



# CHAPTER 2: Why Act Now

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## 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**

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 11<sup>th</sup> 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.<sup>1</sup> 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

<sup>1</sup> Pew Center for Global Climate Change, [www.pewclimate.org/hurricanes.cfm](http://www.pewclimate.org/hurricanes.cfm), 30 November 2006.

the previous record of \$145 billion<sup>2</sup> in 2004. In contrast, the World Trade Center losses were less than \$40 billion.<sup>3</sup>

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).<sup>4</sup> 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.<sup>5</sup>

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

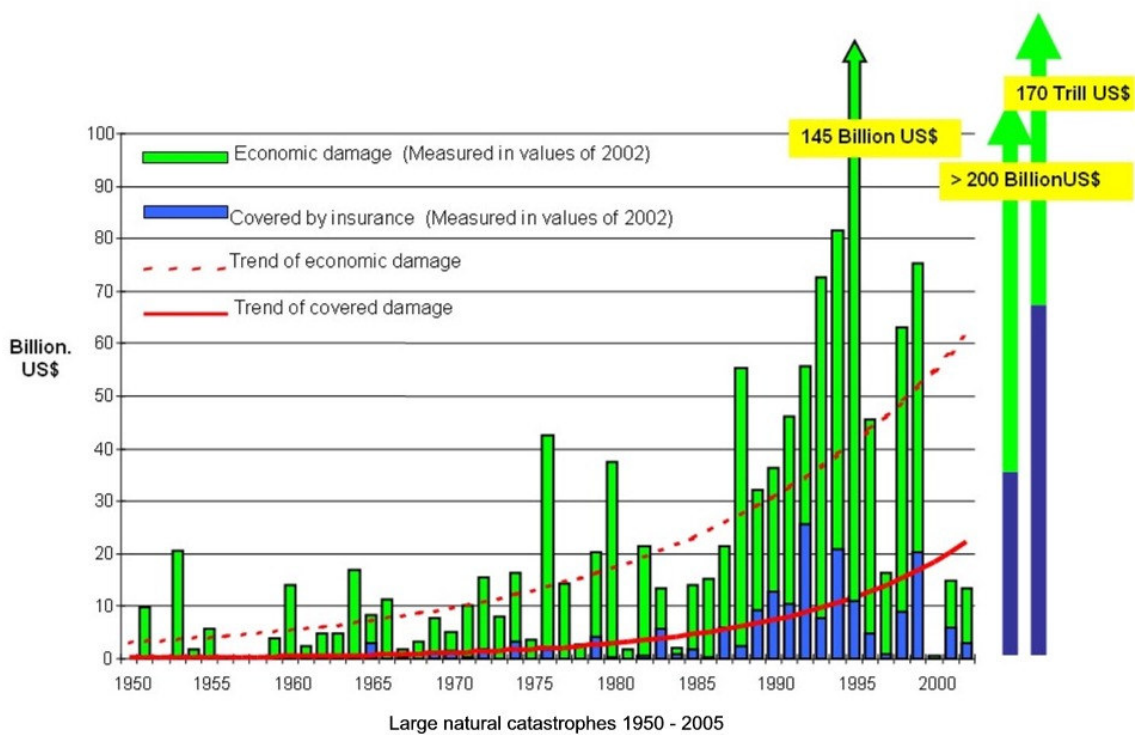


Figure: Evolution of Economic Costs and Insured Costs of Natural Disasters Worldwide<sup>6</sup>

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.<sup>7</sup>

National Oceanic and Atmospheric Administration (NOAA) Administrator D. James Baker says, "Our climate is

<sup>2</sup> Jim Lobe, "2005 Costliest Year for Extreme Weather", Interpress Service, 7 Dec 2005. Available at, [www.truthout.org/docs\\_2005/120705E.shtml](http://www.truthout.org/docs_2005/120705E.shtml), 30 October 2006.

<sup>3</sup> Thomas Atkins, "Insurer warns of global warming catastrophe", Reuters, 3 March 2004.

<sup>4</sup> Munich re, website: [www.munichre.com/](http://www.munichre.com/), 19 July 2006.

<sup>5</sup> Dr. Andrew Dlugolecki, director of the CGNU, sixth largest insurance company in the world, in his report to the 6<sup>th</sup> 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](http://www.unepfi.org/fileadmin/events/2001/cop65/cc_unep_press_cop65_20010718.pdf), 30 October 2006.

<sup>6</sup> © 2003 GeoRisikoForschung, Müncheneruck.

<sup>7</sup> "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.”<sup>8</sup> Hurricane Katrina, which in 2005 destroyed much of New Orleans, may cost insurers as much as \$60 billion.<sup>9</sup>

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.”<sup>10</sup>

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.<sup>11</sup>

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<sub>2</sub> 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.<sup>12</sup>

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.”<sup>13</sup>

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

<sup>8</sup> NOAA web site: see [www.noaa.gov/stories/s412.htm](http://www.noaa.gov/stories/s412.htm), 18 April 2000.

<sup>9</sup> [news.ninems.com.au/article.aspx?id=62176](http://news.ninems.com.au/article.aspx?id=62176), 11 September 2006.

<sup>10</sup> 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.

<sup>11</sup> Perlman, David “Warning of Impact of Global Warming: Scientists forecast economic disruptions.” San Francisco Chronicle (29 January 1999) pg A-4.

<sup>12</sup> Geoffrey Lean, “Global Warming Approaching Point of No Return, Warns Leading Climate Expert,” The Independent (U.K.), 23 January 2005.

<sup>13</sup> 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.<sup>14</sup>

In March 2006, the UN's weather agency, the World Meteorological Organization (WMO) warned that greenhouse gases (GHGs) including carbon dioxide (CO<sub>2</sub>)—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.<sup>15</sup>

Human activity has increased the CO<sub>2</sub> content of the atmosphere by 20% in the last four decades, and today adds three times more annually than in 1960.<sup>16</sup> The levels of CO<sub>2</sub> 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.”<sup>17</sup>

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.<sup>18</sup>

The International Energy Agency projects global emissions to climb another 60% by 2030.<sup>19</sup>

Many scientists now state that to stabilize climate, the world will need to reduce emissions of CO<sub>2</sub> 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.<sup>20</sup>

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

<sup>14</sup> 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](http://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/m<sup>2</sup> 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.

