Wind Power in New England

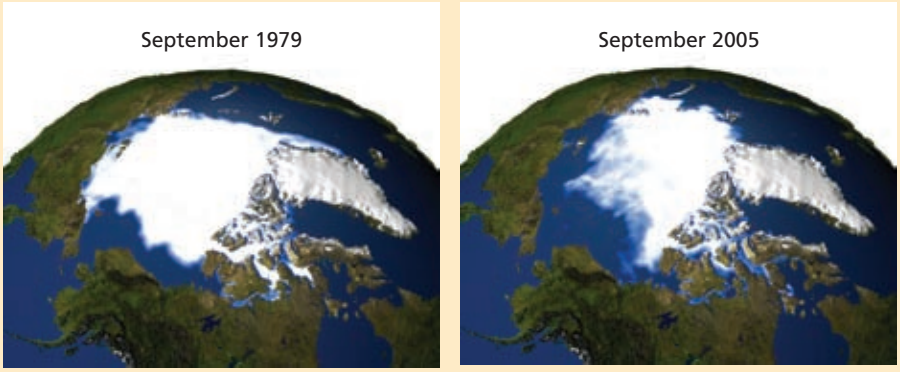
A fact sheet series from the Union of Concerned Scientists

Wind Energy: A Climate Solution

OUR GLOBAL CLIMATE is changing largely because humans are adding ever-increasing amounts of heat-trapping gases such as carbon dioxide (CO_2) to the atmosphere. Electricity generation is the leading U.S. contributor to global warming because most of our energy comes from fossil fuels that emit CO_2—the primary heat-trapping gas—when they are burned in a power plant. Fortunately, there are better options. Wind power, a proven and reliable energy resource, is the most affordable option available today for new sources of power generation without emitting CO_2.

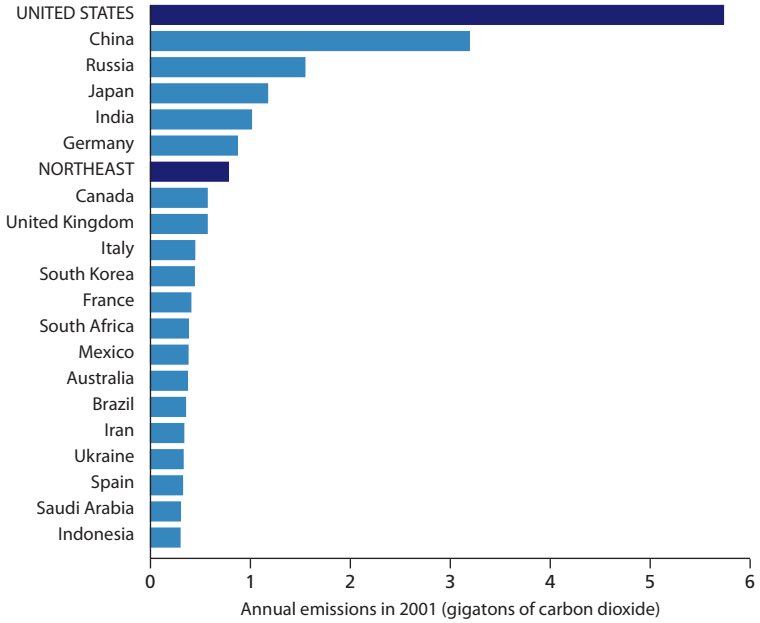
New England has excellent wind resources, particularly along the coast and on mountain ridges, making wind an attractive near-term solution for reducing our region's contribution to global warming. Wind power can reduce air and water pollution, conserve natural resources for future generations, reduce dependence on imported fuels, improve electricity reliability, stabilize and reduce energy prices, and create local jobs.

