reductions versus the capture and destruction of other greenhouse gases, such as methane. The following diagram, modified from the book *Voluntary Carbon Markets: An International Business Guide to What they are and How they Work,*[938] provides examples of the range of project types used to create credits. Because different projects have a range of co-benefits, prices, advantages and disadvantages, depending on the type, size and location, municipalities purchasing credits should be aware of stakeholder interests and the type of projects behind offsets that providers are offering.

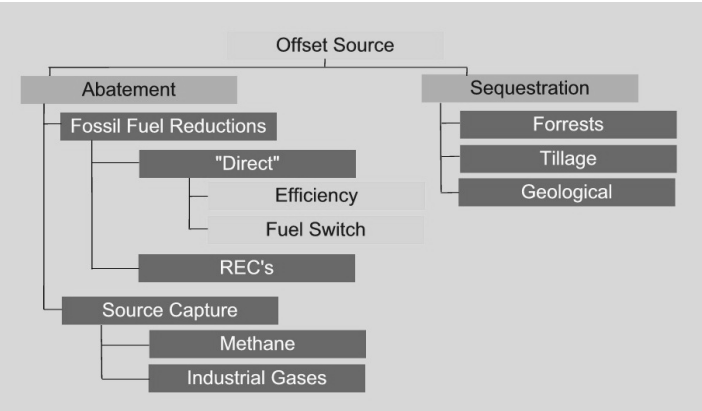

Figure: Carbon Offset Sources[939]

[937] A directory of retail offset sellers and description of various certification programs is included in: Bayon, R., Hawn, A., and K. Hamilton (2006) Voluntary Carbon Markets: An International Business Guide to What they are and How they Work, Earthscan.
[938] Bayon, R., Hawn, A., and K. Hamilton (2006) Voluntary Carbon Markets: An International Business Guide to What they are and How they Work, Earthscan.
[939] Source: Hamilton, Katherine (2006) "Navigating a Nebula: Institutional Use of the U.S. Voluntary Carbon Market. Master's thesis. Yale School of Forestry and Environmental Studies.

Under the category of fossil fuel emissions reductions, it is especially important to differentiate between reducing what are often regarded as 'direct emissions' and buying Renewable Energy Credits (RECs), often called "indirect reduction' of emissions. RECs are also referred to as Tradable Renewable Energy Certificates (TRECs) or Green Tags. They are a separate commodity from the electricity generated and represent the environmental attributes that renewable energy generation provides, such as displaced pollution. According to EPA's Green Power Partnership, voluntary RECs account for 25% of renewable energy currently sold to commercial and industrial customers.[940] While RECs do mean that fewer emissions are produced when renewable energy is substituted for fossil fuel energy, there is some debate on how these certificates should fit within the carbon credit market. For example, one concern is the difficulty of measuring exactly how much fossil fuel is backed off the grid due to additions of renewable energy. New renewable energy projects may only displace future power plants that would otherwise be built, not lead to less use of current fossil energy. Hence, RECs are best used to only offset electricity use.

	ADVANTAGES	CHALLENGES
Methane capture from landfills	- Efficient means of reducing GHG emissions - Captured methane can be used as fuel - Somewhat reduced odors - Reduced risk of ground water contamination - Relatively inexpensive	- Accounting and baseline concerns should be carefully considered
Methane capture from livestock	- Efficient means of reducing emissions - Captured methane can be used as fuel - Reduced odors and co-pollutants - Reduced risk of ground water contamination - Relatively inexpensive	- Accounting and baseline concerns should be carefully considered
Methane capture from coal mines	- Efficient means of reducing emissions - Captured methane can be used as fuel - Few leakage concerns - Can improve safety for mine workers - Relatively inexpensive	- Accounting and baseline concerns should be carefully considered
Industrial gas destruction	- Very efficient - Highly additional - Relatively inexpensive	- Potential supply is limited
Direct fossil fuel reduction	- Supports clean technology - Creates cost savings - Reduces co-pollutants (ex. Sox, PM, VOCs) - Reduces fossil fuel dependency - Potential social benefits	- Less efficient means of reducing GHGs that industrial gas or methane destruction
Renewable Energy Credits	- Already established market with certification/verification systems - Supporting on-grid renewable energy important for decreasing reliance on fossil fuels - Reduces co-pollutants (ex. Sox, PM, VOCs) from fossil fuels	- Compatibility issues between markets for RECs and carbon offsets - Accounting and baseline concerns should be carefully considered - Less efficient means of reducing GHGs that industrial gas or methane destruction
Reforestation/ Afforestation of native tree species	- Large number of potential social co-benefits - Contributes to biodiversity conservation - Addresses deforestation which is an important part of the climate change problem	- Lack of permanence - Relatively inefficient means of reducing GHGs - Less efficient than many mono-crop projects - Relatively expensive
Avoided deforestation of native tree species	- Large number of potential social co-benefits - Contributes to biodiversity conservation - Addresses deforestation which is an important part of the climate change problem	- Lack of permanence - Relatively inefficient means of reducing GHGs - Less efficient than many mono-crop projects - Relatively expensive

[940] Green Power Partnership website, www.epa.gov/greenpower/, 3 May 2006.

	ADVANTAGES	CHALLENGES
Monoculture forestry	- Some potential for social co-benefits - Trees with high sequestration rates can be selected - Often lower cost - Deforestation part of the climate change problem	- Lack of permanence - Relatively inefficient means of reducing GHGs - Concerns about water consumption - Reduced social and environmental co-benefits compared to projects working with native tree species
Soil sequestration	- Promotes healthier food production - Reduces erosion - Large number of potential social co-benefits - Improves water quality - Relatively inexpensive	-Lack of permanence - Accounting and baseline concerns should be carefully considered
Geological sequestration	- Huge potential for storage - Enhances domestic fuel source	- Enables fossil fuel use, leading to more CO_2 emissions

Carbon Offsets

CASE STUDY: Ballard, WA

Citizens, business owners and local governments have joined forces in a campaign to make Ballard, Washington, the United States' first "carbon neutral city." The goal is to educate residents on how they can reduce and then offset emissions. The non-profits NetGreen and Sustainable Ballard are organizing the program by "empowering individuals, businesses and communities to achieve a net reduction in emissions today, while working to reduce their emissions over time."[941] NetGreen has partnered with the state-chartered non-profit, The Climate Trust, to provide offset purchases. The Climate Trust invests funds from Oregon power plants as well as citizens and businesses voluntarily offsetting their emissions in projects, which reduce GHG emissions.[942] Buyers can estimate their emissions online and then purchase offsets from Climate Trust at $10 per ton of carbon.

While this program is primarily driven by local non-profits, local government representatives have been actively involved. At the kick-off, King County Council member Larry Phillips pronounced:

> By the will of the people, the governments of King County and Seattle have become national leaders in developing global warming solutions. We're here today to show that the individual efforts of all of us add up quicker than you think and can have a tremendous impact—right now.
> I congratulate Ballard and challenge other neighborhoods to follow suit."[943]

Convincing people not only to reduce their emissions but also individually to purchase offsets is a major challenge. One local business owner, who calculated that it would take $100 a year to offset her business' emissions commented, "right now I can't afford it, but I definitely would."[944] However, a range of local residents, businesses and organizations have already committed to reducing their carbon footprint. For example, several churches, a high school and businesses from a radio station to a dry cleaner have signed on to the effort.

CONTACT

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[941] NetGreen website, www.achievenetgreen.org/, 5 October 2006.
[942] The Climate Trust, www.climatetrust.org/, 5 October 2006.
[943] "Local Leaders Pledge to Make Ballard First 'Carbon Neutral' Community in the United States." Seattle Daily Business News. 4 October, 2006.
[944] Ibid.

Carbon Offsets

CASE STUDY: Vail, CO

In August 2006 the city of Vail signed an agreement to offset 100% of its electricity use over the next three years, or about 20 million kilowatt hours of electricity use.[945]

The agreement followed Vail Resorts' purchase of RECs to offset energy use of all its properties, such as its ski resorts, shops and hotels, making them the second largest purchaser of wind power of all corporations in the United States.[946] The RECs purchased from the Boulder based Renewable Choice Energy will cost the city of Vail about $12,000 per year in addition the regular energy bill.

Vail Town Manager Stan Zemler, explained the town's motivation. "We believe that protecting Vail's natural environment is critical to the health and prosperity of our community. Wind power is a simple step in continuously improving our environmental practices at the town."[947] The city estimates this effort will reduce about 14,000 tons of carbon dioxide that would otherwise have been emitted into the atmosphere and equates this effort to taking 2,600 cars off the road.

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Vail Town Manager
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Carbon Sequestration

Vegetation on land and in the ocean is considered a carbon 'sink' because it removes carbon from the atmosphere, storing it as biomass. Numerous human activities, such as deforestation and carbon intensive agricultural practices, are reducing the total amount of carbon sequestered in these stocks. Human driven land use changes, along with increased emissions of greenhouse gases, have contributed significantly to climate change. Cities can help fight climate change and reap numerous other benefits by increasing the number of carbon sinks in their communities.

Urban Forests and Green Spaces

Planting and maintaining trees and green spaces is the easiest means of increasing carbon sequestration within most communities.[948] Due to the numerous benefits of tree planting projects and green spaces, such as community gardens, roof gardens and parks, many cities around the U.S. have been motivated to literately 'green' their communities.

