CHAPTER 2:
Why Act Now
Risk Mitigation

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This is the second of three sections. Drivers of Change and The Business Case for Protecting the Climate are the other two. See: www.climatemanual.org

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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.[1] 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-

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

conditioned public buildings and to clear debris.

"We can't overemphasize the danger of this heat," Mayor Francis Slay said. "The longer the heat goes on and the power is out, the riskier it is."[2] 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.

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

Risks of Volatile Fuel Prices

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

Again, climate changes can worsen these risks. Low rainfall or extended drought can worsen the problem, as lost output from hydroelectric dams (traditionally used to meet daytime peaks) produces more pressure on natural gas-fired plants to produce energy, often driving short-term gas prices up. Moreover, strong hurricanes can devastate gas refineries along the Gulf Coast, where on any given month up to 70% of the U.S.' natural gas is refined and sent to market. The price of natural gas spiked right after Hurricane Katrina hit the Louisiana coast and stayed high for most of the following winter.[3] 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.[4] Again they went from an average of roughly $3.50 per million BTUs in 2002 to over $5.20 in 2003. Over the past 20years they have fluctuated about 10-15% per year, on average, and have gone upwards on average 5% per year. This impacts customers in both their electric rates and monthly heating costs. It also drives up the cost of commercial fertilizer to farmers and the costs of other gas-derived products, which affects food prices and trickles down to make *everything* more expensive.

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

Cities also need to take an interest in the types of resources their utilities plan to install in the future to meet future load growth. Most utilities turn a blind eye to the fact that natural gas prices are increasing nationwide, and are still planning to construct large natural gas-fired generating resources to meet demand growth in the 2006-2012 planning horizon. California, alone, is looking at building over 15,000 MW of new gas-fired generation in the next 5-6 years.[5] 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*

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

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

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

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

Recognizing this symbiosis over the decades, the federal government has implemented regulations to protect parts of the ecosystem. Thanks to federal efforts to reduce pollution from power plants and other sources, for example, fewer Americans are dying today from dirty air.[6] 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.[7] 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.[8] Moreover, gas and coal-fired electric generation requires large amounts of water for their cooling towers. Billions of gallons of water are used ever year for cooling in gas and coal-fired plants. In the event of a prolonged drought and a heat wave, water use may have to be carefully rationed between several vital agriculture, energy and residential services.

Heat-Related Deaths and Illnesses

During the summer of 2006, more than 200 Americans died of causes related to the record temperatures that extended throughout the country. In 1995, 465 people died as a direct result of high temperatures in Chicago alone. Studies of selected U.S. cities "indicate that the number of heat-related deaths would increase substantially by the year 2050 under some climate change scenarios."[9]

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.[10]

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.[11]

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

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

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

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

[9] Ibid.

[10] "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.

[11] Ibid

Over 50% of the sulfur dioxide (SO2) 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..[12] Close to 50% of the nation's CO_2 emissions derive from fossil fuel combustion for electricity production.

Sulfur dioxide (SO2) and nitrogen oxides (NOx) contribute to a variety of public health and environmental problems, including asthma, emphysema and other respiratory disorders as well as regional haze and ecological damage.[13] 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.[14] Particulate emissions, NOx and SO2 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 SO2 and NOx react in the atmosphere to form compounds that affect human respiratory and cardiovascular systems.[15]

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.[16] 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.[17]

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.[18] 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.

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12 For more emissions statistics, visit the Department of Energy, Energy Information Administration, Report#: DOE/EIA-0573, "Emissions of Greenhouse Gases in the United States," Released Date: December 2005, at: www.eia.doe.gov/oiaf/1605/ggrpt/index.html, 30 October 2006.

13 For information about the health and respiratory impacts of pollution, see The American Lung Association for a list of articles, at website: www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=33347, 30 October 2006.

14 For more information on the impacts of pollution transport, see "Grand Canyon Visibility Transport Commission: Recommendations for Improving Western Vistas," by the Western Governors Association, 1995, at www.westgov.org/wga/publicat/epafin.htm, 30 October 2006.