<sup>15</sup> Reuters, “WMO Sees Link Between Global Warming and Hurricanes,” [www.planetark.com/dailynewsstory.cfm/newsid/35795/story.htm](http://www.planetark.com/dailynewsstory.cfm/newsid/35795/story.htm), 27 March 2006.

<sup>16</sup> 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.”

<sup>17</sup> New Scientist.com, [www.newscientist.com/article.ns?id=dn443](http://www.newscientist.com/article.ns?id=dn443), 01 February 2007.

<sup>18</sup> Geoffrey Lean, “Global Warming Approaching Point of No Return, Warns Leading Climate Expert,” The Independent, (U.K.) January 23, 2005.

<sup>19</sup> International Energy Agency, “World Energy Outlook 2004,” published October, 2004. [www.iea.org](http://www.iea.org), 30 October 2006.

<sup>20</sup> 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<sub>2</sub> emissions that contribute to global warming.<sup>21</sup>

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<sub>2</sub> 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.<sup>22</sup>

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.<sup>23</sup>

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.<sup>24</sup> 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."<sup>25</sup>

<sup>21</sup> 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](http://news.independent.co.uk/environment/article1932727_ece).

<sup>22</sup> Excerpted from Chapter 10, "Stabilizing Climate," in Lester R. Brown, W.W. Norton & Company, 2006.

<sup>23</sup> Environment DAILY, 21 March 2006, [www.wbcsd.org/Plugins/DocSearch/details.asp?DocTypeId=32&ObjectId=MTq1NTE&URLBack=%2Ftemplates%2FTemplateWB\\_CSD2%2FLayout%2Easp%3Ftype%3Dp%26MenuId%3DMTY5%26doOpen%3D1%26ClickMenu%3DLeftMenu%26CurPage%3D3%26SortOrder%3Dpubdate%2520desc%2C%2520source%2520asc](http://www.wbcsd.org/Plugins/DocSearch/details.asp?DocTypeId=32&ObjectId=MTq1NTE&URLBack=%2Ftemplates%2FTemplateWB_CSD2%2FLayout%2Easp%3Ftype%3Dp%26MenuId%3DMTY5%26doOpen%3D1%26ClickMenu%3DLeftMenu%26CurPage%3D3%26SortOrder%3Dpubdate%2520desc%2C%2520source%2520asc), 30 October 2006.

<sup>24</sup> 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.

<sup>25</sup> Earth Policy Institute, [www.earthpolicy.org/Books/Seg/PB2ch12\\_ss2.htm](http://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 to 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.<sup>26</sup>

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.<sup>27</sup> 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.<sup>28</sup> 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.”<sup>29</sup>

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

<sup>26</sup> Union of Concerned Scientists, [www.worldtrans.org/whole/warning.html](http://www.worldtrans.org/whole/warning.html), 11 September 2006.

<sup>27</sup> Janet Larson, The Sixth Great Extinction: A status report, Earth Policy Institute, March 2004 [www.earth-policy.org/Updates/Update35.htm](http://www.earth-policy.org/Updates/Update35.htm), 30 October 2006.

<sup>28</sup> Millennium Ecosystem Assessment, [www.maweb.org/](http://www.maweb.org/), 30 October 2006.

<sup>29</sup> “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](http://www.independent.co.uk/c/?ec=500), and [www.truthout.org/cgi-bin/artman/exec/view.cgi/34/10059](http://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.<sup>30</sup>

**Regular Oil & Natural Gas Liquids  
2003 Base Case Scenario**

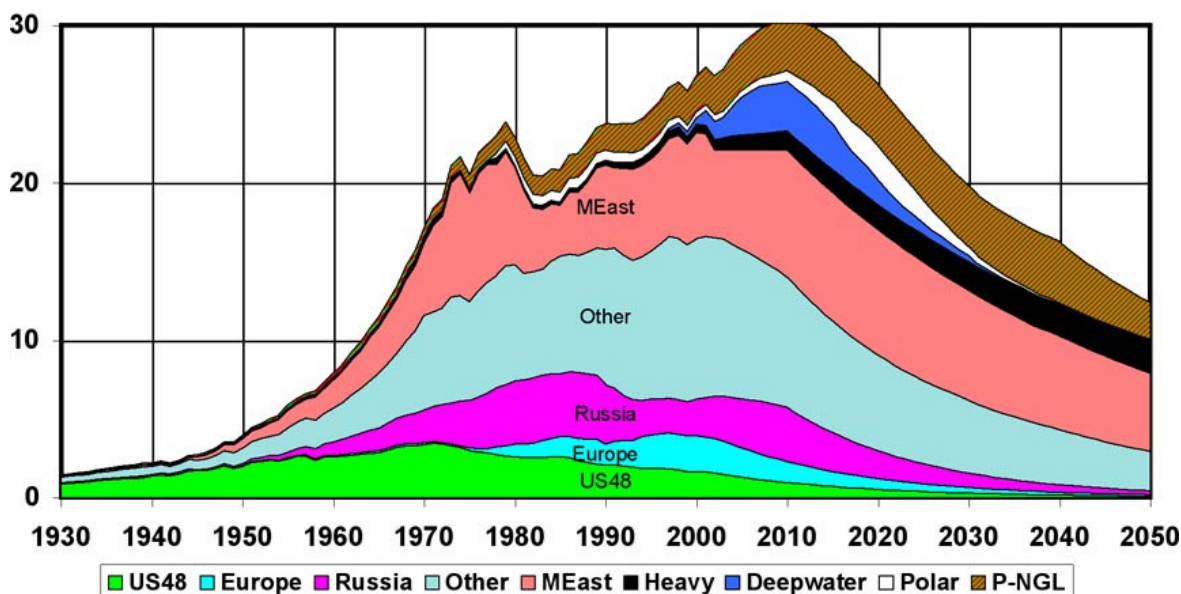


Figure: Hubbert's Needle—Peak Forecast of Fossil Energy Sources

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.<sup>31</sup> 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.<sup>32</sup> 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

<sup>30</sup> Hubbert Peak of Oil Production website: [www.hubbertpeak.com/hubbert](http://www.hubbertpeak.com/hubbert), 13 September 2006.