Urban forests sequester carbon and also save energy. Urban absorption of heat due to lack of trees is known as an "urban heat island effect." When strategically planted, trees can decrease energy costs by shading buildings, pavement and vehicles in the summer, as well as blocking winds in the winter. American Forests calculates that a single tree will sequester one ton of carbon over a 40 year life. They calculate that due to mortality, three trees must be planted to insure that one will have a 40 year life.[949]

For example, the Chicago urban tree canopy removes 15 metric tons of carbon monoxide, 84 metric tons of sulfur dioxide, 89 metric tons of nitrogen dioxide, 191 metric tons of ozone and 212 metric tons of particulates each year, according to David Nowak, project leader of the U.S. Forest Service's Urban Forest Ecosystem Research Unit. Sacramento, California, planted more than 200,000 trees around the city in the mid-1990s.

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[945] Stoner, Edward. "The Town of Vail goes all wind power too." Vail Daily. 7 August, 2006.
[946] Vail resorts website, www.vailresorts.com/, 5 October 2006.
[947] "TOV 100 Percent Powered by Wind" Press Release, 15 September 2006. ci.vail.co.us/release.asp?r_id=2856, 5 October 2006.
[948] Some scientists challenge the idea that planting forests outside of the tropics helps reduce global warming, pointing out that forests trap more heat than they get rid of by sequestering carbon. However, in cities, planting and maintaining trees does appear to be a net reduction of global warming. For more information, environment.guardian.co.uk/climatechange/story/0,,1972729,00.html, 15 January 2007.
[949] The Urban Forest Network Newsletter, http://www.thefreelibrary.com/Parks+as+Lungs-a079575245, "Parks as Lungs" by Roddy Scheer, 11 April 2007.

Greg McPherson of the Western Center for Urban Forest Research found that the region's urban forest removes more than 200,000 metric tons of carbon dioxide from the atmosphere each year, saving taxpayers as much as $3 million annually in pollution cleanup costs.[950]

A study in Los Angeles showed that urban forestry and such measures to reduce the urban heat island as the use of light colored paving and roofs could cool the city by about 6 degrees. This would cut the city's cooling loads by about 20% and smog by about 12%. A similar program nationwide was estimated to be able to save $4 billion a year on air conditioning costs, 7 million metric tons of annual carbon emissions. For these reasons, an urban tree keeps about nine times as much carbon out of the air as the same tree planted in a forest.[951]

The city of Boulder, Colorado, which has integrated forestry into its climate strategy, estimates its 400,000 trees on public and private land are storing an estimated 110,000 million tons of carbon. Through new growth, sequestration and energy savings Boulder estimates the city's trees result in another additional reduction of 43,000 million tons of carbon each year, which they compared to offsetting the carbon "released through driving approximately 16.1 million miles each year."[952] The city of Boulder's Climate Action Plan notes, "According to the U.S. Forest Service, trees properly placed around buildings can reduce air conditioning needs by 30% and can save 20-50% in energy used for heating."[953]

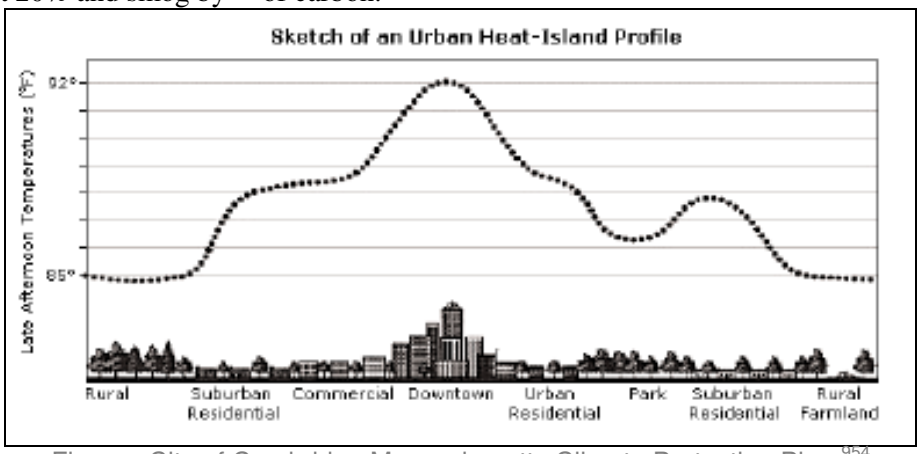

Figure: City of Cambridge Massachusetts Climate Protection Plan [954]

Such energy savings can equate to considerable dollar savings. Boulder estimates the city's trees provide an average energy savings 950 kWh for a one or two story single family detached home, saving families an average of $58/year. A 2005 analysis of municipal tree resources found that each dollar invested in maintaining public trees resulted in $3.64 in benefits due to avoided costs for energy consumption, air pollution control, as well as other benefits.[955]

Proponents of such land use changes also note that green space and forestry are tangible and emotionally appealing. Moreover, at some point most citizens have learned about the role trees play in the carbon cycle and hence, can identify with the role of trees in GHG mitigation. Creating and maintaining green space is thus an easy way to involve all ages in a city's climate action plans. Municipalities can greatly benefit from this citizen involvement. For example, the

[950] The Urban Forest Network Newsletter, www.leaftoronto.org/UFNnews32.pdf, 5 October 2006.
[951] Art Rosenfeld, et al, "Policies to Reduce Urban Heat Islands," LBL 38679, Lawrence Berkeley National laboratory, 1996, and Rosenfeld, "The Art of energy Efficiency," Annual Review of Energy and Environment 1999.
[952] City of Boulder Climate Action Plan. 161.98.15.236/files/Environmental%20Affairs/climate%20and%20energy/cap_final_14aug06.pdf#search=%22Boulder%20Climate%20Action%20Plan%22, also archived at, www.climatemanual.org/Cities/Chapter5/Mitigating/Boulder_CAP_14aug06.pdf, 5 October 2006.
[953] Ibid.
[954] Cambridge Climate Protection Plan, www.ci.cambridge.ma.us/cdd/et/env/clim_plan/clim_plan_full.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/Mitigating/Cambridge_ClimatePlan.pdf, 5 October 2006.
[955] Ibid.

city of Cambridge's Climate Protection Plan states that the wide range of organizations working on issues related to land use have been critical to creating an maintaining green spaces and trees in the community.[956]

Urban forestry and green spaces also have numerous other benefits, including:

Reducing storm water run-off and soil erosion

Improving local air quality

Proving habitat for wildlife

Adding beauty—aesthetics

Increasing property values and residents' quality of life

Despite the benefits associated with urban forestry and green spaces, cities promoting these activities face a range of challenges. A fundamental issue is maintaining vegetative health. Despite the city of Boulder's efforts to promote urban forestry their Climate Action Plan notes that due to recent droughts and budget costs the city has had a net loss of trees, removing 230 trees per year on average (nine-year average) and planting 130 trees per year on the same nine-year average. "To maintain the stream of environmental benefits provided by our urban forest, urban trees must be managed to maintain optimal health and the city must have, at a minimum, a replacement program that offsets the number of removals."[957] Recognizing such challenges, the city of Minneapolis created an urban forest policy designed around "best management practices to mitigate tree loss and tree damage and to promote the long-term health of urban trees."[958]

Other urban reforestation issues relate to permanency and accounting. For example, while Boulder has carefully considered the role of trees in its Climate Action Plan, because the city has not been collecting forestry data since 1990, the city's urban forests have not been included in the GHG accounting inventory. Some uncertainty also surrounds sequestration rates for various vegetation types. Due to the time, cost and evolving scientific understanding around sequestration, municipalities must gage the benefits of accuracy versus estimates. It is also important to remember that if these trees are destroyed, whether due to human intervention or natural causes, carbon stored in vegetation is released back into the atmosphere. Therefore, it is critical they be regarded as, and accounted for as a temporary sink, rather than a permanent reduction.

Soil Conservation

According to the United States Department of Agriculture, "Soil is the largest terrestrial global carbon pool, estimated to be about one-and-a-half trillion tons."[959] However, farming practices have severely depleted soils' organic carbon levels in many agricultural areas.

For municipalities that encompass agricultural areas, providing incentives for agricultural best management practices to sequester carbon is an important step in climate protection. For example, the practice of no-till or conservation tillage[960] farming, which can increase the amount of storage in the soil and reduce emissions from farm equipment used to till the fields has gained considerable attention recently. Other best management practices that contribute to sequestration include organic agriculture, changing grazing practices to forms of "Holistic Management,"[961] converting marginal agricultural land to grassland, forests or wetland and grass buffers.

The following Environmental Protection Agency (EPA) chart summarizes some of these activities and their benefits.

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[956] Ibid.
[957] City of Boulder Climate Action Plan. 161.98.15.236/files/Environmental%20Affairs/climate%20and%20energy/cap_final_14aug06.pdf#search=%22Boulder%20Climate%20Action%20Plan%22, also archived at, www.climatemanual.org/Cities/Chapter5/Mitigating/Boulder_CAP_14aug06.pdf, 5 October 2006.
[958] City of Minneapolis 2004 Environment Report, www.ci.minneapolis.mn.us/environment/docs/MPLSEnvOverview071604.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/Mitigating/Minneapolis_CAP.pdf, 5 October 2006.
[959] USDA Agricultural Research Service, www.ars.usda.gov/research/, 5 October 2006.
[960] Also in this manual, see Chapter 5, Long Term Initiatives, Sustainable Agriculture section.
[961] See Dan Dagget, Gardeners of Eden, Tarcher, 2005.

Key Agricultural Practices	Typical definition and some examples	Effect on greenhouse gases
Conservation or riparian buffers	Grasses or trees planted along streams and croplands to prevent soil erosion and nutrient runoff into waterways.	Increases carbon storage through sequestration.
Conservation tillage on croplands	Typically defined as any tillage and planting system in which 30% or more of the crop residue remains on the soil after planting. This disturbs the soil less, and therefore allows soil carbon to accumulate. There are different kinds of conservation tillage systems, including no till, ridge till, minimum till and mulch till.	Increases carbon storage through enhanced soil sequestration, may reduce energy-related CO_2 emissions from farm equipment, and could affect N_2O positively or negatively.
Grazing land management	Modification to grazing practices that produce beef and dairy products that lead to net greenhouse gas reductions (e.g., rotational grazing).	Increases carbon storage through enhanced soil sequestration and may affect emissions of CH_4 and N_2O.

