

Global Climate Change: A Local Issue

Global Warming 101

The Greenhouse Effect

The climate we enjoy on Earth is made possible due to a delicate balance of naturally occurring gases that trap some of the sun's heat near the Earth's surface. This naturally-caused greenhouse effect is what keeps the Earth's temperature stable at an average of approximately 60°F—warm enough to support life as we know it. Without this natural greenhouse effect, our planet's average temperature would not be warm enough to sustain life.

Global Warming:

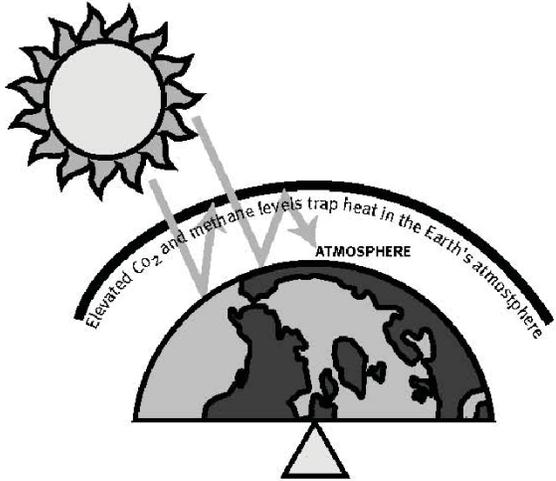
The Enhanced Greenhouse Effect

The problem we now face is that human actions have disturbed this natural balance by producing additional large amounts of some of these greenhouse gases (GHGs) that are warming the climate. The two greenhouse gases of most concern to local governments are carbon dioxide, or CO₂, and methane.

Emissions of CO₂ are produced whenever fossil fuels—such as oil, natural gas, gasoline, diesel fuel, and coal—are burned to produce electricity, heat buildings or power vehicles. Through daily energy-using activities, we are increasing the amount of CO₂ in the atmosphere and magnifying the natural greenhouse effect. The net effect of this increased atmospheric concentration of CO₂ and other GHGs is to trap more of the sun's heat, causing the Earth's average temperature to rise—the phenomenon known as global warming.

Methane is the second most important greenhouse gas resulting from human activities. Methane, or CH₄, is a byproduct of organic waste and sewage decomposition. In

Global Warming



The diagram illustrates the greenhouse effect. A sun in the upper left corner emits rays of solar radiation towards a cross-section of the Earth. Some rays are shown reflecting off the Earth's surface into space. Other rays are shown hitting the Earth's surface and being absorbed. From the Earth's surface, arrows point upwards towards the atmosphere, representing thermal radiation. A curved line above the Earth's surface is labeled 'ATMOSPHERE'. A text box with arrows pointing to this atmosphere says 'Elevated CO₂ and methane levels trap heat in the Earth's atmosphere'. Below the diagram is a list of three bullet points explaining the process.

- Solar radiation passes through the Earth's atmosphere—some is reflected back into space, most is absorbed by the Earth and sent back out as thermal radiation or heat.
- “Greenhouse gases” like CO₂ and methane in our atmosphere trap this heat causing a natural “greenhouse effect”, which keeps the Earth warm enough to support life as we know it.
- Human activities are increasing levels of CO₂ and methane and enhancing the greenhouse effect—too much heat is trapped, causing global warming.

urban areas, methane gas is produced as organic waste such as paper, yard trimmings, wood, and food waste decompose in landfills. Sewage treatment plants are also a significant urban source of methane. In terms of its greenhouse effect, methane is 21 times more powerful per unit of carbon than CO₂.

There is scientific consensus that global warming is occurring and that humans are the primary cause. Pre-industrial levels of carbon dioxide (CO₂) were 270 to 280 parts per million (ppm) in the atmosphere. Today, the level of CO₂ in the atmosphere is about 368 ppm – about 30% higher.² Scientists participating in the British Antarctic Survey have succeeded in charting the atmospheric concentration of carbon dioxide over the last 800,000 years. Their research has shown that temperature unfailingly rises and falls in response to carbon dioxide levels.

