Economic and Environmental Costs of Climate Change

Overview

The earth's climate is changing, and some states are beginning to see the effects—an increase in extreme temperature events, lower water levels in lakes and streams, and increased forest fire risk are a few of the visible signs. National Air and Space Administration (NASA) research shows that the eight warmest years (globally) on record have occurred since 1998[1] and predicts that summer high temperatures in the eastern half of the United States are likely to rise by 10° F by 2080.[2] These changes are likely to affect state forest, agriculture, tourism and water resources. These reports incorporate the latest scientific research to provide policymakers with a solid understanding of how the changing climate could affect their state, and how future changes will impact its economy, environment and people.

State and local decision makers play a critical role in developing and investing in sectors—such as water, energy, agriculture, tourism, forestry, transportation and public health—that are likely to be affected by climate change. These reports build on research by the Center for Integrative Environmental Research (CIER) at the University of Maryland, which explores how climate change could affect the economies and natural environments of states throughout the country. The research highlights the importance of planning for the possible effects of climate change on state natural and economic resources and explores options for reducing these effects.

Introduction to Climate Change

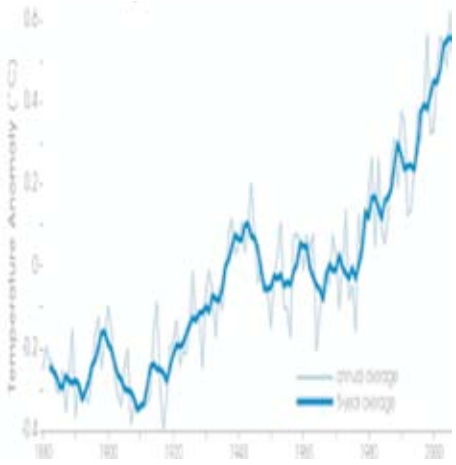
Most of the nation's most prominent scientific bodies support the conclusion that human activities have been the dominant force driving the warming trend of the past 50 years and that the earth's climate will continue to warm throughout this century.[3] The list includes NASA, the National Academy of Sciences,[4] the National Oceanic Atmospheric Administration (NOAA)[5] and many others.

Global temperatures have risen about 1° F over the past century (see Figure 1). Figure 2 illustrates how different emissions reduction scenarios could affect temperature increases by 2100. The global average rise in temperature—according to the best available models—is projected to be between 3.2° F to 7.2° F. Many scientists think that an increase greater than 3.2° F could have catastrophic effects, such as reaching a tipping point where warming accelerates, causing dramatic sea level rise, land loss, declines in food production and other serious negative outcomes. To avoid this scenario, models indicate that global greenhouse gas emissions should be reduced by about 80 percent by 2050 (see line B1 in Figure 2).

What Is the Greenhouse Effect?

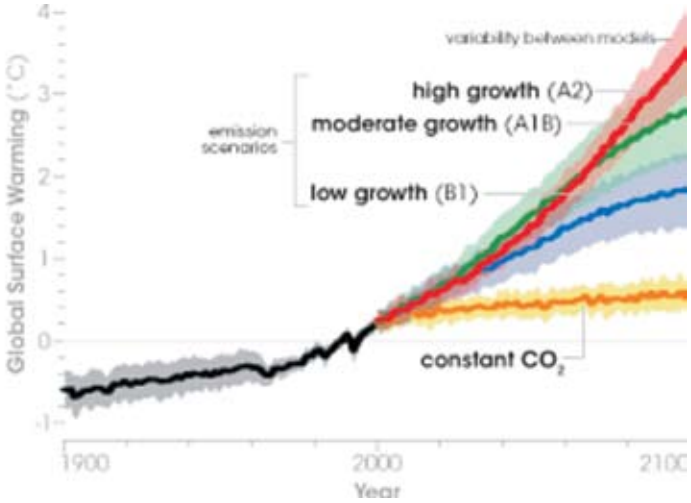
The earth is abundant with life due to the blanket of greenhouse gases that trap some of the sun's energy and allow the rest to escape into space. Without this blanket, temperatures on earth likely would be similar to those on the moon, varying from 280° F below zero on the dark side to 260° F on the side facing the sun. Human activity has changed the composition of these gases that reflect heat back to earth, increasing the amount of energy that is trapped. The result has been a global change in climate. According to research by the European Project for Ice Coring in Antarctica, atmospheric carbon dioxide (CO_2)—the most abundant greenhouse gas—is at its highest concentration in at least 650,000 years, with much of the increase appearing in the last 100 years.[6] Other important greenhouse gases—methane (CH_4), nitrous oxide (N_2O) and chlorofluorocarbons (CFCs)—also saw unprecedented atmospheric increases during the past century.