Table: U.S EPA[962]

Along with sequestration there are numerous co-benefits associated with such changes in land management practices including reducing soil erosion, reducing emissions from farm equipment, increasing the levels of organic material in the soil and reduced water pollution. Like other forestry and green spaces activities, such co-benefits can be the drivers in implementing activites. For example, the Miami Conservancy District in Dayton, Ohio has recently initiated a water quality trading program that provides funding for changes in agricultural practices, such as no-till farming and conservation buffers, to reduce nitrogen and phosphorus water pollution.[963] A major side benefit is increased carbon sequestration.

Challenges associated with utilizing agricultural land use changes in municipal climate protection plans include accurately accounting for carbon storage and the fact that a relatively small amount of carbon is stored per acre. Moreover, carbon sequestered can be quickly lost in a season when a farmer changes tilling practices. Municipalities considering creating incentives for increased soil sequestration will need to ensure that the benefits of carbon storage, reduced emissions and other co-benefits will be maintained.

Technical Sequestration

Included within the context of sequestration is technical sequestration. Due to high costs and evolving technology, this type of sequestration is not yet applicable for most municipal climate strategies. However, a brief introduction is provided for context.

New and evolving means of technologically sequestering include geological and oceanic storage. The potential benefit of these methods is their huge potential for rapid sequestration, especially in comparison to terrestrial sequestration. Geological storage involves capturing carbon dioxide from pollution sources and then injecting it into geological formations in the earth. Examples include enhanced oil recovery or "clean" coal production in which the carbon (and mercury) is stripped off in gasification and then sequestered. Oceanic sequestration involves pumping carbon dioxide deep into the ocean.

One real challenge with all of these methods is that it is not entirely clear whether the carbon will stay where it is put. The permanency of the sequestration is a major concern and risk for both technologies. There are also concerns about such environmental risks as changes in ocean acidity. Because the understanding of the risks and benefits of this technology is still evolving, while technical sequestration may become a significant means of mitigating climate change in the future, land use changes represent a more accessible means for municipalities to encourage sequestration at present.

[962] EPA Carbon Sequestration in Agriculture and Forestry, www.epa.gov/sequestration/ag.html, 4 October 2006.
[963] Hamilton, Katherine. "Testing the Waters: The Great Miami River Watershed Water Quality Credit Trading Program." The Katoomba Group Ecosystem Marketplace. September 2006.

Additional Resources

Voluntary Carbon Markets: An International Business Guide to What they are and How they Work, Bayon, R., Hawn, A., and K. Hamilton (2006) Earthscan

EPA calculators. yosemite.epa.gov/oar/globalwarming.nsf/content/ResourceCenterToolsCalculators.html

***My Climate* video** on the carbon offset concept: www.myclimate.org/film/film_en.php

Consumers' Guide to Retail Carbon Offset Providers Clean Air-Cool Planet has released a new report designed to help organizations and individuals that are considering purchasing offsets to help achieve carbon neutrality. The report evaluates 30 providers selling offsets in the US market on seven criteria and explains some of the key attributes that consumers should look for when purchasing carbon offsets. The survey and report were undertaken by Trexler Climate + Energy Services, Inc. of Portland, Oregon. www.cleanair-coolplanet.org/ConsumersGuidetoCarbonOffsets.pdf

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Chapter 5: Develop a Local Action Plan **Adapting to Climate Change**

DOCUMENT CONTENTS

There are a number of daunting risks that communities eventually need to manage as climate change continues and the broader weather-related affects of global warming become more obvious. The full extent of the positive and negative implications, scope and pace of these effects are not 100% understood, but it is agreed that increases in greenhouse gases loading in the atmosphere will cause such impacts as:

Rising sea levels flooding low-lying coastal plains across the world, forcing population centers to evacuate and damaging trillions of dollars worth of infrastructure;

Different precipitation and temperature patterns impacting livestock and crop production, water supplies, health of forests, biological diversity, wild-life habitat, coastal and inland wetlands, vegetation and stream flow;

Increased insect reproduction rate and expanded geographic distribution of vector-borne disease;

More frequent and more severe summer and winter storms, including hurricanes, tornadoes and floods, and more frequently occurring events characterized by extreme heat, cold or drought conditions, including wildfires, windstorms, hailstorms and ice storms;

Loss of economic output and local tax revenues due to extreme weather conditions, missed work days, power failures, decreased tourism, property damage, property devaluation, and loss of crops and livestock;

Increased human health impacts derived from increased emissions of SO_2, NO_x, CO and particulate matter resulting in higher levels of ground-level ozone, lung disease, emphysema and asthma; *and*

Higher sickness or mortality rates of elderly and ill people due to extreme heat and cold or inability to leave their homes for medical or other purposes.

Managing these effects of climate change will require planning,

investment of resources, outreach to the community and coordination of multiple agencies on both the local and federal level. This chapter briefly describes a some of the strategies for managing these potential impacts.

Emergency Planning

On average, the federal government needs 72 hours to marshal national resources in response to an incident that has surpassed a state's response capacity.[964] Usually, a 72-hour delay is not a problem. State and local governments manage most of the responders that arrive immediately at a disaster scene and, in most circumstances, have the critical assets needed to carry themselves through the first three days. This was largely the case even during terrorist attacks, such as the bombing of the Alfred P. Murrah Federal Building in Oklahoma City and both attacks on the World Trade Center in New York City. On the other hand, when catastrophic disasters overwhelm state and local governments at the outset, as in the aftermath of Hurricane Katrina, the 72-hour buffer disappears, and any delays in a coordinated federal, state and local response cause serious consequences.

Better planning at regional and local levels are needed to prevent such shortfalls in disaster response. Such efforts need to take the form of city or state-based regional programs that focus on ensuring that local communities are prepared to sustain themselves and to facilitate cooperation among federal, state and local efforts. For example, in Dayton, Ohio, a Homeland Emergency Learning and Preparedness (H.E.L.P.) Center, which offers disaster preparedness training to emergency responders and the general public, has been supported at the state and city level.[965]

In the Homeland Security Act of 2002, Congress mandated that the Department of Homeland Security (DHS) set up a regional structure that coordinates and collaborates with state-based regional programs to help to close the 72-hour gap.

Rising Sea Levels

Rising sea levels is a potentially major result of climate change. There are many kinds of coasts, each with different ecological characteristics, economic values, and natural and human uses. In some areas, such as the remote shorelines in California or Oregon the sea is contained by high cliffs and rising sea levels will not be catastrophic. Segments of vulnerable, yet economically valuable, shorelines are often protected with hard structures such as seawalls. Although some coastal areas are somewhat protected by these structures, it is not known how sea level rise, sporadic storm activity, and shoreline hardening harm the ecological services of shoreline habitats. These habitats provide physical and biological buffers in estuaries and are essential to sustainable fishery production and other ecological values. In low-lying urban shorelines, such as Los Angeles, San Francisco, Miami and Manhattan, the impacts could be devastating. Sea level rise is not an easy process to predict or manage, because the rate of change and accompanying shifts in wave activity and storm surges are not well understood. City planners and resource managers have a big job in front of them.

The effects of sea level rise include tidal inundation of low lying areas; coastal erosion of wetlands, beaches, and other types of shores; vertical accretion of wetlands; increased coastal flooding during storm surges and periods of extreme rainfall; and increased salinity of aquifers and estuaries, especially during droughts.[966] Estuarine shorelines are already under the stress of increased water levels ranging from short term waves and storm surge to long term inundation through existing sea level rise.

[964] "State and Regional Responses to Disasters: Solving the 72-Hour Problem", The Heritage Foundation, by Jill D. Rhodes, J.D. and LL.M., and James Jay Carafano, Ph.D. Backgrounder #1962, at website: www.heritage.org/Research/HomelandDefense/bg1962.cfm, 15 August 2006.
[965] Homeland Emergency Learning and Preparedness (H.E.L.P.) Center, www.emhelpcenter.org/, 15 October 2006.
[966] For more information, U.S. Climate Change Science Program www.climatescience.gov, 12 August 2006.

The first and most important action that cities can take is to gather resource data about their shoreline and develop GIS (Geographic Information Systems) models to measure and model possible effects of climate change on coastal resources and human habitat. Many federal agencies and individuals are developing data that can provide insights regarding the implications of sea level rise.

For example, the Federal Emergency Management Agency (FEMA), the Army Corps of Engineers, and several states management. The National (Florida, Texas, North Carolina, and California) are developing elevation data for floodplain Oceanic and Atmospheric Administration (NOAA) and United States Geological Survey (USGS) are developing Digital Elevation Models (DEMs). Local governments and major coastal conservancies are developing GIS land-use data for managing ecosystems and economic activity. The U.S. Fish and Wildlife Service (USFWS) is developing wetlands data. These agencies all have information resources to help local and state governments develop their own models and action plans.[967]

Cities should work in coordination with counties, states and federal agencies in developing a baseline of resource data and models to help understand the full range of possible impacts of higher sea levels on local ecological resources, human habitat and economic activity. The following table provides names and contact information for the agency leaders who are working coastal issues related to climate change.

