Wind Power in New England

A fact sheet series from the Union of Concerned Scientists

The Impact of Our Energy Choices

FOSSIL FUELS—COAL, OIL, and natural gas—are America's primary source of energy, accounting for more than 70 percent of current U.S. electricity generation, and more than 60 percent in New England. However, the extraction and burning of these fuels pose serious threats to human health and our environment. Improving energy efficiency is an important first step toward decreasing the harmful effects of our energy use, but we need to do much more.

There are many energy resources available; by understanding the impact of our energy choices, we can make more responsible decisions that will create a better future for our children while providing the energy we need.

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Global Warming

If left unchecked, heat-trapping emissions such as carbon dioxide (CO_2) are expected to cause irreversible damage to communities and habitats throughout the United States and around the world. This damage will likely include more intense droughts and hurricanes; poorer air quality; increased incidence of infectious diseases such as West Nile Virus; flooding and erosion in coastal communities as a result of rising sea level; reduced productivity of some agricultural regions; and loss of many treasured landscapes and species—from maple trees to coral reefs to polar bears.

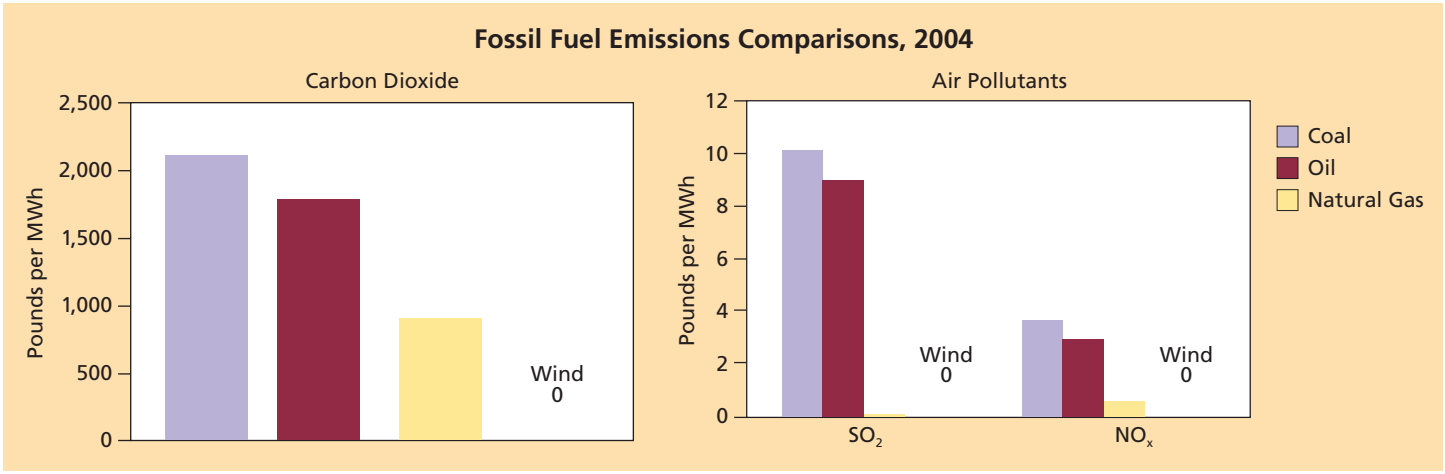
Recent studies have concluded that avoiding dangerous climate change will require the United States and other industrialized countries to reduce their global warming emissions to about 20 percent of 2000 levels by mid-century. Such reductions will require both maximizing energy efficiency and transitioning from fossil fuels to non-carbon energy sources.

Electricity generation accounted for more than 40 percent of U.S. CO_2 emissions in 2004, with coal-fired power plants alone emitting more CO_2 than all transportation sectors combined. In the Northeast, power plants rank second only to transportation as a source of CO_2 emissions. While some CO_2 emissions are generated during the manufacturing process, wind turbines, solar panels, and other renewable energy sources generate electricity with no CO_2 emissions.