<sup>31</sup> James Kuntsler, *The Long Emergency*, Grove Press, 2006.

<sup>32</sup> 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](http://www.netl.doe.gov/publications/others/pdf/Oil_Peaking_NETL.pdf), also archived at [www.natcapsolutions.org/ClimateManual/Cities/Chapter3/DOE\\_peakoil.pdf](http://www.natcapsolutions.org/ClimateManual/Cities/Chapter3/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.<sup>33</sup> 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, geopolitical 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."<sup>34</sup>

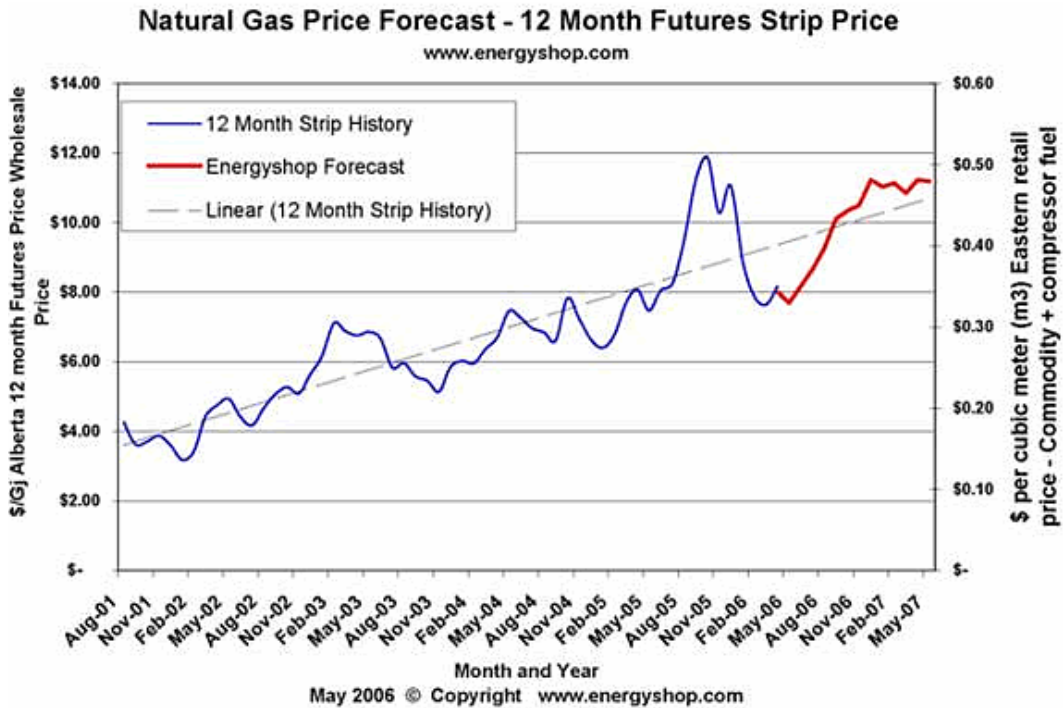


Table: Price Forecast for Natural Gas

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.<sup>35</sup> As described more, there is a great deal that individuals and communities can do to extract themselves from the

<sup>33</sup> Energy Shop, website: [www.energyshop.com/es/homes/gas/gaspriceforecast.cfm](http://www.energyshop.com/es/homes/gas/gaspriceforecast.cfm), August 23, 2006.

<sup>34</sup> Stefan Wagstyl, "Cheney rebukes Putin on energy 'blackmail'," Financial Times, [www.ft.com/cms/s/25eb1452-db62-11da-98a8-0000779e2340.html](http://www.ft.com/cms/s/25eb1452-db62-11da-98a8-0000779e2340.html), 4 May 2006.

<sup>35</sup> Post Carbon Institute, website: [www.postcarbon.org/](http://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.<sup>36</sup> 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.**<sup>37</sup>

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.<sup>38</sup>

An increasing number of homes are being equipped with solar electricity and heat.<sup>39</sup> The

country of Spain recently mandated that all new homes will be equipped with solar and that renovations must include solar, as well.<sup>40</sup> 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.<sup>41</sup> 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.<sup>42</sup> 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

<sup>36</sup> Post Carbon Institute, [www.postcarbon.org/involved/resolution](http://www.postcarbon.org/involved/resolution), 20 July 2006.

<sup>37</sup> City of Bloomington, Indiana, website: [bloomington.in.gov/egov/docs/1153747651\\_559687.pdf](http://bloomington.in.gov/egov/docs/1153747651_559687.pdf), also archived at, [www.natcapsolutions.org/ClimateManual/Cities/Chapter8/Bloomington.pdf](http://www.natcapsolutions.org/ClimateManual/Cities/Chapter8/Bloomington.pdf), 20 July 2006.

<sup>38</sup> List studies, For a discussion of this see Lovins, Lovins, Brittle Power, Chapter 17, [www.natcapsolutions.org/publications\\_files/brittlepower.htm](http://www.natcapsolutions.org/publications_files/brittlepower.htm), 30 October 2006.

<sup>39</sup> Earth Policy Institute, Eco-Economy Indicators, [www.earth-policy.org/Indicators/2004/indicator12.htm](http://www.earth-policy.org/Indicators/2004/indicator12.htm), 30 October 2006.

<sup>40</sup> 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.

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.<sup>43</sup> 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?<sup>44</sup>

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.<sup>45</sup>

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.<sup>46</sup>

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.<sup>47</sup> 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.<sup>48</sup> 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.<sup>49</sup> Approximately 30% of the

<sup>41</sup> Collaborative Biodiesel Tutorial, [www.biodieselcommunity.org/](http://www.biodieselcommunity.org/), 30 October 2006.

<sup>42</sup> BBC News, "Brazil's Alcohol Cars Hit 2 Million Mark", Friday 18 August 2006.