CCSP Agency	***Contact***	***E-mail***
USEPA	James G. Titus	Titus.jim@epa.gov
NOAA	Mike Szabados	Mike.Szabados@noaa.gov
USGS	Eric Anderson	Eric.K.Anderson@noaa.gov
USFWS	Brian Czech	brian_Czech@fws.gov
Corps of Engineers	Charles Chesnutt	Charles.b.Chesnutt@usace.army.mil
FEMA	Mark Crowell	Mark.Crowell@dhs.gov
DOE	Anjuli Bamzai	anjuli.bamzai@science.doe.gov
NASA	Eric Lindstrom	Eric.J.Lindstrom@nasa.gov

Table: List of key agency contacts working on sea level rise, August 2006

The program managers listed above are responsible for developing a report titled: "Coastal Elevations and Sensitivity to Sea Level Rise." The lead agencies are USEPA, NOAA, USGS. This report is available on line and will help city governments get started.[968]

Another information resource about adapting to climate change impacts is provided on line by the World Health Organization.[969]

Different Precipitation and Temperature Patterns

Yet another set of challenging issues city governments must plan to address for the safety and survival of their citizens are. changes in precipitation patterns and changes in average mean temperatures that could arise from climate change. These impacts are difficult to prepare for because the long-term effects of climate change on precipitation patterns and mean temperatures are still unknown. Temperature and precipitation patterns are both affected by cloud cover, wind, solar radiation, topography and numerous other physical features that are difficult for scientists to model.

Moreover, the impacts will vary regionally, meaning that cities will have to develop unique, local action plans. San Francisco's action plan for addressing change in

[967] For more information, please visit the website hosted by The U.S. Climate Change Science Program, at: www.climatescience.gov/Library/sap/sap4-1/default.htm, 14 August 2006.
[968] Ibid.
[969] Climate Change and Adaptation Strategies for Human Health, www.who.dk/ccashh, 5 October 2006.

precipitation and change in mean temperatures will undoubtedly be different from Salt Lake City's or Atlanta's. The impacts on agricultural areas will be different from what will challenge an urban area. Again, city governments will frequently be working with county, state and federal agencies to address these issues. The following information can provide city governments with a general understanding of potential impacts on precipitation levels and water supplies that climate change can impose.

Changes in Precipitation, Water Supply and Water Quality

Changes in weather patterns, snow cover, ice and precipitation are likely results of a warming climate. Examples of these include a more active hydrological cycle with more heavy precipitation events and shifts in precipitation in some regions while others enter prolonged droughts. There is already widespread retreat of non-polar glaciers, increases in ocean-heat levels and decreases in snow cover, sea-ice extent and thickness. For instance, it is very likely that 20th century warming has contributed significantly to the current observed sea-level rise, through thermal expansion of seawater and widespread loss of land ice.[970]

Among the expected impacts of climate changes on water resources are higher global and regional water temperatures, increases in global average precipitation and evaporation, changes in the regional patterns of rainfall, snowfall and snowmelt, changes in the intensity, severity and timing of major storms and a wide range of other geophysical effects. These changes will also have many secondary impacts on freshwater resources, altering both the demand and supply of water and changing its quality.[971]

Evaporation of water from land and water surfaces will increase as global and regional temperatures rise. More evaporation will result in more precipitation on average, though regional precipitation patterns will continue to be very complex and variable. Reviews of state-of-the-art climate models suggest that *global average evaporation and precipitation may increase by 3 to 15%* from an equivalent doubling of atmospheric CO_2 concentration. The greater the warming, the larger these increase.[972]

One of the most important hydrologic impacts of climatic change will be snowfall and snowmelt changes in high altitude watersheds or areas with strong snowmelt runoff characteristics. In these watersheds, changes in temperature are expected to lead to important changes in water availability and quality and complicate the management of reservoirs and irrigation systems.

The Intergovernmental Panel on Climate Change (IPCC) stated "freshwater resources in many regions of the world are likely to be significantly affected," and that many current freshwater problems will be made worse by the greenhouse effect. They urge water managers to begin "a systematic reexamination of engineering design criteria, operating rules, contingency plans, and water allocation policies." The report states with "high confidence" that "water demand management and institutional adaptation are the primary components for increasing system flexibility to meet uncertainties of climate change."[973] This emphasis on demand management rather than construction of new facilities marks a change in traditional water management approaches, which in the past have relied on the construction of large and expensive supply infrastructure.

Water demand-side management (DSM), is the water equivalent of energy efficiency: cheaper, faster

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[970] "Climate Change 2001: Synthesis Report Summary for Policymakers," An Assessment of the Intergovernmental Panel on Climate Change, at website, www.ipcc.ch/pub/un/syreng/spm.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/Adapting/spm.pdf, 5 October 2006.

[971] "Water Planning and Management Under Climate Change," Peter H. Gleick, Co-Founder and President of the Pacific Institute for Studies in Development, Environment, and Security in Oakland, California, www.ucowr.siu.edu/updates/pdf/V112_A5.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/Adapting.pdf, 14 August 2006.

[972] Ibid.

[973] For more technical reports on climate change and water resources, biodiversity, etc., visit the IPCC website at: www.ipcc.ch/pub/techrep.htm, 14 August 2006.

and clearly the first option to be pursued. It reduces demand for water by increasing the efficiency of water services, and water conservation (which conserves water by decreasing its use). These are not new ideas. Cities and water districts in the western U.S. have had water conservation programs for many years, targeting both residential users and commercial/agricultural customers. For example, in 1989, Goleta, California, faced drought and the threat of a multi-million-dollar expenditure to meet EPA sewage-treatment standards. This spurred a $1.5-million municipal program that provided information and incentives to the town's 74,000 citizens to reduce water waste. More than 17,000 ultra-low-flow toilets were installed in a few years. The utility gave away 35,000 high-performance showerheads, reformed its tariff structures, made metering universal, raised public awareness and knowledge and offered free onsite surveys of outdoor water-efficiency opportunities. These technical improvements, plus some emergency drought measures (peak-season surcharges and a little rationing), cut citywide water consumption within a single year, 1989–90, by 30%, from an average of 135 to 90 gallons per person per day—twice the targeted savings. Sewage flow fell by over 40%, enabling the existing plant to run within its rated capacity and EPA secondary standards. The proposed plant expansion was indefinitely deferred. Total water savings later grew to 40 percent. In the drought of 1990, while some nearby communities were forced to cut their water use by 30–45%, Goleta had only to reduce 15%, avoiding disruption or hardship.[974]

In 1994, Mayor Martin J. Chavez and the Albuquerque City Council called for a 30% reduction in water use over 10 years. The response by city water customers was strong, with per person usage dropping from 250 gallons per capita per day when the program began in 1995, to 174 by the end of 2005. Per household analysis in 2004 shows a reduction of 34% compared to the baseline use in 1995. Residential customers, who represent approximately 50% of all water use, have reduced their usage by 39% since the program began. Institutional customers, whose numbers are much smaller, have achieved similar results. Commercial and industrial customers are being urged to respond accordingly.[975]

Some features of the program in Albuquerque include:

Offering rebates for low flow toilets (the largest source of water use in most American homes);

Offering free low flow shower heads;

Offering free public courses on Xeriscape (low water/draught resistant) gardening techniques; and

Offering rebates for high-efficiency washing machines (high-efficiency washers use approximately 25 gallons per load versus 40 to 50 gallons per load)

In the event of a longer drought period, communities would need more aggressive action plans for water DSM and conservation. Large cities and agricultural areas will adopt different strategies for functioning under extended drought conditions, including looking for new suppliers, developing new supplies, and deepening wells on the supply-side. As climactic regimes shift, it is likely that agriculture will shift as well, and crops that may have predominated in an area will no longer be grown.

New Mexico State University provides a very comprehensive, on-line template for community–scale drought emergency planning.[976]

This template assists water officials to plan for four different phases of an action agenda:

Drought alert;

Conservation;

Restrictions; and

Emergency.

In worst-case scenarios, some cities may have to limit water usage, in both residential and commercial/agriculture sectors. This could raise the price of food,

[974] Hawken, Lovins and Lovins, *Natural Capitalism*, P. 231, Little Brown, NY, 1999.
[975] City of Albuquerque, www.cabq.gov/waterconservation, 13 August 2006.
[976] "Action Plan for Emergency Drought Management: Short-term Strategy," New Mexico State University, website, weather.nmsu.edu/drought/action-plan/index.htm, 13 August 2006.

and cause unemployment in farming and ranching communities.

Emergency Response to Floods

In addition to conserving water during or in anticipation of drought periods, many cities must also address the other important water-related impact of climate change: increased precipitation. Increased evaporation will beget more cloud cover, which will deliver more frequent rain and snow storms in different regions. Rain patterns could greatly differ from year to year across the U.S.

Many cities already have flood action plans. The breaking of the Corp of Engineers' levees in New Orleans under hurricane Katrina has precipitated much discussion about national preparedness for storm surges. The Center for Disease Control (CDC) provides an online tool describing preparations individual households can make in the event of flood conditions to which cities can refer their citizens. The CDC manual provides information on keeping food and water safe, sanitation, re-entering the home, electrical hazards, etc.[977] Cities that do not have flood or drought action plans can get assistance from the Corps of Engineers. The Corps can provide many different types of assistance under the Flood Control and Coastal Emergency Act (Public Law 84-99), the National Emergency Preparedness Program (NEPP) and the Federal Response Plan and can provide planning assistance to cities.

The Department of Homeland Security has a new program called Citizen Corps. It hopes to recruit volunteers to be trained for emergency response in situations such as floods, ice storms, power outages, and extreme heat. Cities can leverage this federal program as well to help residents prepare for extreme conditions.[978]

Increased Insect Reproduction Rate

With warmer weather and more moist conditions in some parts of the country, another potential issue is increased insect reproduction rates and a greater distribution of vector-borne disease, such as malaria, dengue fever and Lyme disease.[979] Most cities or counties have pest management programs in place governing both agriculture and urban settings. These programs may have to be strengthened in, some regions as climate change produces conditions for faster reproduction of mosquitoes and other disease-carrying insects.

