

Nuclear Energy and the Environment

January 2007

Key Facts

- Nuclear power plants generate about 20 percent of U.S. electricity. They do not burn anything, so they do not produce any combustion byproducts. By substituting for other fuels in electricity production, nuclear energy has significantly reduced U.S. emissions of nitrogen oxides, sulfur dioxide and carbon dioxide.

- Only 27 percent of America's electricity comes from clean-air sources, including nuclear power plants, hydroelectric plants, wind farms and solar energy facilities.

- Nuclear energy accounts for 73 percent of the nation's clean-air electricity generation. It is the only large-scale, clean-air electricity source that can be expanded widely to produce large amounts of electricity.

- In 2005, U.S. nuclear power plants reduced emissions of nitrogen oxides and sulfur dioxide—pollutants controlled under the Clean Air Act—by 1.1 million short tons and 3.3 million short tons, respectively. The amount of nitrogen oxide emissions that nuclear plants prevent annually is the equivalent of

taking nearly 55 million passenger cars off the road.

- Also in 2005, U.S. nuclear plants prevented the discharge of 682 million metric tons of carbon dioxide into the atmosphere. This is nearly as much carbon dioxide as is released from all U.S. passenger cars.

- Environmental responsibility is an important part of nuclear power plant management. Plants are designed, built and regulated to prevent radioactive emissions. The companies that operate nuclear power plants also voluntarily work to protect nearby wildlife and their habitats.

Nuclear Energy: Clean-Air Energy

America's 103 nuclear power reactors provide about 20 percent of its electricity—the second-largest electricity source after coal. Among clean-air electricity sources, nuclear energy plays an even greater role. Only 27 percent of our nation's electricity overall comes from clean-air sources, and nuclear power plants generate almost three-fourths of it.

The other major sources of clean-air electricity are hydroelectric plants, which provide 6.4 percent of our nation's electricity; wind energy, 0.4 percent; and solar energy, 0.01 percent.

Clean Air Act Targets Two Major Pollutants

Nuclear power plants do not burn anything, so they do not produce combustion byproducts—such as nitrogen oxides, sulfur dioxide and carbon dioxide. The first two types of emissions are regulated under the 1990 Clean Air Act amendments. Carbon dioxide is the focus of the administration's voluntary greenhouse gas reduction program.

By substituting for other types of generating facilities, nuclear power plants prevent substantial emissions of these materials and are essential to meeting clean-air goals in the states where they are located.

Nitrogen Oxides. Nitrogen oxides play a major role in the formation of ozone, which is detrimental to human health. Nitrogen oxides also are a significant contributor to acid rain. The U.S. Environmental Protection Agency's Clean Air Interstate Rule will reduce total nitrogen oxide emissions by 2 million tons for 28 states and the District of Columbia by 2015. Fourteen of those states generate more than 25 percent of their electricity from nuclear energy, so clearly maintaining diverse electricity portfolios is important.



SUITE 400
1776 I STREET, NW
WASHINGTON, DC
20006-3708
202.739.8000
www.nei.org

Nuclear Energy and the Environment

Page 2 of 3—January 2007

In 2005, U.S. nuclear power plants avoided the emission of 1.1 million short tons of nitrogen oxides—the same amount emitted by 55 million passenger cars in a year. This means that without nuclear energy, 55 million cars would have to come off the road to keep the emission of nitrogen oxides where they are today.

Sulfur Dioxide. Sulfur dioxide contributes to acid rain. A main objective of the Clean Air Act amendments is to reduce the amount of sulfur dioxide emitted into the atmosphere.

In 2005, nuclear plants avoided the emission of 3.3 million short tons of this pollutant—more than twice that avoided by hydroelectric power and all other renewable energy sources combined.

Reducing Carbon Dioxide Emissions

Carbon dioxide—the greenhouse gas mainly emitted by human activity—is the major focus of global discussions to reduce emissions.

Many scientists believe that carbon dioxide emissions increase Earth's warming effect, bringing about changes in climate. According to the U.S. Environmental Protection Agency, 85 percent of U.S. greenhouse gas emissions are carbon dioxide.

The U.S. Department of Energy runs a voluntary greenhouse gas reduction

program. Increased electric generation by nuclear power plants accounted for 36 percent of the total carbon dioxide reductions in 2004,ⁱ the most of any sector.