<sup>43</sup> Arizona Water Resource, [cals.arizona.edu/AZWATER/awr/dec99/Feature2.htm](http://cals.arizona.edu/AZWATER/awr/dec99/Feature2.htm), 11 September 2006.

<sup>44</sup> Ibid.

<sup>45</sup> USA Today, [www.usatoday.com/news/nation/2003-01-26-water-usat\\_x.htm](http://www.usatoday.com/news/nation/2003-01-26-water-usat_x.htm), 11 September 2006.

<sup>46</sup> Hawken, Lovins, Lovins 1999, *Natural Capitalism*, Little Brown, P. 107-124.

<sup>47</sup> Global Footprint Network, [www.footprintnetwork.org/](http://www.footprintnetwork.org/), 30 October 2006.

<sup>48</sup> "Learning From China, Why the Western Economic Model Will not Work for the World", [www.earth-policy.org/Updates/2005/Update46.htm](http://www.earth-policy.org/Updates/2005/Update46.htm), Lester R. Brown, March 9, 2005.

<sup>49</sup> 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](http://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.<sup>50</sup>

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.<sup>51</sup>

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 market for these products, is at least \$81 billion and growing. The 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.<sup>52</sup>

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.<sup>53</sup>

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<sup>50</sup> LOHAS website, [www.lohas.com/about.htm](http://www.lohas.com/about.htm), 11 September 2006.

<sup>51</sup> Ray, Paul, and Anderson, Sherry, *The Cultural Creatives*, Three Rivers Press (October 2, 2001) ISBN: 0609808451

<sup>52</sup> LOHAS website, [www.lohas.com/about.htm](http://www.lohas.com/about.htm), 30 October 2006.

<sup>53</sup> Paul Hawken, Natural Capital Institute, [www.naturalcapital.org/Projects.html](http://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."<sup>54</sup>

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%.<sup>55</sup>

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.<sup>56</sup>

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.<sup>57</sup>

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

<sup>54</sup> Jeffrey Immelt and Jonathan Lash, *Washington Post*, May 21, 2005; Page A19.

<sup>55</sup> Marc Gunther, "The Green Machine," *Fortune Magazine*, July 27 2006 [money.cnn.com/magazines/fortune/fortune\\_archive/2006/08/07/8382593/index.htm](http://money.cnn.com/magazines/fortune/fortune_archive/2006/08/07/8382593/index.htm), 30 October 2006.

<sup>56</sup> *Ibid.*

<sup>57</sup> 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](http://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.<sup>58</sup>

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.<sup>59</sup> 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.<sup>60</sup>

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

<sup>58</sup> Greenbiz.com, Joel Makower, Top Green Business Stories of 2006, January 3 2007, [www.greenbiz.com/news/reviews\\_third.cfm?NewsID=34384](http://www.greenbiz.com/news/reviews_third.cfm?NewsID=34384).

<sup>59</sup> USA Today, "Group: ExxonMobil paid to mislead public," [http://www.usatoday.com/money/industries/energy/2007-01-03-global-warming\\_x.htm](http://www.usatoday.com/money/industries/energy/2007-01-03-global-warming_x.htm), Updated 4 January 2007.

<sup>60</sup> Marc Gunther, "The Green Machine," Fortune Magazine, July 27 2006 [http://money.cnn.com/magazines/fortune/fortune\\_archive/2006/08/07/8382593/index.htm](http://money.cnn.com/magazines/fortune/fortune_archive/2006/08/07/8382593/index.htm), 30 October 2006.

cost-effective for non-profit (including government) organizations.<sup>61</sup> 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.<sup>62</sup>

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."<sup>63</sup> The Climate Group website<sup>64</sup> 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.<sup>65</sup> 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.

<sup>61</sup> Amory Lovins and L. Hunter Lovins, *Climate: Making Sense and Making Money*, Rocky Mountain Institute, 1997.

<sup>62</sup> 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](http://www.naturaledgeproject.net), 30 October 2006.

<sup>63</sup> 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.

<sup>64</sup> The Climate Group, [www.theclimategroup.org/](http://www.theclimategroup.org/), 11 September 2006.

<sup>65</sup> 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.<sup>66</sup> The main sources of ST's GHG emissions are 45% facility energy use, 35% industrial

process (PFC<sup>67</sup> and SF6<sup>68</sup>) 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<sup>69</sup>) 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).<sup>70</sup>

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.<sup>71</sup> By the time ST meets its commitment, it predicts that it will have saved almost a billion dollars.

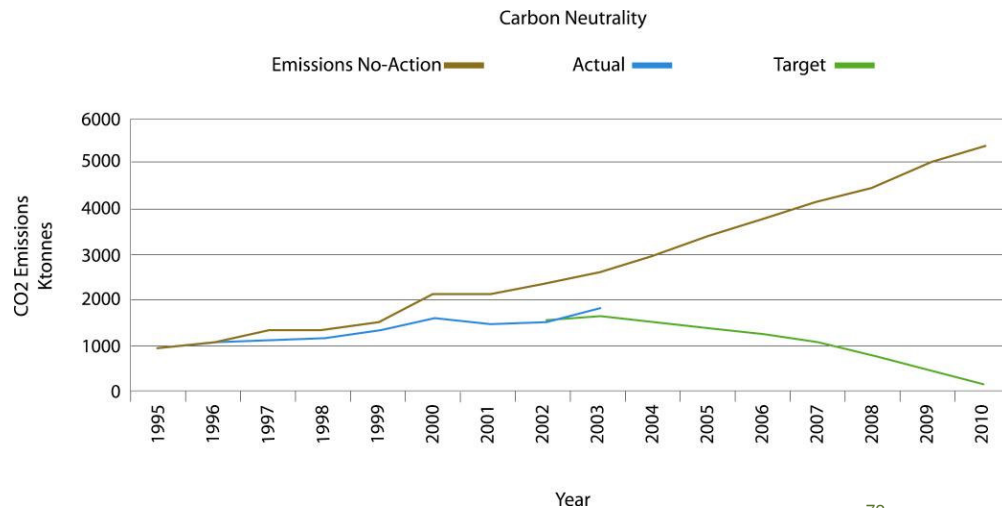


Figure: STMicroelectronics Commitment to Carbon Neutrality<sup>72</sup>

<sup>66</sup> STMicroelectronics (2003) Sustainable Development report, [www.bl.uk/pdf/eis/stmicroelectronics2003is.pdf](http://www.bl.uk/pdf/eis/stmicroelectronics2003is.pdf), 11 September 2006, 30 October 2006.