The U.S. Department of Agriculture has developed the "Integrated Pest Management (IPM) Road Map."[980] The goal of the IPM Road Map is to increase nationwide communication and efficiency through information exchanges among federal and non-federal IPM practitioners and service providers including land managers, growers, structural pest managers and public and wildlife health officials.

At the Federal level, the IPM program is a multi-agency effort that demands coordination and collaboration. The Federal IPM Coordinating Committee provides oversight of the federally funded programs. This committee is made up of representatives of the major participating Federal agencies and departments. The USDA IPM Coordinator is responsible for preparing an annual report documenting the status and performance of the IPM program nationally and distributing the report to Congress, Federal and State IPM partners, and the general public.

USDA Regional IPM Centers play a major role in gathering information concerning the status of IPM, and in the development and implementation of an adaptable and responsive National IPM Road Map. These Centers have a broad, coordinating role for IPM and they invest resources to enhance the development and adoption of IPM practices at the level of cities and local government.

[977] CDC online tool, www.bt.cdc.gov/disasters/floods/, 14 August 2006.
[978] For more information, see Department of Homeland Security website: www.citizencorps.gov/, 14 August 2006.
[979] World Health Organization 2000 Bulletin, whqlibdoc.who.int/bulletin/2000/Number%209/78(9)1136-1147.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/Adapting/WHO_vectorborne_2000.pdf, 5 December 2006.
[980] National Road Map For Integrated Pest Management, May 17, 2004, no author name. Website: www.ipmcenters.org/IPMRoadMap.pdf, 20 August 2006, also archived at, www.climatemanual.org/Cities/Chapter5/Adapting/IPMRoadMap.pdf, 30 October 2006.

Increased Human Health Impacts

A study, by scientists at the World Health Organization (WHO) and the London School of Hygiene and Tropical Medicine, determined that 160,000 people already die every year from the effects of climate change, from malaria to malnutrition, children in developing nations seemingly the most vulnerable. The study projected that these numbers could almost double by 2020.[981] [982]

As described in Chapter Two, human health impacts may increase in the U.S. from global warming in a number of ways: **Fatigue, sickness, dehydration or inability to leave the home during periods of extreme heat;**

Inability to leave the home during periods of extreme cold weather to buy food or get medical treatment;

More SO_2, NOx, ground-level ozone and airborne particulate matter due to increased need to operate coal-fired power plants during periods of extreme heat;

Damage to lungs from increased forest fires;

Power outages during summer peak loads, leading to spoilage of food, spoilage of medicine, interruption of medical equipment in the home or inability to pump water, and **Increased disease from vector-borne diseases.**

Managing all of these potential health impacts will challenge city governments, along with county, state and federal agencies. These impacts will likely afflict the sick and elderly more than younger or healthy people, but all ages are vulnerable.

The health impacts from heat waves have already been felt in many parts of the U.S. and Europe. For example, over 100 people died in California alone during July 2006 from heat-related deaths, a marked increase over previous years. In areas extreme heat has not previously been a problem, many people do not have air conditioners for their homes. Those that do may not be able to operate them when heat waves coincide with power outages, a confluence of events that is becoming more common.

Cities, working with county, state and federal agencies, are developing emergency protocol to address these challenging and varied problems. In the heat wave of 2006, a number of cities offered central "Cooling Centers" for people trying to survive extreme heat. For example, hundreds of Cooling Centers were set-up in cities across America, including Baltimore (11 centers), St. Louis (60), Chicago (100), and New York (over 300). Boston and Chicago has free air-conditioned shuttle bus services to transport vulnerable populations to Cooling Centers, situated in community centers, police stations, libraries, park facilities and other locations.

Telephone hotlines, with up to date and accurate information on heat resources and medical advice were used in Chicago, Philadelphia and Boston. Chicago even had reverse 911 calls, automatically sent to seniors and those at risk. Some cities (Philadelphia, Baltimore and New York) went a step further and sent outreach workers to check on the homeless and elderly, providing water and fans. Chicago deployed air-conditioned buses to points around the city while Baltimore, St. Louis, Omaha and others helped provide and install air conditioners to those in need.

The city of West Palm Beach Mayor Lois J. Frankel announced that the city would extending the hours of its swimming pools to help residents and visitors beat the record-setting heat in summer. The city waived the fee to use the Warren Hawkins Aquatic Center at Gaines Park and extended pool hours.[983]Cities may have to work with clinics, hospitals and health-care providers to transport important medicines to disabled, frail or otherwise ill people trapped in their homes during periods of extreme heat or cold.

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[981] Planet Ark, www.planetark.org/dailynewsstory.cfm/newsid/22420/story.htm, 15 October 2006.
[982] WHO, www.who.int/globalchange/climate/en/ccSCREEN.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/Adapting/ccSCREEN.pdf, 15 October 2006.
[983] City of West Palm Beach, www.wpb.org/News/showStory.php?link=06-07-31CityTakingActiontoHelpPeopleDealwithExtremeHeat.php, 14 August 2006.

CASE STUDY: Philadelphia, PA

The city of Philadelphia began taking steps to reduce the public health threat from excessive heat in 1993.[984] The cornerstone of the city's response plan is its Heat Health Watch-Warning System (HHWWS). Under the HHWWS, city staff works with the National Weather Service to determine when a heat wave is imminent.

Once a heat alert is issued, the Philadelphia Health Department contacts news organizations with tips on how vulnerable individuals can protect themselves. People who do not have air conditioning are advised to seek relief from the heat in shopping malls, senior centers and other air-conditioned spaces.

In addition, the city's 6,300 "block captains" are notified and asked to check on elderly neighbors. Block captains are individuals appointed by the city to assist vulnerable residents in their neighborhood. The Public Health Department also takes the lead on activating a number of special summer heat responses, including:

Home-visits by field teams;

Activation of the Philadelphia Corporation for Aging's "Heatline;"

Enhanced daytime outreach for the homeless; and

A "Buddy System"

The Heatline initiative is a telephone-based service where nurses are standing by to assist callers who may be experiencing health problems. If callers are deemed at-risk, mobile units are dispatched to that individual's residence. The Buddy System is a city-sponsored outreach effort that encourages the public to visit older friends, relatives and neighbors during excessive heat events.

Buddy systems may have to be deployed in many U.S. cities to save lives during power outages and extreme weather conditions to transport high-risk people to cooler or warmer places or to deliver food, water or medicine.

[984] From EPA website, www.epa.gov/heatisland/about/heatresponseprograms.html, 12 August 2006.

CASE STUDY: Chicago, IL

Chicago's Action Plan for Extreme Weather Conditions[985]

In the event that an extreme weather emergency is declared in Chicago:

The Department of Human Services operates 24-hour cooling centers and provides transportation;

The Department on Aging's senior centers have extended hours;

The Mayor's Office for People with Disabilities contacts more than 100 disability advocacy organizations, asking them to check on the health and safety of their clients;

Staff from the Department of Human Services, Department on Aging, and the Chicago Housing Authority visits at-risk residents in their homes and telephones others to ensure they are well;

The Department of Public Health monitors nursing homes and hospital emergency rooms, and deploys mobile assessment teams of nurses;

The Department of Water Management closely observes water pressure around the city and shuts off illegally opened fire hydrants;

The Department of Buildings inspects high-risk buildings to ensure that windows are open and ventilation systems are functioning;

Extra tow trucks from the Department of Streets and Sanitation are made available to assist stranded motorists;

The Chicago Public Schools limits students' strenuous activities and modifies dress codes; and

The Extreme Weather Notification System places automatic telephone calls to at-risk individuals in advance of a heat wave or severe cold (the calls consist of a recorded message of weather forecasts, safety tips and information on city services).

CONTACT

The Office of Emergency Management and Communications[986]
(312) 746-9111
oemc@cityofchicago.org

[985] For more information about Chicago's and other cities' emergency action plans, please see EPA's website at: www.epa.gov/heatisland/about/heatresponseprograms.html, 12 August 2006.

[986] The Office of Emergency Management and Communications website, egov.cityofchicago.org/city/webportal/portalEntityHomeAction.do?BV_SessionID=@@@@0043648670.1166219364@@@@&BV_EngineID=ccceaddjjdgjhijcefecelldffhdfgm.0&entityName=Emergency+Communications&entityNameEnumValue=12, 5 December 2006.

Additional Resources

California Climate Change Center: In 2003, the California Energy Commission, through its Public Interest Energy Research program, established the California Climate Change Center to undertake a broad program of scientific and economic research on climate change in California. The Center is organized as a "virtual" institution with sites at both the UC Berkeley campus and the Scripps Institute of Oceanography (UC San Diego campus). The Berkeley Center, based at the Richard & Rhoda Goldman School of Public Policy, is focusing on economic and policy analysis, while the Scripps Center focuses on physical climate modeling. www.climatechange.ca.gov/research/index.html

"**Climate Change 2001: Impacts, Adaptation and Vulnerability**." International Panel on Climate Change. www.ipcc.ch/

"**Coping with Global Climate Change: The Role of Adaptation in the United States.**" Prepared for the Pew Center on Global Climate Change, June 2004 www.pewclimate.org/global-warming-in depth/all_reports/adaptation/index.cfm

CHAPTER 6: Monitor and Report Performance

DOCUMENT CONTENTS

Metrics

Metrics are ways of measuring the outcome of a given set of actions.