15 Ibid, footnote 25.

16 For information about mercury accumulation in fish, visit the website hosted by the U.S. Department of Health and Human Services, at: www.cfsan.fda.gov/~frf/sea-mehg.html, 30 October 2006.

17 A Balanced Energy Plan for the Interior West," Produced by Western Resources Advocates, 2004, at website: www.westernresourceadvocates.org/, 31 July 2006.

18 "Climate Change Futures: Health, Ecological and Economic Dimensions", Epstein, Paul, 1 November 2005, web.med.harvard.edu/sites/RELEASES/html/11_1Epstein.html, 7 January 2007.

The Study's author, Dr. Paul Epstein, in a subsequent article in Forbes Magazine, stated,

> Climate change is already having a less conspicuous, but just as dangerous, impact on humans and the natural systems upon which we depend. Of immediate concern are the implications for human health. For example, asthma rates have quadrupled in the U.S. since 1980. Recent research reveals that rising carbon dioxide--itself, the driver of photosynthesis--stimulates ragweed and some flowering trees to produce an inordinate amount of pollen. Some soil fungi produce many more spores when grown under conditions of elevated CO_2. These "aeroallergens" are carried deep inside our lungs by diesel particles common in urban areas. This unwelcome synergy may be contributing to acute and chronic lung disease. And this factor will grow stronger in a world with increasing levels of CO_2.
>
> Another cause of respiratory disease: Dust clouds emanating from Africa's expanding deserts. Drought in Africa exacerbates this factor, and the clouds are propelled across the Atlantic Ocean by the pressure contrasts between warmer, saltier tropical seas and cooler, fresher water from Arctic and Greenland ice melting into the North Atlantic. The particles (and microbes) in these dust clouds then settle into the lungs of children in Florida and on Caribbean islands in which asthma rates have risen some twentyfold in the past several decades. A rise in wildfires with climate-change-exacerbated droughts are also projected to adversely affect respiratory health.[19]

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

Municipal governments can have an important influence on the greenhouse gas emissions from the two biggest anthropogenic sources: vehicles and buildings[21]. 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;

[19] 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.

[20] "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.

[21] Gasoline consumption produces carbon emissions. The electricity used in the operation of buildings is most often generated by coal-burning power plants.

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

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

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

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

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

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

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

Creating early warning systems for severe weather and pollution;

Implementing stricter zoning and building codes to minimize storm damage;

Improving disease surveillance and prevention programs;

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

Changing how water infrastructure and management to prevent contamination of potable supplies[22];

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

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

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

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

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

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

Regulatory Risks

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

For example[23]**:All of the Northeast and Mid-Atlantic states are studying or implementing programs to reduce GHG emissions.**

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

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

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

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

Risk Mitigation

CASE STUDY: Evanston, IL[24]

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.[25] 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.

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

Risk Mitigation

CASE STUDY: Ft. Collins, CO[26]

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.[27]

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

How Can The Risks Be Managed?

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

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

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

Implementing thorough electricity and natural gas energy efficiency programs. By reducing demand on the system, the probability of a transformer failure is decreased. Though utilities have invested in demand-side management (DSM) resources in the past, there is still a lot of room for efficiency improvements in commercial, industrial and residential buildings. Utility deregulation slowed the rate of efficiency investments in the past five years, but higher fuel prices are starting to stimulate this activity again. City governments can direct their own utility or petition their investor-owned utility to offer more rebates and incentives for energy efficiency programs directed towards all sectors, including low-income residential Using combined heat and power resources where possible. In many industrial facilities, as well as some commercial buildings (such as hospitals and hotels), using the waste process heat to pre-heat water reduces energy costs and strain on the delivery system.[28]

Offering interruptible load programs, voluntary load curtailment, smart meters and other peak shaving programs to reduce energy use at critical peak times.[29]

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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.[31]

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.[32]

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.[33]

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.[34] For an example, see the case study at the end of the document.

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

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

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

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

[32] Ibid.

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.[35]

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

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

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

Additional Resources

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

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

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

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

Environmental Protection Agency: EPA maintains a section for health professionals on its global warming web site: http://yosemite.epa.gov/oar/globalwarming.nsf/content (August 2006)

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

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

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