Observed Changes in Arctic Sea Ice



Source: NASA Earth Observatory

Carbon Dioxide Emissions, by Country



Note: U.S. emissions include the Northeast

Source: Energy Information Administration (EIA), International energy annual (2003), and EIA, Emissions of greenhouse gases in the United States (2004)

The Problem: Increasing Temperatures

Global warming is caused primarily by the CO_2 emitted by burning fossil fuels: coal, oil, and natural gas. In the northeastern United States (from Pennsylvania and New Jersey northward to Maine), power plants are a close second to transportation in total CO_2 emissions. Together, the Northeast states emit more CO_2 than all but six countries in the world.

The signs of global warming are already evident. Every single year since 1992 is among the 20 warmest years on record, with 2005 being tied with 1998 for the hottest year. Some of the most dramatic changes are visible in the Arctic region, where sea ice has steadily decreased in recent decades. However, other early warning signs are visible in New England as well as across the globe including more frequent and extreme heat, an increase in heavy rainfall, reduced snowpack, and earlier bloom dates for plants.

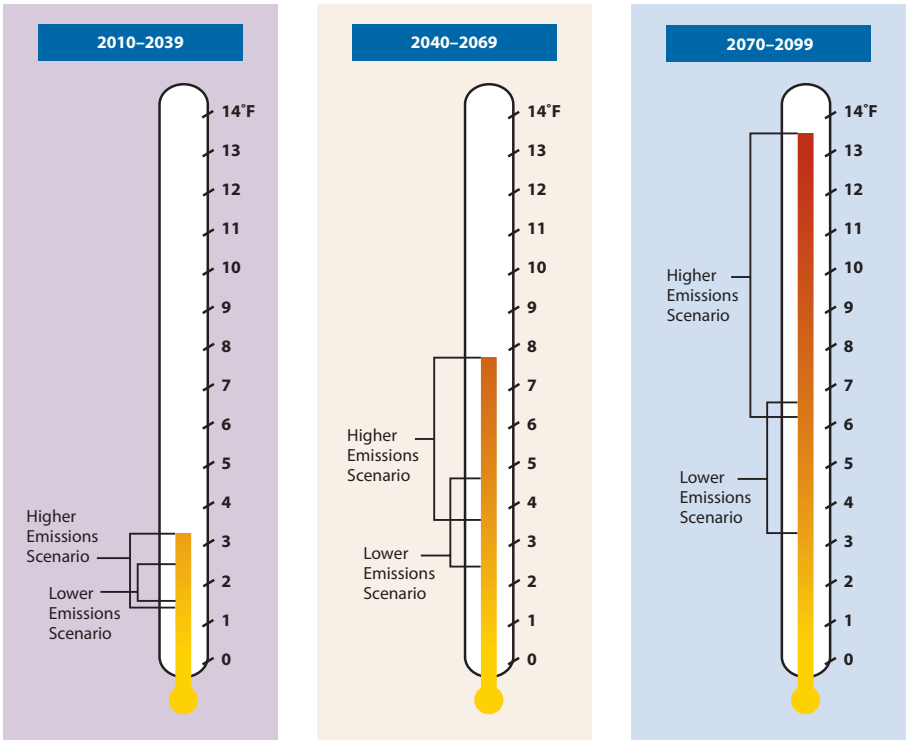
Scientists project that continued warming will bring more extreme heat and drought, rising sea levels, more intense tropical storms, and many other

severe consequences. These changes threaten public health; coastal property and resources; the livability of our cities in summer; the productivity of our farms, forests, and fisheries; and recreational industries and opportunities.