The ability to demonstrate positive performance results will help your city to[987]:

Garner support for innovative efforts

Gain favorable public recognition

Retain or increase funding

Recruit and retain talented staff

Enlist and motivate able volunteers

Attract new participants

Engage collaborators

Win designation as a model or best practice

Measurement results can also help:

Strengthen existing programs

Target effective services for expansion

Identify staff and volunteer training needs

Develop and justify budgets

Prepare long-range plans

Focus city staff attention on programmatic issues

Some system of metrics is necessary for any program that seeks continuous improvement. There are, in general, two sorts of metrics. The first, prescriptive metrics, tell an audience what they will do, and set out the precise basis for measuring whether that aim is achieved. Most building codes, and health and safety codes fall under this category.

A second type of metrics are performance metrics. These set the desired outcome, then measure what has been achieved. The actor can choose any number of ways of meeting the goal, in contrast to prescriptive standards, which spell out only one approach. According to the Department of Energy:

[987] List modified from the United Way Outcome Measurement Resource Network, national.unitedway.org/outcomes/resources/What/OM_What.cfm, 5 October 2006.

"A PERFORMANCE METRIC is a standard of measurement of a function or operation. Performance metrics provide owners, operators, occupants and society a way of quantifying and tracking how well [for example] buildings are doing compared to performance goals.[988]"

The importance of benchmarking and performance metrics for Climate Protection programs is they allow cities to:

Determine the success or failure of individual programs and determine how the programs should be changed, added or eliminated;

Track the big picture progress of the Climate Action Plan;

Compare their own progress with other cities; and
Determine what still needs to be done to reach goals.

Metrics for Climate Action Plan

Greenhouse Gas (GHG) Inventory

Once a city has set a greenhouse gas emission baseline, it can perform a periodic inventory to track the progress of its programs to reduce GHGs. Chapter 3 describes how to establish a baseline inventory, what tools are available and how to use them to track sector emissions. The resulting numbers can be compiled into reports, which, when combined with an economic analysis of program, will enable a city to determine the success of its programs, what measures need to be adjusted, and the extent to which its actions are cost-effective. Cities should compute their GHG emissions for each sector, assess how emissions compare to last year's and decide whether they are on track to meet their goals.

Utilizing a periodic GHG inventory stacks annual progress and exact GHG reduction, but does not help a city determine how far away it is from reaching all of its long-term, big picture goals.

Indicators[989]

Measurements called "Indicators of Sustainability"[990] can help city officials and citizens understanding and enhance the relationships between the economy, energy use, and the various environmental and social aspects of achieving long-term sustainability. This manual focuses on indicators that directly relate to climate protection and reducing GHG emissions, however, if used correctly, a Local Climate Protection Plan will not only achieve carbon reduction, but will also enhance overall community sustainability.

Once cities have implemented initial best bets to reduce their emissions (switch to LED lights, implement other energy efficiency programs, provide city bus passes, etc), they will have to consider more systematic programs to reduce GHG emissions. These will have to be balanced with programs to meet all of a community's priorities. At this point, setting and monitoring indicators can enable a community to ensure that its programs meet all of its priorities.

Indicators provide a vision of the direction a city wishes to head, and enable it to measure how far it is from reaching its desired goals and vision. There are many measurements that a city can make. It is important that indicators are:

Relevant; they show you something about the system that you need to know.

Easy to understand; even by people who are not experts.

Reliable; you can trust the information that the indicator is providing.

Based on accessible data; the information must be available or able to be gathered while there is still time to act.

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[988] Department of Energy Metric Terminology, www.eere.energy.gov/buildings/highperformance/performance_metrics/metrics_terminology.html, 5 October 2006.

[989] Definition of indicators and effectiveness are taken from the website of Maureen Hart, a consultant in community sustainability, www.sustainablemeasures.com. This website provides a wealth of information including definitions, training, resources and a database of existing indicator projects.

[990] International Sustainability Indicators Network, www.sustainabilityindicators.org/resources/WhoWorkingOnIndicators.html#Communities, 8 October 2006.

Recent signatories of the Mayor's Climate Protection Agreement may wish to start with climate specific indicators. At a later time, they can expand indicators to reflect broader sustainability goals.

Process to Establish Indicators

As you develop indicators, record the following elements for each one. It helps to use a simple table for this purpose. During the brainstorming phase it is not essential to complete each section, but will be a helpful tool for adopted indicators.[991]

Indicator name

Definition: Define the indicator in detail. What metric will the indicator will use to measure progress toward your community's target?

Justification: Why will data gathered for this indicator clearly tell you whether your strategy is being successfully implemented and that your community is making progress toward realizing the target?

Units: What are the units associated with this indicator. For example: Percent, Parts per million (ppm), Incidence per 1000 people, etc.

Data Sources: Where will the data be obtained? Will it be gathered by the community? Can it be accessed from local or regional administrative records? Do local NGOs or federal agencies gather data?

Data Gathering Methodology: What method will be used to gather the data?

Apply Selection Criteria

Incisive: the indicators chosen should tell clearly and specifically about the problems the city is addressing. Avoid choosing indicators that can fluctuate for reasons unrelated to efforts the community is making.

Measurable: in order to be useful for assessing progress, indicators need to be quantifiably measurable.

Results oriented: can focus on measurement of the effect of the actions taken. This will sometimes seem difficult, since the pressures that lead to a situation like air or water pollution often take place far outside the community.

Reliable: indicators must be based on variables that can be measured as accurately as possible. In addition, you must be able to gather the needed data at an appropriate scale and frequency.

Replicable: if a measurement can't be accurately repeated, you will not be able to assess progress over time.

Simple: choose indicators that are easy to understand, while being as precise as possible.

Cost-effective: relatively inexpensive to monitor without diminishing the effectiveness or quality of the data.

Relevant: relevancy is a top priority when developing indicators. Do not spend your time with indicators that to not relate to the goals and targets you have developed.

Examples of Climate Indicators

The following is a list of indicators that can be used to assess a city's progress around climate protection. Each indicator provides a measurement that demonstrates decreased GHG emissions within the community.

Resource Conservation:
Energy Use
Renewable Energy Use
Carbon/ GHG Footprint
GHG emissions
Procurement practices
Imported Energy
Energy Program
Solid Waste Generation
Water Use
Agricultural practices

Transportation:
Residential Use of Sustainable Transportation Options
Vehicle Miles Traveled
Bus Ridership
Car/Van Pool Programs
Bicycle Lanes
Alternative Fueled City Vehicles
Transportation Options Available
Plug in hybrid programs
Traffic Congestion

Environmental and Public Health:
Wastewater Generation
Vehicle Miles Traveled
Local Purchasing Policies in Place (cont'd)

[991] LASER Unit Six, Indicators of Community Performance, www.global-laser.org/resources/indicator_development.pdf, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter7/LASER_indicators.pdf, 5 December 2006.

Environmental and Public Health (cont'd):
Urban Runoff Reduction[992]
Air Quality[993]

Education and Outreach:
Community Energy/Climate Task Force
Community Energy Website
Green Builder Program
Small Business Assistance

Land Use:
Presence of Urban Forestry Program
Open Space/ Green Space
Sustainable Agriculture Practices
Carbon Conscious Land Use and Development Program

Buildings:
Green Building/construction
Production of Energy Efficient Housing
Financial Assistance Program for Energy Efficient Housing
Net Zero Energy Homes

Monitoring Indicators

Indicators should be monitored regularly to assess whether various programs created to achieve them are being successful. Well-designed indicators set targets and specify goals that a city aims to achieve within each metric. Through assessment and measurement, cities can determine if they are on track to reach targets for each climate indicator. Cities may choose to track some goals annually while other goals are better measured at key milestones.

Santa Monica released a Report Card[994] to measure and report their indicator progress. The report card describes how the city is meeting its goals and highlights challenges and successes.

The grades given reflect the progress on the part of the entire community to reach the adopted goals. A secondary grade reflects the level of effort the community has put forth. Similar report cards could be used to evaluate cities from across the nation on their level of commitment to reduce the GHG emissions and achieve overall sustainability.

The trick to establish indicators is to determine the variables that will incisively and meaningfully demonstrate the city's progress. If done correctly, a list is created of the specific type of data that might reveal where the city is and where direction it is headed with respect to goals.

For help in creating a list of indicators, make sure to seek out examples of other cities. Below are a few cities that have established climate related indicators.

Sustainability Indicators Include Climate

CASE STUDY: Minneapolis, MN

In 2006, the Minneapolis City Council passed a resolution establishing 24 sustainability indicators. The initial indicators were developed in two public roundtable meetings facilitated by Crossroads Resource Center (through a grant from the Minnesota Office of Environmental Assistance).

The process involved asking approximately 100 residents and professionals to express a 50-year vision for the City's future. The City then set 10-year targets to provide numerical and focused goals to move the city towards this vision.

The indicators reflect areas in which the city aspired to improve.[995] These are high level, forward- looking measurements on specific topics. They center on a vision for the community's long-term future and address the linkages between various issues. Specific climate indicators are included in the list.

[992] Can serve as an indicator for lack of impermeable surfaces, which will then tend to heat a city.
[993] When used as a basis for regulation.
[994] Santa Monica Report Card, santa-monica.org/epd/scpr/SCRC_ReportCard_2006.pdf, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter7/SantaMonica_ReportCard.pdf, 22 September 2006.
[995] Minneapolis Sustainability Initiatives www.ci.minneapolis.mn.us/environment/Sustainability-Initiatives.asp, 22 September 2006.