CO₂ levels are higher now than they have been in the past 650,000 years. According to NASA scientists, the 1990s were the warmest decade of the century, and the first decade of the 21st century is well on track to be another record-breaker. The years 2002, 2003, 2004 2005 and 2006 along with 1998, were the warmest six years since the 1890s, with 2006 being the warmest year in over a century. Over the last 100 years, temperatures at the Earth's surface increased by an estimated 1.4 degrees F.^{3,4} This present concentration of CO₂ will double in 45 years if current patterns of fossil-fuel use continue, with drastic temperature increases predicted to occur as well.

Even the slightest increase in average global temperature can cause major changes in climate patterns, resulting in more frequent and extreme weather events. Globally, while some regions may experience warming, other regions may become colder. Precipitation may increase in some regions, causing floods and mudslides, while decreasing in other regions, causing droughts and water shortages.

Here in the U.S., we are already feeling climatic effects of more frequent and extreme weather events, mirroring the models developed by scientists. Over the last several years, the Midwest has endured one of the worst droughts on record. Higher temperatures are melting the snow-pack that provides much of the water supply for people in the western United States. Experts predict the region could lose nearly half its water supply by 2100.

Climate Change and Local Communities

Cities and Counties are Impacted

As the population centers of the world, urban and suburban areas will experience most of the negative impacts of climate change. Whether these climate changes affect

² Intergovernmental Panel on Climate Change (IPCC). "[Climate Change 2001: Synthesis Report, Summary for Policymakers](#), 2001.

³ National Aeronautics and Space Administration (NASA). "[2005 Warmest Year in Over a Century](#)," January 24, 2006

⁴ National Oceanic and Atmospheric Administration (NOAA). "[NOAA Reports 2006 Warmest Year on Record for U.S.](#)," January 9, 2007

agricultural production and thus food supply, or an extreme weather event that hits a specific urban area, the impacts will be hardest felt by local communities.

Heat. Prolonged heatwaves, which scientists predict will occur with increasing frequency, hit urban areas hard. The impact of hot weather is intensified by certain features of the typical urban landscape. Dark surfaces of pavements and rooftops that cover the typical urban landscape worsen heatwaves, as they absorb and trap additional heat when struck by solar rays and increase already higher temperatures. The European heat wave of 2003 killed over 35,000 people, and raised even more concerns there about global warming. The heat wave that struck California in 2006 killed 140 people.

Another serious implication of hotter temperatures is the increase in incidences of diseases, such as malaria, dengue fever, and others spread by vectors that are temperature dependent. Malaria has been confined to tropical regions because the species of mosquito that carries the virus can only live within a small temperature range. As areas get hotter, the geographic range of the mosquito and the malaria it carries grows larger.

Air pollution. The issues of global warming and the dirty air that often plagues cities are closely linked. First, the primary activities that create the emissions that cause these two problems are essentially the same—the burning of fossil fuels for energy production, industrial processes or powering vehicles. As fossil fuel combustion increases, the emissions that cause global warming and air pollution also increase.

Second, hotter urban temperatures intensify air pollution. The chemical mix needed for ground-level ozone formation, which is one of the most damaging aspects of urban smog, requires not only air pollution emissions like nitrous oxide and VOCs, but also sunlight and heat. An average annual increase of only 0.5°F can turn an urban area that has worked hard to cut air pollution emissions into a non-attainment area due to an increase in the conditions that create smog.

A nationwide study of 95 urban areas jointly conducted by John Hopkins Bloomberg School of Public Health and the Yale University School of Forestry and Environmental Studies in 2004 showed that changes in ground-level ozone were significantly associated with an increase in deaths. The researchers calculated that a 10 ppb reduction in daily ozone, which is roughly 35 percent of the average daily ozone level, could save nearly 4,000 lives throughout the 95 urban communities included in the study.⁵

Children are particularly at risk, as their lung tissues are still developing and their air passages are smaller than those of adults. Incidences of asthma are also strongly associated with periods of high ozone pollution. Asthma studies in Los Angeles, CA and Houston, TX have found that chest discomfort increased by 17% with high ambient ozone levels.