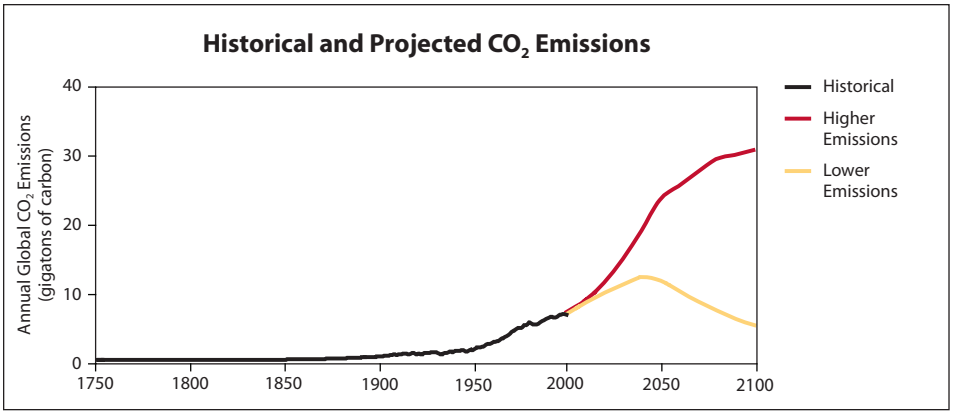
The Solution: Reducing Emissions

CO_2 and other heat-trapping emissions remain in our atmosphere for decades or even centuries. While we can't avoid all the consequences of global warming, committing ourselves to action today can still help ensure our children and grandchildren inherit a cleaner, healthier world. To minimize the risk of dangerous global warming, some scientists suggest keeping concentrations of heat-trapping emissions in the atmosphere below 450 parts per million (CO_2 equivalent). Achieving this goal may require reducing CO_2 emissions to about 20 percent of 2000 levels by 2050. Reductions of this size will require a major transformation of our energy system away from fossil fuel energy sources, and possibly large-scale capturing and storage of CO_2 as well.

Meeting this enormous challenge will require new energy-use policies for the electric utility, transportation, construction, commercial, and industrial sectors. It will require action by governments, businesses, institutions, and individual citizens. And it will require the participation of every town, city, state, and region in the United States.



The Northeast is already experiencing rising temperatures, with dramatic warming expected later this century if our heat-trapping emissions continue to increase unabated. How high temperatures rise depends on the emissions choices we make next, in the Northeast and globally. These thermometers show projected increases in regional average summer temperatures for three time periods: early-, mid-, and late-twenty-first century. Temperature ranges reflect the results of three different state-of-the-art climate models.



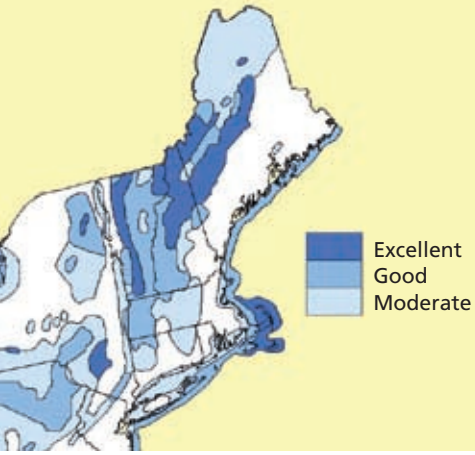
CO_2 emissions from human activities (such as the burning of fossil fuels) were negligible until around the start of the Industrial Age in the 1850s.

Energy Solutions to Global Warming

No single technology can achieve a 60 to 80 percent reduction in heat-trapping emissions but many options exist today that, taken together, can achieve this goal. In looking at potential global warming solutions, it is important to consider how big a role they can play, how fast they can be implemented, how affordable they are, and what impact they have on the environment. Cost is an especially important factor because without relatively affordable solutions, it could be impossible to generate the political will to implement them. Fortunately, there are some low-cost ways to begin transforming our energy system today as well as cutting-edge technologies under development that offer promising longer-term solutions.

Energy efficiency. Improving the efficiency of our vehicles, homes, offices, and factories is often the fastest and least-expensive way to reduce emissions. By reducing energy waste, we can cut energy costs along with cutting pollution. Cost-effective technologies are already being used to improve the efficiency of lighting, heating and cooling systems, appliances, industrial

New England Wind Resource Potential



Source: National Renewable Energy Laboratory

systems, and vehicles. Power plant efficiency can also be greatly improved by using "combined heat and power" systems that use waste heat from the combustion process for space heating or industrial applications, or by using a "combined cycle" that uses the waste heat to power a steam turbine and make more electricity. It is important to note, however, that reaching our emission reduction target will require many strategies. While efficiency alone will not meet this target, it is one important and easy step that we can start right away.