Sample of climate indicators and accompanying ten year targets for each Indicator:

Renewable Energy Use	*Municipal (City buildings/fleets):* By 2008, increase renewable electrical to 10% above renewable energy supply by Xcel and at that time set a longer-term target. *City Wide:* By 2015, increase renewable energy usage to 10% above state/federal mandates.
Bicycle Lanes and Paths	44 additional miles of bike trail & bike lanes by 2015 (14 miles of on-street bike lanes and 30 miles of off-street bike trails).
Carbon Dioxide Emissions	Reduce municipal operations emissions by 12% by 2012 and by 20% by 2020. Reduce City-wide emissions by 12% by 2012 and by 20% by 2020.
Urban Tree Canopy	*Municipal*: Plant at least 2,500 trees on public land every year thru 2015. *City Wide*: No net loss of tree canopy cover (26.4%) thru 2015.

Minneapolis released a 2005 Sustainable Initiatives Annual Report introducing the indicators and showing progress made to date. Below is an update on their Renewable Energy Use Goal. Minneapolis is working to integrate their indicators[996] into the future decision making process:

As directed by the City Council, the principles, goals and indicators from the Sustainability Report will be incorporated into all city decision-making. Elements from the report will become part of all City departments' business plans. Each department will develop strategies to meet the sustainability goals that correspond to their business areas and report on annual progress in their business plans. Coordination among City departments is critical to achieving these goals.

Stronger alignment among stakeholders will help by streamlining resources, spurring creativity and institutionalizing sustainability principles.[997]

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[996] Minneapolis Sustainability Target Highlights Matrix, www.ci.minneapolis.mn.us/environment/docs/indicators-matrix.pdf, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter7/Minneapolis_Indicators.pdf, 22 September 2006.

[997] Minneapolis Sustainability Initiative 2005 Annual Report, http://www.ci.minneapolis.mn.us/sustainability/sustainability-report2005.pdf, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter7/Minneapolis_SustReport2005.pdf, 22 September 2006.

CASE STUDY: Santa Monica, CA

Santa Monica was one of the first cities to develop comprehensive sustainability indicators, adopting them in 1994[998]. In 2001, when Santa Monica's task force reviewed the progress made since the original adoption of indicators in 1994, members decided it was time to update their indicators to portray a more comprehensive picture. This process began in July 2001 with the Sustainability City Working Group. The group met often during a 15-month period to discuss future goals. After receiving public input, the task force introduced a new Santa Monica Sustainable City Plan.[999] The plan includes eight goal areas that as a whole represent a vision for sustainability in the community. The goals are:

1. Resource Conservation
2. Environmental and Public Health
3. Transportation
4. Economic Development
5. Open Space and Land Use
6. Housing
7. Community Education and Participation
8. Human Dignity

The Santa Monica Sustainability Matrix[1000] presents the goals and indicators and the relationship between them. The following shows a segment of the Resource Conservation Indicators and how each performance metric addresses Santa Monica's eight goal areas.

	Resource Conservation	Environmental and Public Health	Transportation	Economic Development	Open Space and Land Use	Housing	Community Education and Civic Participation	Human Dignity
Resource Conservation Indicators								
Solid waste generation	●			●				
Water use	●	●		●			●	
Energy use	●	●	●	●		●		
Renewable energy use	●	●		●			●	
Greenhouse gas emissions	●	●	●	●	●	●		
Ecological Footprint for Santa Monica	●	●	●	●	●	●		
Indicator of sustainable procurement	●	●		●				
"Green" construction	●	●	●			●		

CONTACT

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Sustainable City Plan,
Environmental Programs Division
(310) 458-2227

[998] Local Government Guide to the Internet, www.rural.org/lgg/Ch15_CommIndic.html, 5 December 2006.
[999] Santa Monica Sustainable City Plan, archived at: www.natcapsolutuions.org/ClimateManual/Cities/Chapter7/SCP_2006_Adopted_Plan.pdf, 5 December 2006.
[1000] Santa Monica Matrix santa-monica.org/epd/scp/matrix.htm, entire goal indicator archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter7/SantaMonica_GoalIndicator.doc, 5 December 2006.

Celebrating Successes

Celebrating successful initiatives within a community will be critical to a city's progress in reaching its GHG reduction goals. There are many ways to celebrate accomplishments. Many cities choose to give awards. These can provide an opportunity for both the city and the participating organizations to celebrate their achievements. Awards should provide organizations and individuals:

Positive Publicity—Recognition of achievements should enhance the person's or the organization's image in the community. This can be done through award ceremonies, newspaper stories, posting winners on city website, providing a plaque to be posted in the group's office, etc

Credibility for Environmental Achievements—A city's recognition of program achievements provides outside verification of actual reductions and success.

Support in Maintaining Momentum—Awards maintain organizations internal momentum by providing continued encouragement for management and staff. It also helps to encourage other organizations to address their GHG reductions and sustainability programs.

Networking Opportunities—Recognition as a leader in GHG reductions provides an opportunity to work with other environmentally minded organizations.

Recognition of a Broader Change—Although all the points above are important for cities to recognize, organizations mostly need recognition that their programs and achievements are helping to protect the climate.[1001]

Examples of Climate Awards

Connecticut Climate Change Leadership Awards[1002] During 2006, awards were given for exemplary actions to reduce greenhouse gas emissions in the following six categories:

1. Fleet Vehicle Incentives and Initiatives
2. Transit, "Smart Growth" and Vehicle Miles Traveled Reduction
3. Forest and Agricultural Land Preservation
4. Increase Recycling and Source Reduction
5. Clean Energy Option
6. Public Education Initiative

Clean Air – Cool Planet presents Climate Champion Awards[1003] Every two years to organizations and individuals for their actions to reduce GHG emissions and the threat of global warming. The City of Stamford, Connecticut was one of the 2005 winners. CA-CP Executive Director, Adam Markam stated, "Stamford has long been a leader in energy efficiency. The City has a full-time energy manager and has achieved significant savings of taxpayer dollars by annually reducing 60,000 emissions tons of heat-tapping gases from public operations."[1004]

EPA Climate Protection Partnership Awards[1005] EPA gives a variety of awards to recognize outstanding efforts to protect the climate.

Climate Protection Awards are presented to companies, non-governmental organizations (NGOs), and individuals each year to recognize exceptional leadership, outstanding innovation, personal dedication and technical achievements in protecting the Earth's climate.

Energy Star Awards honor businesses and organizations that made outstanding contributions to reducing GHG emissions through energy efficiency.

Energy Star Combined Heat and Power (CHP) Awards recognize projects that reduce emissions and use at least 5% less fuel than state-of-the-art comparable separate heat-and-power generation.

Green Power Leadership Awards recognize the actions of individuals, companies and

[1001] Climate Biz, Receiving Recognition, www.climatebiz.com/sections/backgrounder_detail.cfm?UseKeyword=Recognition, 5 October 2006.
[1002] Connecticut Leadership Awards, ctclimatechange.com/CTClimateChangeLeadershipAwards.html, 5 October 2006.
[1003] Clean Air – Clean Planet www.cleanair-coolplanet.org/GlobalWarmingSolutions05/documents/awards.php, 5 October 2006.
[1004] Clean Air – Clean Planet, 2005 Climate Champion Award Winner, www.cleanair-coolplanet.org/GlobalWarmingSolutions05/documents/Stamford.php, 5 October 2006.
[1005] EPA Climate Protection Partnerships Awards, www.epa.gov/appdstar/awards/awards.htm, 5 October 2006.

organizations that significantly advance the development of renewable electricity sources through green power markets.

Celebrating Successes

CASE STUDY: Portland, OR[1006]

Portland's Office of Sustainable Development has presented the BEST (Businesses for Environmentally Sustainable Tomorrow) Award since 1993. The award is given each year to the seven companies demonstrating excellence in business practices that promote economic growth and environmental benefits.

The 2006 BEST Award Winners:

Sustainable Energy: The Holland Inc

Sustainable Product Development: Arnold Creek Productions

Water Efficiency: Port of Portland Property Maintenance Department

Sustainable Food Systems: Portland State University

Transportation Alternatives: Portland Energy Conservation, Inc.

Waste Reduction/ Pollution Prevention: Columbia Steel Casting Company & SCRAP

BEST Practices for Sustainability: Large Company: Nike, Inc.

BEST Practices for Sustainability: Medium Company: Stumptown Coffee Roasters

BEST Practices for Sustainability: Small Company: Eleek, Inc.

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Portland Office of Sustainable Development
(503) 823-0229

[1006] Portland BEST Awards, www.portlandonline.com/osd/index.cfm?c=41891, 22 September 2006.

Celebrating Successes

CASE STUDY: San Mateo County, CA

Since 1999, Sustainable San Mateo County (SSMC) has conducted an annual Sustainability Awards program[1007], an event that heightens community awareness about sustainability. The awards recognize San Mateo County businesses, community groups and individuals that have demonstrated an outstanding commitment to bringing sustainable practices to their work. Nominations are accepted at large; individuals and groups may self-nominate.

Each nomination is evaluated based on how well the nominee's actions reflect basic sustainability criteria:

Future and long-term oriented

Aware of ecological and resource limits

Regional, as well as local in scope

Cognizant that everything is interconnected

Concerned with creating diverse and balanced communities

Inclusive of social equity and well-being

Supportive of public involvement in community decisions

In addition, SSMC, the County of San Mateo's RecycleWorks program and the San Mateo County Chapter of the American Institute of Architects present a Green Building Award. The goal is to inspire and support sustainable design in architecture and to recognize the designers, builders and owners of green buildings in San Mateo County.

More than 250 community leaders, volunteers, interested citizens and local media representatives attend the awards event.

CONTACT

Sustainable San Mateo
(650) 638-2323

[1007] San Mateo County Sustainability Awards, www.sustainablesanmateo.org/index.cfm?fuseaction=awards.welcome, 22 September 2006.