<sup>67</sup> 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.

<sup>68</sup> Sulfur Hexafluoride (SF6) is another potent greenhouse gas. It one of the most popular insulating gases.

<sup>69</sup> Conventional power stations that burn fossil fuels give off a lot of heat, wasting as much as 70% of the energy they consume.

<sup>70</sup> 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.

<sup>71</sup> IC Insights, IC Insights Announces 1Q 05 Top Ten Semiconductor Supplier Ranking," from [www.icinsights.com](http://www.icinsights.com), 30 October 2006

<sup>72</sup> STMicroelectronics Sustainable Development Report 2003.



## The Emerging Greenhouse Gas Marketplace

In January 2005, an independent commission of businesspeople, politicians and scientists<sup>73</sup> 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<sub>2</sub> 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.<sup>74</sup>

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<sub>2</sub> 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.<sup>75</sup>

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<sub>2</sub> 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 12<sup>th</sup> largest carbon emitter in the world despite leading the nation in energy efficiency standards and its lead role in protecting its environment.<sup>76</sup>

<sup>73</sup> "Global Warming Approaching Critical Point 'An Ecological Time-bomb is Ticking Away,'" CNN Report, Monday, 24 January 2005.

<sup>74</sup> Chicago Climate Exchange, [www.chicagoclimatex.com/](http://www.chicagoclimatex.com/), 11 September 2006.

<sup>75</sup> Natural Capitalism was one of the earliest members.

<sup>76</sup> 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](http://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<sup>77</sup> 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

may be coming, and offered detailed advice on how they should be designed.<sup>78</sup>

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.<sup>79</sup>

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.<sup>80</sup> 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.<sup>81</sup> It is reducing costs, gaining market

<sup>77</sup> New Voice of Business, [www.newvoiceofbusiness.org/](http://www.newvoiceofbusiness.org/), 12 September 2006.

<sup>78</sup> 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](http://www.salon.com/opinion/feature/2006/04/10/muckraker/index_np.html), 12 September 2006.

<sup>79</sup> 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.

<sup>80</sup> BP 2003 Sustainability Report.

<sup>81</sup> Personal communication with Hunter Lovins, 2002 Fortune Magazine Annual Meeting, Aspen, CO.

acknowledged that regulations

share and attracting and retaining the best talent.<sup>82</sup>

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.<sup>83</sup> 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.<sup>84</sup>

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.<sup>85</sup>

Many participants in the voluntary U.S. EPA performance-challenge programs (such as 33/50<sup>86</sup> and Green Lights<sup>87</sup>) 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.<sup>88</sup>

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.<sup>89</sup>

Lockheed commissioned a new headquarters building for its Sunnyvale facility. The architects successfully argued that the “litterium” 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

<sup>82</sup> BP now states this on its website and in its advertisements.

<sup>83</sup> Marc Gunther, “The Green Machine,” *Fortune Magazine*, July 27 2006

[money.cnn.com/magazines/fortune/fortune\\_archive/2006/08/07/8382593/index.htm](http://money.cnn.com/magazines/fortune/fortune_archive/2006/08/07/8382593/index.htm), 30 October 2006.

<sup>84</sup> DuPont reports: [www1.dupont.com/NASApp/dupontglobal/corp/index.jsp?page=/social/SHE/usa/us3b.html](http://www1.dupont.com/NASApp/dupontglobal/corp/index.jsp?page=/social/SHE/usa/us3b.html), 12 September 2006.

<sup>85</sup> Marc Gunther, “The Green Machine,” *Fortune Magazine*, July 27 2006

[money.cnn.com/magazines/fortune/fortune\\_archive/2006/08/07/8382593/index.htm](http://money.cnn.com/magazines/fortune/fortune_archive/2006/08/07/8382593/index.htm), 30 October 2006.

<sup>86</sup> 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.

<sup>87</sup> 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.

<sup>88</sup> 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](http://news.sel.sony.com/en/corporate_information/environmental), 30 October 2006.

<sup>89</sup> Romm and Browning, *Greening the Building and the Bottom Line: Increasing Productivity Through Energy-Efficient Design*, 1994.

the “value engineers” sought to eliminate it from the design.

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.<sup>90</sup>

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.<sup>91</sup>

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.<sup>92</sup>

### 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.”<sup>93</sup> 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.

<sup>90</sup> Ibid.

<sup>91</sup> Heschong Mahone Group, [www.h-m-g.com/projects/daylighting/projects-PIER.htm](http://www.h-m-g.com/projects/daylighting/projects-PIER.htm), 8 September 2006 .

<sup>92</sup> Hawken, Lovins and Lovins, *Natural Capitalism* p 52. Also see Rocky Mountain Institute, [www.rmi.org/sitepages/pid208.php](http://www.rmi.org/sitepages/pid208.php), 30 October 2006.

<sup>93</sup> Health and Energy Company, a Nebraska energy testing company, [healthandenergy.com/osage\\_energy\\_efficiency.htm](http://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.”<sup>94</sup>

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.<sup>95</sup>

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<sub>2</sub> emissions per year.<sup>96</sup>

### 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

<sup>94</sup> “The Jobs Connection: Energy Use and Local Economic Development,” *Tomorrow’s Energy Today*, US Department of Energy, 1994.

<sup>95</sup> Byron Kennard, “Global Warming on Main Street,” *Business Week*, 27 June 2006.