Comparing Electricity-Sector Carbon Dioxide Emissions

Generating 1 million kilowatt-hours of electricity produces:

- 996 metric tons of carbon dioxide from a coal-fired plant
- 809 metric tons of carbon dioxide from an oil-fired plant
- 476 metric tons of carbon dioxide from a natural gas-fired plant
- none from a nuclear power plant.ⁱⁱ

In 2005, the use of nuclear power to generate electricity avoided emissions of nearly as much carbon dioxide as is released from all U.S. passenger cars combined. If nuclear power were not used, 131 million of the nation's 136 million passenger cars would have to be eliminated to keep U.S. carbon dioxide emissions from increasing.

More than 400 nuclear power plants worldwide produce 16 percent of the world's electricity—while reducing carbon dioxide emissions by more than 2 billion metric tons per year.

Fossil-fired power plants are becoming cleaner, and renewables have a small but growing

role to play in electricity generation. Renowned environmentalist James Lovelock said, "By all means, let us use the small input from renewables sensibly, but only one immediately available source does not cause global warming, and that is nuclear energy."

Policymakers Recognize Nuclear Power's Contribution

In 2006, seven northeastern states established the first mandatory regional cap-and-trade program for carbon dioxide. The program treats all emission-free sources of electricity, such as nuclear power and renewables, equally in the framework for awarding credits for greenhouse gas reduction.

The seven states are part of the Regional Greenhouse Gas Initiative (RGGI). The program will cap emissions from the power sector in the states of Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York and Vermont. Nuclear power plants generate about one-third of the region's electricity.

A cap-and-trade system limits the total allowable amount of emissions and creates tradable certificates called "allowances" that permit the bearer to emit a certain quantity of the capped gas. The RGGI cap on carbon dioxide emissions affects only the power sector, which must maintain current emission levels through 2014 and reduce those levels by 10 percent by 2018.

Nuclear Energy and the Environment

Page 3 of 3—January 2007

Each state must implement the program by 2009 through legislation or regulation, where appropriate.

Protecting Resources For Future Generations

Nuclear energy has the smallest environmental impact of any clean-air electricity source. For example, a 1,000-megawatt wind farm would occupy 78 square miles. A 1,000-megawatt nuclear plant would occupy less than 5 percent of that area.ⁱⁱⁱ A 1,000-megawatt power plant can meet the needs of a city the size of Boston or Seattle.

Life-cycle analysis is a mechanism for measuring the total environmental impact of various energy sources. Environmental researchers have evaluated total emissions from various energy sources. This includes emissions resulting from all aspects of each energy source—construction, operation, dismantling and disposal. The life-cycle impact of nuclear energy is among the lowest of any form of electricity generation, comparable with renewable technologies such as wind and solar power.

Clean Water and Safe Haven for Wildlife

Protecting the environment extends to safely managing used fuel, protecting water quality and preserving—even improving—habitat for plants and wildlife, including some endangered species.

The companies that operate nuclear power plants honor and protect the environment in all these ways, under strict regulations and through many voluntary programs. Cooling water discharged from a nuclear plant contains no harmful pollutants, and it meets federal Clean Water Act requirements and state standards for temperature and mineral content.

Nuclear power plants are so clean and safe that they provide excellent habitats for wildlife and plants. Virtually all companies that operate nuclear power plants have extensive environmental programs, many of them at nuclear reactor sites. For example, some companies have developed environmentally rich wetlands, providing better nesting areas for waterfowl and other birds, new habitats for fish, and sanctuaries for other wildlife, flowers and grasses.

“Residents” at power reactor sites include many endangered and protected species, such as bald eagles, manatees, crocodiles, blue crabs, oysters and fish. Several species of endangered plant life also find refuge at nuclear plant sites.

The environmental activities conducted by nuclear companies have been recognized by the nation’s best-known environmental organizations, including the Audubon Society, Ducks Unlimited, the National Wildlife Federation, the Nature Conservancy, Trout Unlimited, the Wildlife Habitat Council and the U.S. Fish and Wildlife Service.

This fact sheet also is available at <http://www.nei.org>.

ⁱ Most recent data available.

ⁱⁱ Nuclear energy, like all non-emitting technologies such as wind turbines and hydroelectric generation, does not emit criteria pollutants or greenhouse gases in the direct production of electricity. All of these technologies may produce some emissions during maintenance, while testing backup generators or arising from other segments of the life cycle. These emissions, in all cases, have been found to be insignificant when compared with air emissions from fossil fuel-based generation.

ⁱⁱⁱ A 1,000-megawatt wind farm occupies 50,000 acres—about 3.5 times the area of Manhattan (source: Nuclear Regulatory Commission Relicensing Environmental Impact Statement). The average 1,000-megawatt U.S. nuclear power plant requires about 2,000 acres—one-seventh the size of Manhattan.