Additional Resources

Sustainable Cities Report, Best Practices in Renewable Energy & Energy Efficiency, Austin, Chicago, Fort Collins and Portland[1008]
The purpose of Sustainable Cities is to help all cities efficiently implement energy sustainability programs. It is an in-depth look into the history, status and results of the programs in four cities. The report identifies 14 key elements that all cities can use to become more sustainable and includes more than 80 links to web pages and source reports allowing deeper exploration of a particular city's programs.

SustainLane[1009] provides detailed report cards ranking U.S. city's quality of life combined with indicators of sustainability programs, policies and performance. The 2005 results place San Francisco as the leader in sustainability with Portland, Oregon a close second. Overall rankings were determined by averaging 12 individual category rankings into a cumulative average. Cumulative averages ranged from 5 for the highest-scoring city to18.93 for the lowest-scoring city. The best possible score would be 1 (average of first place across all categories) and the worst possible score would be 25 (average of 25th place across all categories.) Categories include: Transportation, Tap Water Quality, Air Quality, LEED Building, Solid Waste, Food/Agriculture, Zoning, Land Use, Planning, Energy/Climate Policy, City Innovation and Knowledge Base

Sustainable Measures[1010] is a private consulting firm dedicated to promoting sustainable communities, primarily through the development, understanding and use of effective indicators and systems for measuring progress. They help governments, businesses, and non-profits find appropriate, practical ways to contribute to the overall sustainability of their communities.

[1008] Downloadable from Sierra Club Rocky Mountain Chapter's library: www.rmc.sierraclub.org/energy/library/index.shtml, also archived at, www.natcapsolutions.org/ClimateManual/Cities/Chapter7/SustainableCitiesReport.pdf, 22 September 2006.
[1009] To compare SustainLane U.S. City Rankings and report cards, refer to www.sustainlane.com/cityindex/citypage/ranking/, 5 October 2006.
[1010] Sustainable Measures, www.sustainablemeasures.com, 8 October 2006.

Chapter 7: Climate Protection Manual **Resources**

Copious resources are included in footnotes and at the end of each chapter in the Additional Resources section. This chapter is intended to describe other resources that have not been presented elsewhere in the manual.

Energy & Environment Best Practices Report, National Summit of the United States Conference of Mayors, May 2006.
Cities from around the U.S. were asked to submit their best practices in 7 different categories, and the case studies are summarized in one page with relevant background information and a point of contact.
mayors.org/uscm/best_practices/EnergySummitBP06.pdf#search=%22best%20practices%20ethanol%20E85%20city%22

California Leep (CALeep) Workbook
The Workbook lays out a process for instituting local energy efficiency programs based on information developed at CALeep Energy Efficiency Summits, in six Pilot Projects and other sources. It is intended to serve as a tool to be used by local officials and community activists to initiate, plan, organize, implement and assess energy efficiency activities at the local and regional level.
www.caleep.com/workbook/workbook.htm.

SustainLane Government Best Practices Database
Free online database of best practices searchable by category. The database is designed for state and local government professionals and their preferred contractors.
sustainlane.us/home.jsp

Clean Air – Cool Planet: Community toolkit
Community toolkit of case studies of cities divided into 4 different categories.
www.cleanair-coolplanet.org/for_communities/toolkit_home.php

Agenda for Climate Action,
Prepared by the Pew Center for Global Climate Change, February 2006
Identifies both broad and specific policies, combining recommendations on economy-wide mandatory emissions cuts, technology development, scientific research, energy supply and adaptation with critical steps that can be taken in key sectors. These recommendations have been designed to be both cost-effective and comprehensive.
www.pewclimate.org/global-warming-in-depth/all_reports/agenda_for_climate_action/index.cfm

Economic Growth and Greenhouse Gas Mitigation in California, David Roland-Holst, UC Berkeley. The report is a study on the economic impacts of policy measures in California, as the executive summary describes:
This research note offers preliminary results on the link between GHG abatement strategies and economic growth from on-going research with a forecasting model of the California economy. The Berkeley Energy and Resources (BEAR) model is a detailed empirical simulation tool that can evaluate the complex linkages between climate policy and economic activity. In the analysis presented here, eight targeted GHG emission policies are combined with an overall cap to meet the state's targets for 2020. No specific implementation of the cap is assumed; these results can be interpreted as the result of

an efficient combination of policies.
calclimate.berkeley.edu/Growth_Strategies_Full_Report.pdf

Energy Efficiency Bottom Line Opportunities for Metro Denver Companies
The Metro Denver Economic Development Corporation (Metro Denver EDC) revealed a report on June 16, 2006 that suggests investments and low-cost efforts that Metro Denver businesses can make to conserve energy and boost their bottom lines. Prepared for Metro Denver EDC by the Colorado Energy Science Center, this report offers concrete evidence of cost-saving efficiency upgrades and return-on-investment figures.
www.metrodenver.org/documents/newsCenter/EnergyEfficiencyReport.pdf

"Climate Change Action Plan," Prepared by the Committee on the Environment and the Northeast International Committee on Energy of the Conference of New England Governors and Eastern Canadian Premiers, August 2001. Provides 9 action items for reducing greenhouse gas emissions.
www.negc.org/documents/NEG-ECP%20CCAP.PDF#search=%22climate%20action%20plans%22

Massachussetts Climate Action Network (MCAN). Lists 7 city climate action plans and gives resources on how to write and implement an action plan.
www.massclimateaction.org/plans.htm

Climate Northeast Page offers resources and tools to reduce emissions, with World Resource Institute climate resources.
www.climatenortheast.org/resources_tools.php

Energy Information Administration (EIA), Energy Related Greenhouse Gas Emissions Links. An extensive database of state climate action plans and climate science.
www.eia.doe.gov/emeu/efficiency/greenhouse_gas/greenhouse_links.html

Adapting to Global Warming Guidebook, co-authored by the King County Executive and his global warming team, and the internationally distinguished Climate Impacts Group is currently being drafted. Contact the King County office for more information, (206) 296-4301.

SWEEP, collaborates with utilities, state agencies, environmental groups, universities, and other energy efficiency specialists. SWEEP also conducts studies and engages in policy advocacy. SWEEP's main focus is on electricity conservation, but SWEEP intends to address more efficient fuel use and transport issues in the future.
www.swenergy.org/index.html

"Climate Action Planning and Implementation in US States," The Center for Climate Strategies, July 2006. The Center has helped many states develop their climate action plans.
www.rockymountainclimate.org/website%20pictures/CCS%20Fact%20Sheet.pdf#search=%22climate%20action%20plans%22

New Energy for Cities: Energy Saving & Job Creation Policies for Local Governments, The Apollo Alliance
www.apolloalliance.org/docUploads/new_energy_cities.pdf

High Performance Cities: A Guide to Energy-Saving Policies in Urban Areas, The Apollo Alliance
www.apolloalliance.org/docUploads/apollo-final.pdf

Greenhouse Gas Action Guide, BC Climate Exchange. This guide is a set of straightforward cost-effective actions, most of which have been implemented by some BC local governments.
www.ghgactionguide.ca/

City/County Local Action Plans

Austin, Texas
Climate Protection Plan, 2007
www.ci.austin.tx.us/council/downloads/mw_acpp_points.pdf

Berkeley, California
Berkeley Government Action Plan website:
www.ci.berkeley.ca.us/sustainable/Government/actionplans.html
Berkeley Resource Conservation and Global Warming Abatement Plan, 1998,
www.natcapsolutions.org/ClimateManual/Cities/ClimatePlans/Berkeley_CP1998.pdf

Boulder, Colorado
Energy & Climate Change Portal :
www.bouldercolorado.gov/index.php?option=com_content&task=view&id=1058&Itemid=396
Climate Action Plan, 2006,
www.natcapsolutions.org/ClimateManual/Cities/ClimatePlans/Boulder_CP2006.pdf

Brookline, Massachusetts
Local Action Plan on Climate Change, 2002, can be downloaded from the website:
www.townofbrooklinemass.com/conservation/climatechange.html

Burlington, Vermont
Burlington Electric Department Climate Action Plan, each section can be downloaded from the website:
www.burlingtonelectric.com/SpecialTopics/Reportmain.htm

Cambridge, Massachusetts
Cambridge Climate Initiatives:
www.cambridgema.gov/%7ECDD/et/env/climate/climate.html
Climate Protection Plan, 2002,
www.natcapsolutions.org/ClimateManual/Cities/ClimatePlans/Cambridge_CP2002.pdf

Charleston, South Carolina
Local Action Plan on Climate Change, 2003,
www.natcapsolutions.org/ClimateManual/Cities/ClimatePlans/Charleston_CP2003.pdf

Chicago, Illinois
Chicago Department of Environment website:
egov.cityofchicago.org/city/webportal/portalEntityHomeAction.do?entityName=Environment&entityNameEnumValue=05
Environmental Action Agenda, 2006,
www.natcapsolutions.org/ClimateManual/Cities/ClimatePlans/Chicago_ActionAgenda2006.pdf

Denver, Colorado
Greenprint Denver website:
www.greenprintdenver.org
Greenprint Action Agenda, 2006,
www.greenprintdenver.org/docs/greenprint_report.pdf

Fort Collins, Colorado
Local Action Plan to reduce GHG emissions, 1999, can be downloaded at:
fcgov.com/airquality/lap.php
Municipal Climate Protection Plan, 2001,
fcgov.com/climateprotection/pdf/map.pdf

Los Angeles, California
Global Climate Change website:
www.lacity.org/EAD/EADWeb-AQD/GlobalClimateChange.htm
Climate Action Energy Plan, 2001,
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A list and explanation of smart growth and natural resource and open space protection ordinances passed by 566 municipalities in New Jersey to address different facets of smart growth:
www.smartgrowthgateway.org/ordinances.shtml

Smart Growth Online
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