Air Pollution

Burning fossil fuels releases significant amounts of sulfur dioxide (SO_2), nitrogen oxides (NO_X), and fine soot particles into the air. These pollutants can cause acid rain and smog, and cause or aggravate a wide range of acute respiratory and cardiovascular diseases. According to a 2004 report, U.S. power plant pollution contributes to nearly 24,000 premature deaths each year, including 2,800 from lung cancer. Electricity generation in 2003 was responsible for 68 percent of SO_2 emissions and 22 percent of NO_X emissions in the United States.

Coal, the nation's largest source of electricity, also releases significant amounts of dioxin and mercury into our air. Dioxin causes liver damage and cancer in humans, while mercury is a neurotoxin that can cause brain damage and birth defects. Women of childbearing age and children are advised to limit their intake of swordfish, tuna, and certain other fish because they contain high levels of mercury. In addition, more than 160 active fish advisories are currently posted for New England lakes, specifically relating to high mercury levels.



Note: Based on emissions from power plants operating on coal, oil, or natural gas. Emissions are from generation only, not the full fuel cycle.
Source: Energy Information Administration, 2005

Land Use

Land is required to generate electricity from virtually any energy resource. At a minimum, land is used for the footprint of the facility (a power plant or wind turbine base) and any roads needed to access the facility.

Drilling for oil and natural gas, and mining for coal and uranium, can cause irreversible damage to large areas of land. In 2005, more than 24 million acres—an area larger than the state of Indiana—were used for oil and gas production. Between 1977 and 2004 more than 5.5 million acres of land were permitted for coal mining. Mining also affects local waterways; for example, mountaintop removal coal mining buried or polluted more than 1,200 miles of streams across Appalachia between 1985 and 2001.

Land is also needed to transport fossil fuel to power plants, where it is converted to electricity. Coal transport accounts for around 40 percent of rail use in the United States. In 2001 more than 480 million tons of coal were transported between states. Linked end to end, the trains needed to transport this amount of coal would stretch around the equator almost two times.

A utility-scale wind facility on flat terrain requires about 50 acres of land per megawatt of installed generating capacity. On rolling terrain, like the hills and ridgelines of New England, the required area can be as low as two acres per megawatt. While this is a somewhat larger land area than required by the total needed for a fossil fuel power plant, a very small portion of that land (two percent or less) is actually occupied by turbines, access roads, and other equipment—leaving the vast majority of the land free for compatible or existing uses such as farming or recreation. For example, to generate about 20 percent of the nation's electricity from wind power by 2020, approximately 8,000 square miles of land—an area roughly the size of Massachusetts—would be required. More than 98 percent of this land, however, would still be available for other uses, leaving the actual footprint of these turbines at about 100 square miles, about the same land area as Greater Boston (inside I-95) but spread across the entire nation.



Wind turbines can also be removed if necessary, leaving no lasting impact on the surrounding environment.

Water

Dramatic events like the 1989 Exxon Valdez oil spill show the devastating impact that transporting fossil fuels can have on the marine environment, but even the everyday operation of fossil fuel power plants plays a major role in water usage and pollution. The U.S. Geological Survey estimated that in 2000 the electricity sector used 195 billion gallons of water each day, about 48 percent of all U.S. water use. In other words, generating a year's worth of power for the average U.S. home uses more than 5,000 gallons of water. Most of this water is used to cool equipment in the power plant, after which it is discharged back into waterways. The heated water can harm marine life that is sensitive to changes in temperature. For example, the Rhode Island Division of Fish and Wildlife found that winter flounder in Mt. Hope Bay declined by 87 percent in the 12 years after the Brayton Point coal plant, in southeastern Massachusetts, installed its current cooling system.

Coal bed methane, a rapidly growing source of natural gas (especially in parts of Montana and Wyoming) also creates water-related environmental challenges. Large quantities of water are extracted from underground coal seams to release the trapped methane; the water is then often discharged to streams or stored in holding ponds. This water's generally high salt content can pose threats to local plant life and soil quality.