<sup>96</sup> Case study from [greenerbuildings.com](http://greenerbuildings.com/case_studies_detail.cfm?LinkAdvID=38528): [www.greenerbuildings.com/case\\_studies\\_detail.cfm?LinkAdvID=38528](http://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.<sup>97</sup>

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 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

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<sup>97</sup> 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](http://www.bdcnetwork.com/article/CA335621.html?text=driven+to+be+green), 30 October 2006.



what appears to be a revolution.<sup>98</sup>

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.<sup>99</sup>

Renewables can also be cheaper than any conventional supply. Energy from wind turbines in good sites now costs 3¢ per kilowatt-hour (kWh).<sup>100</sup> 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.<sup>101</sup>

## 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.

<sup>98</sup> 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](http://seattlepi.nwsource.com/opinion/280625_solarcell10.html), 30 October 2006.

<sup>99</sup> 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 sites 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](http://www.nrel.gov/docs/fy05osti/37657.pdf#search=%22wind%203%C2%A2%2FkWh%22), 10 June 2005.

<sup>100</sup> 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](http://www.natcapsolutions.org), 30 October 2006.

<sup>101</sup> Robert Sanders, "Investment in renewable energy better for jobs as well as environment," [www.berkeley.edu/news/media/releases/2004/04/13\\_kamm.shtml](http://www.berkeley.edu/news/media/releases/2004/04/13_kamm.shtml), 13 April 2004.

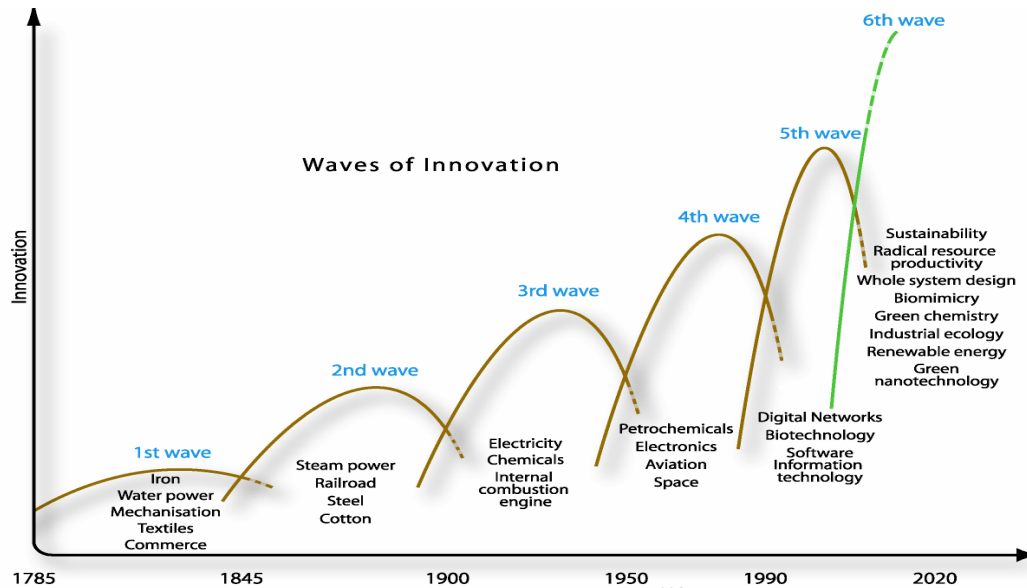


Figure: Waves of Innovation<sup>102</sup>

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.<sup>103</sup>

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.<sup>104</sup>

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.<sup>105</sup>

<sup>102</sup> The Natural Edge Project, Australia, [www.naturaledgeproject.net/](http://www.naturaledgeproject.net/), 30 October 2006.

<sup>103</sup> W. Drozdziak, "Big Corporations Alter View of Global Warming," Washington Post Service, Friday, 24 November 2000.

<sup>104</sup> BBC, Wednesday, 8 February 2006, 17:14 GMT [news.bbc.co.uk/1/hi/sci/tech/4694152.stm](http://news.bbc.co.uk/1/hi/sci/tech/4694152.stm), 30 October 2006.

<sup>105</sup> 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](http://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.<sup>106</sup>

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.<sup>107</sup>

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.<sup>108</sup>

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*,<sup>109</sup> 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 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<sup>110</sup>

<sup>106</sup> Ibid.

<sup>107</sup> William Greider: *One World: Ready or Not* (New York: Simon and Schuster, 1997; juxtaposition quoted in *Success Digest* March 1997).

<sup>108</sup> Tom Peters, Re-image, [www.tompeters.com/reimagine/toc.php](http://www.tompeters.com/reimagine/toc.php), 12 September 2006.

<sup>109</sup> Richard Florida, *Rise of the Creative Class*, Basic Books, 2002, [www.creativeclass.org/press.htm](http://www.creativeclass.org/press.htm), 12 September 2006.

<sup>110</sup> U.S. Mayors Climate Protection Agreement website, [www.ci.seattle.wa.us/mayor/climate/default.htm#what](http://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"<sup>111</sup> 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 underfunded 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 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.

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<sup>111</sup> ICLEI, [www.iclei.org/index.php?id=1118](http://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 became 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<sub>2</sub> 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<sup>112</sup> 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.<sup>113</sup>

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.

<sup>112</sup> “Reducing Greenhouse Gas Emissions: Municipal Solutions – Fact Sheet #5”, Waquoit Bay National Estuarine Research Reserve, August 2002.

<sup>113</sup> Rebuild America, [rebuild.gov](http://rebuild.gov), 30 October 2006.

## 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<sub>2</sub> and \$2.9 million annually.<sup>114</sup> 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.<sup>115</sup>

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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 shareholder value remains to be seen, the first such suits have already been filed.<sup>116</sup>

### Legal Risks

In the U.S., the Sarbanes-Oxley Act<sup>117</sup> 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<sup>118</sup> 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

<sup>114</sup> U.S. Department of Energy, [www.eere.energy.gov/news/archive.cfm/pubDate=%7Bd%20'2002-10-30'%7D](http://www.eere.energy.gov/news/archive.cfm/pubDate=%7Bd%20'2002-10-30'%7D), 12 September 2006.

<sup>115</sup> Fort Carson Sustainability Program and SEMS, [sems.carson.army.mil](http://sems.carson.army.mil), 12 September 2006.

<sup>116</sup> 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.

<sup>117</sup> 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](http://www.gcd.com/db30/cgi-bin/pubs/Sarbanes2.pdf), 12 September 2006.