Renewable energy. Earth has an abundance of clean, renewable energy resources that can be used to generate electricity, provide heat, and power vehicles, all while emitting little to no CO_2. These resources include wind, sunlight, water, biomass (plants and animal wastes), and underground heat. Clean electricity technologies represent some of the most affordable options for reducing carbon emissions. Studies from the Union of Concerned Scientists show that we can increase non-hydro renewable energy in the United States from about two percent of electricity use today to at least 20 percent by 2020, while saving consumers $49 billion.

In New England specifically, wind energy is the most viable near-term option for significantly increasing renewable electricity generation. Hydropower sites in New England are largely developed already, and wave and tidal power are not yet mature technologies. The region can expand its use of wood and agricultural waste as a power source, but new bioenergy plants are generally more expensive than wind power. Geothermal electricity is not viable in New England with current technology (although geothermal heat pumps can help improve the efficiency of heating and cooling). And solar energy, while a promising option for New England, still produces electricity at a much higher cost than wind energy.

New England has abundant onshore wind energy resources, with the technical potential to supply about 60 percent of the region's current electricity use. Some of those sites are too far from transmission lines or have other siting constraints that limit how much could or should be developed; however, selected sites are cost-effective to develop in the near term.

Carbon capture and storage. Significant effort is going into researching and developing ways of capturing and storing CO_2 emitted from fossil fuels when they are burned. New technologies that convert coal to a combustible gas can potentially capture the CO_2 and store it underground. While many scientists are optimistic about the prospects for such technology, there are still uncertainties about the feasibility and cost of large-scale storage, and also risks associated with CO_2 leakage. And even with a reliable CO_2 storage system in place, there would still be significant environmental problems associated with coal mining, transport, and waste disposal.

Among the various energy technologies available today, wind energy is clearly the most cost-effective near-term option for generating significant amounts

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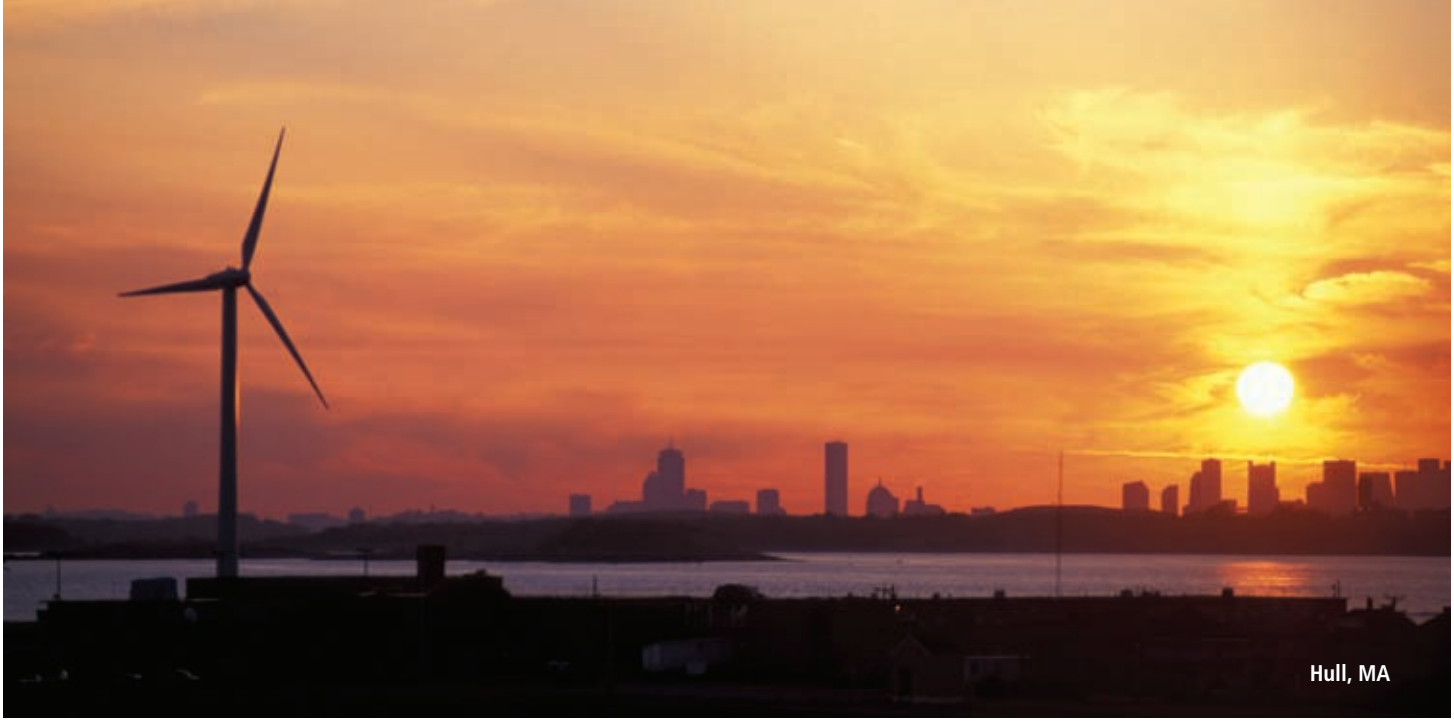

