

INDICATOR: MICHIGAN'S CARBON EMISSIONS

Background

Water vapor, carbon dioxide, and other gases in the Earth's atmosphere trap some of the sun's heat close to the surface, creating a natural "greenhouse" that permits life to flourish. Without these gases the Earth would be too cold for life to survive. In the last 50 years, however, human activities have increased the concentration of these greenhouse gases in the atmosphere, trapping more of the sun's heat close to the Earth's surface. The heat-trapping properties of carbon dioxide, methane, nitrous oxide, water vapor and other greenhouse gases in the Earth's atmosphere is undeniable, but uncertainty remains as to precisely how the Earth's climate will respond to increased levels of greenhouse gases.

Evidence continues to build that accelerated warming of the Earth's surface temperature has occurred during the past two decades and that this warming is attributed to human activities that have increased the levels of greenhouse gases. These human activities include the burning of fossil fuels to run cars and trucks, heat homes and businesses, power factories, and to run equipment for agriculture, logging, and mining. Since pre-industrial times, atmospheric concentrations of carbon dioxide have increased by 35%, atmospheric levels of methane have increased by 150%, and atmospheric levels of nitrous oxide have increased by 18% (EPA 2006). These increases in greenhouse gases have enhanced the heat-trapping capability of the Earth's atmosphere.

Status and Trends

Human activities over the last century (primarily the burning of fossil fuels) have changed the composition of the atmosphere in ways that threaten to dramatically alter the climate in years to come. The U.S. is the largest worldwide contributor of carbon dioxide – the primary greenhouse gas. The U.S. Public Interest Research Group (U.S. PIRG) Education Fund (2006) has recently reported on carbon emission trends over four decades spanning 1960 to 2001 (data were compiled by the Oak Ridge National Laboratory). Key findings from the U.S. PIRG (2006) study include:

- between 1960 and 2001, U.S. emissions of carbon dioxide doubled, jumping from 2.9 billion metric tons of carbon dioxide in 1960 to almost 5.7 billion metric tons in 2001, an increase of 95%;
- in the 1990s, carbon dioxide emissions grew more quickly than in the 1970s and 1980s, increasing steadily at an average rate of 1.5% per year; and
- among the states, Michigan ranked ninth in 2001, releasing 189.1 million metric tons of carbon dioxide.

Between 1960 and 2001, Michigan’s carbon emissions from fossil fuel combustion increased by 59.7 million metric tons (Table 1). This represented a 46% increase over four decades.

A dramatic increase in greenhouse gas emissions from the transportation sector and energy sector (primarily coal combustion) fueled the national increase in carbon emissions between 1960 and 2001 (U.S. PIRG 2006). For example, carbon dioxide emissions from oil combustion jumped 1.1 billion metric tons between 1960 and 2001, accounting for 40% of the total increase in U.S. carbon emissions. The transportation sector primarily drove this increase. Carbon dioxide emissions from coal also climbed 1.1 billion metric tons between 1960 and 2001, accounting for another 40% of the total increase in U.S. carbon emissions. Increased electricity generation from coal-fired power plants primarily fueled this rapid growth.

Table 1. Trends in Michigan’s carbon dioxide emissions (million metric tons per year) from fossil fuel combustion, 1960-2001 (U.S. PIRG 2006).

Year	1960	1970	1980	1990	2001
Michigan’s CO ₂ Emissions (million metric tons per year)	129.4	185.9	179.4	180.1	189.1

Management Next Steps

Action is occurring at every level to reduce, avoid, and better understand the risks associated with climate change. Many cities and states across the country have prepared greenhouse gas inventories; and many are actively pursuing programs and policies that will result in greenhouse gas emission reductions.

At the national level, the U.S. Global Change Research Program (www.usgcrp.gov) coordinates the world’s most extensive research effort on climate change. Federal agencies are actively engaging the private sector, states, and localities in partnerships based on a win-win philosophy aimed at addressing the challenge of global warming while, at the same time, strengthening the economy. For more information, see the U.S. Climate Action Report (<http://www.gcric.org/CAR2002/>).

At the global level, countries around the world have expressed a firm commitment to strengthening international responses to the risks of climate change. The U.S. is working to strengthen international action and broaden participation under the auspices of the United Nations Framework Convention on Climate Change (<http://unfccc.int/2860.php>).

Key elements of a carbon emission reduction action plan identified by U.S. PIRG (2006) include:

- establishing targets for reduction of carbon dioxide and other greenhouse gases; and
- reducing U.S. dependence on fossil fuels by making homes and businesses more energy efficient, making cars and sport utility vehicles (SUVs) go farther on a gallon of gasoline, and generating more electricity from renewable energy sources.

Research/Monitoring Needs

Research should be conducted to address the following:

- improve computer modeling to give scientists more confidence about their projections of the global warming impacts on a large scale (e.g., global temperature, precipitation changes, ecosystem impacts) and small scale (e.g., local temperature, precipitation changes, ecosystem impacts);
- determine if global warming could lead to more frequent and intense storm events; and
- investigate the link between El Niño events (the periodic warming of the equatorial Pacific Ocean) and global warming.

References

[U.S. PIRG] U.S. Public Interest Research Group Education Fund. 2006. *The Carbon Boom: National and State Trends in Carbon Dioxide Emissions since 1960*. Washington, DC.

[EPA] Environmental Protection Agency. 2006. Climate Change – Science. Atmosphere Changes. <http://www.epa.gov/climatechange/science/recentac.html>

Links for More Information

U.S. Environmental Protection Agency's – Global Warming: <http://epa.gov/climatechange/index.html>

Union of Concerned Scientists – Global Warming: http://www.ucsusa.org/global_warming/

Contact Information

Audrie Washington
Energy Star Program Manager
U.S. Environmental Protection Agency
E-mail Address: washington.audrie@epa.gov