<sup>118</sup> In Germany, only "heavy" industry is currently required to report greenhouse gas emissions.

their GHG emissions.<sup>119</sup> 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.<sup>120</sup>

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.<sup>121</sup>

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.<sup>122</sup>

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.<sup>123</sup>

## 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%).<sup>124</sup> 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.

<sup>119</sup> "Big Investors Demand Disclosure on Corporate Climate Practices," from GreenBiz.com, at website: [www.greenbiz.com/news/news\\_third.cfm?NewsID=27640](http://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](http://www.greenbiz.com/news/reviews_third.cfm?NewsID=34384), 3 January 2007.

<sup>120</sup> "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](http://www.ftse.com/Indices/FTSE4Good_Index_Series/Downloads/FTSE4Good_Climate_Change_Consultation_Aug_06.pdf), 12 September 2006.

<sup>121</sup> Financial Times, 13 June 2006, Sustainable Bank of the Year, . [news.ft.com/cms/s/c1f6fade-fafa-11da-b4d0-0000779e2340.html](http://news.ft.com/cms/s/c1f6fade-fafa-11da-b4d0-0000779e2340.html), 12 September 2006.

<sup>122</sup> Marc Gunther, "The Green Machine," Fortune Magazine, 27 July 2006 [money.cnn.com/magazines/fortune/fortune\\_archive/2006/08/07/8382593/index.htm](http://money.cnn.com/magazines/fortune/fortune_archive/2006/08/07/8382593/index.htm), 12 September 2006.

<sup>123</sup> Planet Ark, U.S. Oil Majors Seen Lagging in CO<font size="1">2</font> Risk Management [www.planetark.com/dailynewsstory.cfm/newsid/35747/story.htm](http://www.planetark.com/dailynewsstory.cfm/newsid/35747/story.htm), 22 March 2006.

<sup>124</sup> Investor Network on Climate Risk, website: [www.incr.com](http://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.<sup>125</sup> 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<sub>2</sub> 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<sub>2</sub> emission reduction targets, American companies such as ChevronTexaco, ExxonMobil, General Electric and Xcel Energy continue to ignore the threat of global warming.<sup>126</sup>

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.<sup>127</sup> 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.<sup>128</sup>

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<sub>2</sub> emissions.

<sup>125</sup> Institutional Investor Summit on Climate Risk (2005), Summary, By Investor Network on Climate Risk, website: [www.incr.com/index.php?page=19](http://www.incr.com/index.php?page=19), 31 July 2006.

<sup>126</sup> 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](http://www.irrc.com/company/CERES_Corp.Gov.Report.pdf), 30 October 2006.

<sup>127</sup> 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](http://www.incr.com/index.php?page=ia&nid=186), 30 October 2006.

<sup>128</sup> 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.<sup>129</sup>

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.<sup>130</sup> 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.<sup>131</sup>

### **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.<sup>132</sup>

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."<sup>133</sup>

In the Fortune Magazine article "Cloudy with a Chance of Chaos,"<sup>134</sup> 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;

<sup>129</sup> Ibid.

<sup>130</sup> CERES website, [www.ceres.org/pub/](http://www.ceres.org/pub/), 1 August 2006.

<sup>131</sup> 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](http://www.ceres.org/news/news_item.php?nid=57), 1 August 2006.

<sup>132</sup> Jeffrey Ball, *Wall Street Journal*, 7 May 2003.

<sup>133</sup> Thomas Atkins, "Insurer warns of global warming catastrophe", Reuters, 3 March 2004.

<sup>134</sup> 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](http://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 reinsurance 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.<sup>135</sup> 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."<sup>136</sup>

### 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.<sup>137</sup>

**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

<sup>135</sup> "Insurers see more disasters due to climate change," Planet Ark, website: [www.planetark.org/dailynewsstory.cfm/newsid/13100/story.html](http://www.planetark.org/dailynewsstory.cfm/newsid/13100/story.html), 27 July 2006.

<sup>136</sup> "Insurers Retreat From Coasts: Katrina Losses May Force More Costs on Taxpayers," By Spencer S. Hsu, Washington Post Staff Writer, Sunday, 30 April 2006; A01, [www.washingtonpost.com/wpdyn/content/article/2006/04/29/AR2006042901364\\_pf.html](http://www.washingtonpost.com/wpdyn/content/article/2006/04/29/AR2006042901364_pf.html), 27 July 2006.

<sup>137</sup> *Ibid.*

program \$50 billion and prompted federal relief spending of more than \$100 billion.<sup>138</sup> 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.<sup>139</sup>

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.<sup>140</sup> 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.

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<sup>138</sup> Ibid.

<sup>139</sup> Ibid.

<sup>140</sup> 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.<sup>141</sup> 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-

<sup>141</sup> Power remains out for 231,000 in St. Louis, MSNBC website: [www.msnbc.msn.com/id/13954663/](http://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.”<sup>142</sup> 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.

<sup>142</sup> Heat Up St. Louis, website: [www.heatupstlouis.org/News.html](http://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.<sup>143</sup> 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.<sup>144</sup> Again they went from an average of roughly \$3.50 per million BTUs in 2002 to over

\$5.20 in 2003. Over the past 20 years 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.<sup>145</sup> 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

<sup>143</sup> 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](http://www.fas.org/sgp/crs/misc/RS22233.pdf), also archived at, [www.natcapsolutions.org/ClimateManual/Cities/Chapter8/RS22233.pdf](http://www.natcapsolutions.org/ClimateManual/Cities/Chapter8/RS22233.pdf), 11 September 2006.

<sup>144</sup> Data from Energy Shop, [www.energyshop.com/es/homes/gas/gaspriceforecast.cfm](http://www.energyshop.com/es/homes/gas/gaspriceforecast.cfm), 25 July 2006.

<sup>145</sup> 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](http://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.<sup>146</sup> 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.<sup>147</sup> 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.<sup>148</sup> Moreover, gas and coal-fired electric generation requires large amounts of water for their cooling towers. Billions of gallons of water are used every 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.”<sup>149</sup>

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.<sup>150</sup>

### **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.<sup>151</sup>

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.