⁵ Michelle L. Bell, PhD; Aidan McDermott, PhD; Scott L. Zeger, PhD; Jonathan M. Samet, MD; and Francesca Dominici, PhD. "[Ozone and Short-Term Mortality in 95 U.S. Urban Communities, 1987-2000.](#)" *John Hopkins Bloomberg School of Public Health and the Yale University School of Forestry and Environmental Studies*. November, 2004

Damage to infrastructure and property. Hurricanes, blizzards, storms, and floods cause billions of dollars of damage each year. Most of that damage occurs in urban or suburban areas. With huge investments in private and public works infrastructure, cities and urbanized counties are especially vulnerable to the effects of climate change. Federal and state disaster relief programs cannot begin to cover the types of long-term economic, property, and infrastructure losses experienced due to these events.

Hurricane Katrina has provided perhaps the most compelling visual, emotional and financial impression of the damage a changing climate can inflict on communities. The National Academy of Sciences found that most of the increase in ocean temperature that feeds more intense hurricanes is a result of human-induced global warming. Considering the damage to both community and industrial infrastructure, and resultant flight, unemployment and decreased tax revenue, the total economic impact of Hurricane Katrina to Louisiana and Mississippi is estimated to exceed \$150 billion.⁶

Realizing the powerful ways in which global warming could impact their communities, municipal leaders from across the country are making commitments to reduce GHG emissions from their jurisdictions.

Cities and Counties are Part of the Problem

As the population and economic centers of the world, urban areas are major consumers of energy and thus major emitters of GHGs. Urban areas are currently growing both in terms of population and geographic area. As they grow, energy demands for supporting daily activities and public and private infrastructure also increase. Land use and development decisions often cause cities and counties to spread outward, resulting in urban sprawl that encourages more driving, increasing fossil fuel consumption, and thus more GHG emissions.

Sprawling patterns of development in urban areas have increased transportation energy use, as well as the need for electricity to power lights and appliances and fossil fuels to heat buildings and fuel industry. Today, cities are such concentrations of energy use that they glow brightly on infrared photos taken from outer space.

In addition to energy use, another large source

Global Warming: Causes

Transportation

- Engines relying on fossil fuels
- Vehicle use increasing
- Vehicle miles traveled increasing

Waste

- Energy lost when materials become waste
- Methane released as waste decomposes

Energy Use

- Electricity generated by fossil fuels
- Fossil fuels used for heating and industrial processes
- Electricity use increasing

Loss of Vegetation

- Deforestation
- Increased urbanization
- Lack of green space, trees in existing urban areas

⁶ Burton, Mark L.; Hicks, Michael J. "[Hurricane Katrina: Preliminary Estimates of Commercial and Public Sector Damages](#)." *Marshall University: Center for Business and Economic Research*. September, 2005.

of GHG emissions is the waste sector. Wasted materials represent greenhouse gas emissions from two sources—the emissions from the upstream processes needed to mine the raw material and manufacture it into a product, and methane released as the organic portions of the wasted materials decompose in landfills.

Local governments have a substantial impact on energy use and waste practices within their communities. The day-to-day decisions made by local governments, the facilities they operate, and the services and infrastructure they provide are significant determinants of the energy consumed, fuel used, and waste generated within their communities.

Energy use. The energy load of commercial and residential buildings is affected by building size and location along with the energy efficiency standards followed in building construction and operation. Local governments, through land use and development policies, building codes, and the like have a strong influence on these factors. In the case of municipally-owned utilities, the local government can determine whether the community’s energy comes from fossil fuel or renewable energy sources.

Transportation and land use. Local government decisions that determine the type of infrastructure that is or isn’t provided within a community—whether there are bike lanes, public transit, the type of roads, etc.—contribute to the level of a community’s dependency on automobiles. In U.S. cities, energy use in the transportation sector is typically four times higher than in Western European cities—largely due to land use decisions that create sprawl and a lack of effective public transportation options.

Waste. Cities and counties usually have responsibility for waste management services, controlling source reduction and recycling programs, collecting waste or operating landfills.

Local government operations. Finally, local government operations themselves directly consume large quantities of energy and resources with the myriad facilities, vehicle fleets, parks, street and traffic lights, sewage and water treatment plants, landfills, and other public works that they own and operate.