Waste

Coal and nuclear power generation create large volumes of long-lived wastes, posing environmental concerns. Coal ash and sludge is often disposed of in unlined and unmonitored landfills and reservoirs. Arsenic, mercury, chromium, cadmium, and other toxic substances in this waste can contaminate drinking water supplies and harm local ecosystems. In 2000, after a structural failure at one such impoundment in eastern Kentucky, more than 300 million gallons of coal slurry spilled into nearby waterways, including the Big Sandy River, smothering plants and aquatic life for miles. This contamination, nearly 30 times the volume of the Exxon Valdez oil spill, landed the Big Sandy River on American Rivers' Most Endangered Rivers list in 2001 and has been called one of the South's worst environmental disasters.

Spent nuclear fuel contains highly radioactive waste that requires hundreds of thousands of years to decay and become harmless, along with large quantities of less radioactive (yet still dangerous) waste. There is no licensed long-term storage facility available in the United States, so spent nuclear fuel is currently stored onsite at nuclear power plants.

Security and Safety

Fossil fuels and nuclear power also pose security and safety risks for New England. The United States has only 2.4 percent of the world's proven oil reserves, but is responsible for nearly one-quarter of the world's total oil consumption each year. And as U.S. natural gas production continues to decline, we are becoming increasingly dependent on imported liquefied natural gas (LNG). Both oil and LNG are often produced in countries that are considered unstable and unfriendly.

Importing more LNG will mean increased tanker traffic near ports and require the construction of new LNG import terminals and storage facilities. If located onshore near a major metropolitan area like Boston those facilities could become terrorist targets, increasing the risk under certain circumstances of a fuel spill or fire. Nuclear power plants are also vulnerable to attack, and their fissile material could potentially be stolen and used to make nuclear weapons. Wind and other renewable electricity facilities tend to be geographically dispersed and require less of the infrastructure—and none of the fuel or

waste—that make our current electricity system so vulnerable.

Wildlife

Fossil fuel and nuclear power generation have a significant impact on wildlife. Land and water used for extracting, refining, transporting, and generating power from these fuels reduces available wildlife habitat, and air and water pollution harm land and marine animals. The most serious threat to wildlife, however, is global warming. According to one major study, if heat-trapping emissions continue to rise at the current rate, approximately one million species—up to 37 percent of non-marine species—could become extinct by 2050.

Wind power can help meet our energy needs without creating air, water, or global warming pollution. However, it can have an impact on wildlife. Birds and bats can collide with power generating facilities, including wind turbines. The wind industry and environmental groups have worked together to study the interaction of birds with turbines and to create siting guidelines that minimize the risk and make each new wind farm safer for the wildlife around it. Thanks to lessons learned from early wind projects like Altamont Pass in California, today's turbines are much safer; current studies show an average of around three bird deaths per megawatt per year.

While wind turbines do contribute to bird deaths, collisions with other human structures are estimated to cause far more bird deaths each year: up to 980 million deaths from buildings and windows; up to 50 million from communications towers; and up to 174 million from transmission lines for all power sources. Bird deaths have been documented at conventional power plants as well; collisions with cooling towers at the Susquehanna nuclear power plant in Pennsylvania killed more than 1,500 birds over less than a decade.

Mountaintop removal coal mining buried or polluted more than 1,200 miles of streams across Appalachia between 1985 and 2001.

photo © Vivian Stockman, www.ohvec.org

Resource Depletion

Our dependence on fossil fuels extends far beyond the electricity sector. Along with fueling the vast majority of our nation's vehicles, petroleum is the raw material for most of our plastic products, and commercial fertilizers are derived from natural gas. A growing number of analysts believe we will reach peak global oil production within decades (or even sooner). Natural gas is only somewhat more plentiful. And while U.S. coal reserves are estimated to last 240 years at current rates of use, using more coal for electricity, transportation, or other purposes would accelerate environmental damage and reduce reserves much faster.

Once any resource has peaked, its extraction becomes increasingly expensive. Wind and other renewable energy sources, on the other hand, are abundant and naturally replenished, and conserve natural resources for future generations.

Wind—A Smart Energy Choice

Wind energy is among the least expensive and most abundant renewable energy sources available today. It provides electricity without the serious health and environmental impacts associated with conventional power supply options. We have an exciting opportunity to use renewable resources to meet our energy needs without contributing to global warming, acid rain, smog, asthma, and water pollution. Responsibly sited wind projects can take advantage of strong winds to provide energy while protecting our environment for generations to come.

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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