<sup>146</sup> 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 unhealthy 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](http://lungaction.org/reports/stateoftheair2006.html), 30 October 2006.

<sup>147</sup> 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](http://yosemite.epa.gov/OAR/globalwarming.nsf/UniqueKeyLookup/SHSU5BNNXJ/$File/ccandpublichealth.pdf), 30 October 2006

<sup>148</sup> “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](http://hdl.handle.net/1928/2807), 30 October 2006.

<sup>149</sup> Ibid.

<sup>150</sup> “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.

<sup>151</sup> Ibid

Over 50% of the sulfur dioxide (SO<sub>2</sub>) 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..<sup>152</sup> Close to 50% of the nation's CO<sub>2</sub> emissions derive from fossil fuel combustion for electricity production.

Sulfur dioxide (SO<sub>2</sub>) and nitrogen oxides (NO<sub>x</sub>) 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.<sup>153</sup> 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.<sup>154</sup> Particulate emissions, NO<sub>x</sub> and SO<sub>2</sub> 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<sub>2</sub> and NO<sub>x</sub> react in the atmosphere to form compounds that affect human respiratory and

cardiovascular systems.<sup>155</sup>

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.<sup>156</sup> 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.<sup>157</sup>

### **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 of found that climate change will significantly affect the health of humans and ecosystems and these impacts will have economic consequences.<sup>158</sup> 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 costs the US \$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.

<sup>152</sup> 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](http://www.eia.doe.gov/oiaf/1605/ggrpt/index.html), 30 October 2006.

<sup>153</sup> 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](http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=33347), 30 October 2006.

<sup>154</sup> 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/wqa/publicat/epafin.htm](http://www.westgov.org/wqa/publicat/epafin.htm), 30 October 2006.

<sup>155</sup> Ibid, footnote 25.

<sup>156</sup> 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](http://www.cfsan.fda.gov/~frf/sea-mehg.html), 30 October 2006.

<sup>157</sup> A Balanced Energy Plan for the Interior West," Produced by Western Resources Advocates, 2004, at website: [www.westernresourceadvocates.org/](http://www.westernresourceadvocates.org/), 31 July 2006.

<sup>158</sup> "Climate Change Futures: Health, Ecological and Economic Dimensions", Epstein, Paul, 1 November 2005, [web.med.harvard.edu/sites/RELEASES/html/11\\_1Epstein.html](http://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<sub>2</sub>. 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<sub>2</sub>.

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.<sup>159</sup>

### **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.<sup>160</sup>

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 . But there is no reason for “doom and gloom”, the team concluded, if substantially to climate change. 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<sup>161</sup>. 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;

<sup>159</sup> 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](http://www.forbes.com/2005/11/15/energy-pollution-oil_cx_1116energy_epstein_mills.html).

<sup>160</sup> “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.

<sup>161</sup> 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<sub>2</sub>.

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<sup>162</sup>;**

**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**

<sup>162</sup> 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 (SO<sub>2</sub>, NO<sub>x</sub>, and mercury) or reducing CO<sub>2</sub> emissions.

**For example<sup>163</sup>: 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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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. RGGI will develop a cap-and-trade program to reduce CO<sub>2</sub> emissions from power plants in the participating states.
- Oregon and Washington require new power plants to offset their CO<sub>2</sub> 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.

<sup>163</sup> 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](http://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<sub>2</sub> 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 proactively can help their citizens and local businesses prepare for forthcoming national and state policy addressing CO<sub>2</sub> emissions.

## Risk Mitigation

### CASE STUDY: Evanston, IL<sup>164</sup>

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.<sup>165</sup> 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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<sup>164</sup> CHP Midwest Application Center Site Description, [public.ornl.gov/mac/pdfs/casestudies/cs-ETHS030324.pdf](http://public.ornl.gov/mac/pdfs/casestudies/cs-ETHS030324.pdf), 13 September 2006.

<sup>165</sup> CHP Midwest Application Center, [www.chpcentermw.org/](http://www.chpcentermw.org/), 30 October 2006.

## CASE STUDY: Ft. Collins, CO<sup>166</sup>

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.<sup>167</sup>

### CONTACT

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<sup>166</sup> ENERGY STAR® Building Design Guide, [www.energystar.gov/index.cfm?c=new\\_bldg\\_design.poudreschool\\_cs](http://www.energystar.gov/index.cfm?c=new_bldg_design.poudreschool_cs), 13 September 2006.

<sup>167</sup> American Institute of Architects COTE Newsletter, [www.aia.org/nwsltr\\_cote.cfm?pagename=cote\\_a\\_200602\\_epa](http://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.**<sup>168</sup>

**Offering interruptible load programs, voluntary load curtailment, smart meters and other peak shaving programs to reduce energy use at critical peak times.**<sup>169</sup>

**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.**<sup>171</sup>

**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.**<sup>172</sup>

**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.**<sup>173</sup>

**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.**<sup>174</sup> For an example, see the case study at the end of the document.

<sup>168</sup> For more information on CHP, visit WADE (“World Alliance for Decentralized Energy”) at: [www.localpower.org/](http://www.localpower.org/), 30 October 2006

<sup>169</sup> 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](http://www.goodcents.com/Info/research.htm), 30 October 2006.

<sup>170</sup> For more information on utility DSM programs, visit the American Council for an Energy Efficient Economy’s website at: [www.aceee.org](http://www.aceee.org), 30 October 2006.

<sup>171</sup> 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/](http://www.distributed-generation.com/), 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.**<sup>175</sup>

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.

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<sup>172</sup> Ibid.

<sup>173</sup> For more information about renewable energy resources and technologies, visit National Renewable Energy Lab website: [www.nrel.gov/](http://www.nrel.gov/), 30 October 2006.

<sup>174</sup> For more information on green building codes, the U.S. Green Buildings Council website, at: [www.usgbc.org/DisplayPage.aspx?CMSPageID=76](http://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/](http://www.energystar.gov/), 30 October 2006.

<sup>175</sup> 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/](http://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](http://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](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> (August 2006)

**U.S. Global Change Research Program:** This government program offers hotlinks from its 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> (August 2006)

**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.climatechange-futures.org/>



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