Cities and Counties are Part of the Solution

Local governments can use their influence, decision-making and purchasing powers to increase energy efficiency and reduce greenhouse gas emissions. By doing so, cities and counties can also improve air quality, reduce pollution and waste,

Global Warming: Solutions

Local Governments Can:

- Encourage building and growth that reflect traditional, mixed use neighborhoods rather than sprawl
- Legislate energy-efficient building codes
- Construct public transit systems, pedestrian areas, and bicycle lanes
- Provide reuse, recycling, composting, and other waste reduction services
- Encourage combined or district heating, cooling and power systems
- Plant trees and expand green space
- Buy green, renewable power
- Provide energy saving measures for the community
- Lead by example by maximizing energy efficiency and waste reduction in local government buildings, facilities and operations

create jobs, save money and enhance the quality of life in their communities.

In most parts of the U.S., local governments possess regulatory and economic tools that can make communities greener and more energy and transportation efficient. These powers include land use and zoning decisions, control over building codes and licenses, infrastructure investments, municipal service delivery and jurisdiction over local schools, parks and recreation areas.

In sum, though climate change is a global problem, local authorities have plenty of tools to influence local energy use and greenhouse gas emissions. As the level of government that determines the physical form and spatial structures of a community, and that interacts most closely with people, local governments can affect community energy use in ways that national governments cannot.

Cities and Counties Benefit from Acting

Preventing climate change is not the only, or in some cases even the primary reason local governments are acting to reduce greenhouse gas emissions. Many are drawn to the issue because of local economic, environmental, and community needs. Local governments understand that they can benefit from reducing fossil fuel consumption and increasing energy efficiency—both economically, through lower energy bills, and socially, through improved air quality and more livable communities.

Saving Taxpayer Dollars Through Energy Efficiency

By investing in energy-efficient technologies—from high-mileage or alternative fuel fleet vehicles to energy-efficient public buildings, water and sewage treatment plants and streetlights—cities have dramatically reduced their energy expenses while cutting their contribution to global warming.

Investments in Mass Transit: A 6 to 1 return

Cities that invest in public transportation realize substantial economic benefits. These include increased real estate values, investments in neighborhood development and direct savings for city residents coping with today's high prices at the gas pump. Mass transit also helps improve mobility and opportunities for the elderly -- one of the highest priorities for older Americans. According to the American Public Transportation Association, investments in mass transit provide an economic stimulus far exceeding the original investment, through increased jobs, income profit and tax revenue – as much as six dollars gained for every dollar invested.

New Jobs and Businesses in the Clean Energy Industry

As demand for clean, renewable energy continues to grow, cities that tap into this demand will have a competitive economic advantage. Renewable energy technologies, such as wind and solar power, generate more jobs in construction, manufacturing and installation than fossil fuel-based energy technologies. They also create opportunities for public-private partnerships. As America's fossil fuel supply continues to decline, the importance of investing in clean energy technologies will continue to grow.

Protecting Health and Safety and Reducing Healthcare Costs

Over 140 million Americans, 25% of them children, live, work and play in areas where air quality does not meet national standards. Harmful motor vehicle emissions account for between 25 and 51% of the air pollutants in these unhealthy neighborhoods. From 2000 to 2002, the number of recorded high-ozone days in the U.S. increased 18.5%.

Pollution-related health ailments bring with them both a human toll and a staggering cost: \$3.2 billion is spent each year treating children under the age of 18 for asthma alone. Unhealthy air is known to trigger asthma attacks. By investing in technologies that reduce pollution, cities and their partners in the business community can improve air quality and decrease and prevent negative health impacts like lung and heart disease, asthma and other respiratory ailments.

Clean Cities Are the 'Best Places to Live'

Cities that take action to reduce global warming pollution routinely receive local, regional and national acclaim as the best places to raise a family, do business and lead a healthy lifestyle. Popular magazines consistently give the highest marks to cities that have sound and sustainable urban planning, effective mass transit, clean air and energy-efficient buildings - the same measures that reduce global warming pollution.

“Being green (or clean) can have substantial benefits. Transportation, logistics and the supply chain are best practiced where they do not have to fight traffic jams, pollution and a tattered infrastructure. That goes for people’s health as well.”

-- “America’s Greenest Cities,” 2006 Forbes Magazine