Figure 1. Global Surface Temperature



Source: NASA http://data.giss.nasa.gov/gistemp/2007/, 2007.

Figure 2. Emissions Reduction and Temperature Increases



Source: NASA Earth Observatory, 2007.

Options for State Policymakers

States nationwide are implementing policies to address climate change—17 have greenhouse gas reduction targets, and five have made these targets enforceable. These states aim for a 50 percent to 80 percent emissions reduction by 2050. California, Oregon, Massachusetts and Washington are requiring power plants to meet greenhouse gas emissions standards, which will help the states meet their reduction targets. Twenty-five states have implemented renewable portfolio standards and many have passed renewable energy and energy efficiency incentives. Analysis of state policies that reduce greenhouse gas emissions—such as renewable portfolio standards and energy efficiency—have not been found to substantially affect electric rates, and energy efficiency has been found to save ratepayers money in most cases. New Jersey has projected that its greenhouse gas reduction plan will provide a net economic benefit. States also are creating incentives for nuclear energy and carbon sequestration from coal-fired power plants as greenhouse gas reduction options.

The least cost approach to reducing greenhouse gas emissions and meeting energy demand usually is energy efficiency. Businesses, consumers, state governments and industries find that energy efficiency investments return money by reducing energy consumption. Since buildings account for approximately half of U.S. energy consumption and greenhouse gas emissions, energy efficient building codes, green building requirements and retrofit policies are popular state options. Policymakers also are addressing greenhouse gas emissions from transportation and industry, the next largest contributors of greenhouse gases after buildings.

Minnesota has seen returns of $3 for every $1 spent on its energy efficiency programs. The state recently passed a law that requires its utilities to meet 1.5 percent of demand each year through energy efficiency. These efforts are predicted to meet state energy demand growth, while the state's renewable energy standard of 25 percent by 2025 will reduce dependence on energy generated from fossil fuel.

California is considering requirements that all new residential buildings built after 2020 and new commercial buildings built by 2030 consume no more energy than they generate. These "zero net energy" buildings, which have been built since the 1980s, incorporate highly energy efficient designs along with on-site clean distributed generation—such as solar or wind power—to satisfy energy needs.

If and when Congress enacts national climate change legislation, the states that have developed climate-friendly technologies and energy resources may have an advantage. States that are leading the way in creating policies now may also have more leverage in influencing the federal debate.

Since information about the localized impacts of climate change is still lacking, states may wish to promote research that will more accurately predict potential changes at the regional and state level. Detailed assessments of potential climate outcomes and how they will affect various industries and ecosystems provide policymakers with the knowledge to create effective policies that will help the state adapt to changes while protecting its economy. Since climate change touches on many sectors, identifying and analyzing costs of inaction and policy implementation will be essential to creating effective policies.

The following conclusions can be drawn for all states.

- Although, these reports focus on the potential economic outcomes that changes in state climates may bring, the changes seen already have produced significant costs in some states. These have arisen from the changing climate's influence on infrastructure, agriculture, forestry and other sectors. These costs are likely to increase if greenhouse gas emissions are not significantly reduced.

- The effects of climate change should not be considered in isolation. Every state's economy is linked to the economies of surrounding states as well as to the national and global economy. Since state economies are directly linked to the economies of neighboring states and regions, policymakers may wish to consider both state and regional policies to address climate change.

- More information on the localized effects of climate change—including its impacts on water resources, ecology, health and natural resources—is needed to improve state mitigation and adaptation strategies. Better data on local outcomes would improve estimates of economic effects that climate change will have on a state.

Notes

1. National Air and Space Administration, "Global Temperature Trends: 2007 Summation," data.giss.nasa.gov/gistemp/2007/, (2007).
2. National Air and Space Administration, "Study Suggests Extreme Summer Warming in the Future," www.nasa.gov/centers/goddard/news/topstory/2007/extreme_summer.html, (May 9, 2007).
3. Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2007: Summary for Policymakers*, www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf, (2007).
4. National Academy of Sciences, *Understanding and Responding to Climate Change: Highlights of the National Academies Reports*, dels.nas.edu/dels/rpt_briefs/climate-change-final.pdf, (2005).
5. National Oceanographic Air Administration, *Global Warming FAQ*, www.ncdc.noaa.gov/oa/climate/globalwarming.html, (2007).
6. Urs Siegenthaler et al., "Stable Carbon Cycle–Climate Relationship During the Late Pleistocene" *Science* 310, no. 5752 (November 2005): 1313-1317.

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