Hull, MA

Courtesy of New England Wind Fund

of electricity without carbon emissions. And while wind energy, like all energy sources, can have environmental impacts that need to be considered, they are generally much smaller and more manageable than the impacts and risks of fossil and nuclear fuels.

Can We Wait For New Technologies?

The actions we take in the next decade are critical in determining whether we will succeed in stabilizing the climate. If we proceed with a "business as usual" approach to energy generation and use, we would have much less time to transform our energy system, and much steeper emission cuts would be needed. Such radical reductions would require revolutionary new technologies to become available (a strategy that is not guaranteed), and would likely be much more expensive.

In addition, developing new technologies—and improving existing technologies—requires learning lessons from prototypes and early operating experience; developing infrastructure to install, operate, and maintain the technologies; and developing economies of scale. These steps can take several years or decades to fully implement.

The Role New England Can Play

Combating global warming is a collaborative effort; each region of the country will have to implement the most feasible emission-reduction projects available to them based on economics, resource availability, siting constraints, and state and local policies. New England has already shown leadership through its landmark Regional Greenhouse Gas Initiative, which aims to reduce carbon dioxide emissions from power plants. In addition, four New England states have established policies to secure a percentage of their electricity from renewable resources such as wind.

New England's excellent wind resources offer an opportunity to produce clean, local, and affordable power. If all the wind projects currently proposed in New England were built, we could generate more than 5,700 gigawatt-hours (GWh) of electricity each year without producing CO_2. This amount is about seven percent of the electricity used in the states where wind power projects are proposed.

By implementing energy conservation and efficiency, and clean electricity generation, we can protect New England's environment, strengthen its economy, and secure a healthy world for our children and grandchildren. The faster we shift to clean energy, the closer we will come to solving the climate challenge.

Wind Power in New England is a series of fact sheets that describes the economic and environmental benefits wind power can bring to New England residents and businesses, and the important role it can play in reducing the impact of global warming on our ecosystems and communities. These fact sheets were created by the Union of Concerned Scientists (UCS) with funding from the Massachusetts Technology Collaborative (MTC). Fully referenced versions of these fact sheets are available on the UCS website at *www.ucsusa.org* and the MTC website at *www.masstech.org*

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