

Nuclear Energy and the Environment

October 2007

Key Facts

■ Nuclear power plants generate about 20 percent of U.S. electricity. They do not burn anything when producing electricity, 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 71 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 2006, U.S. nuclear power plants reduced emissions of nitrogen oxides and sulfur dioxide—pollutants controlled under the Clean Air Act—by 1 million short tons and 3.1 million short tons, respectively. The amount of nitrogen oxide emissions that nuclear plants prevent annually is the

equivalent of taking more than 51 million passenger cars off the road.

■ Also in 2006, U.S. nuclear plants prevented the discharge of 681 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 104 nuclear power reactors provide about 19 percent of its electricity. 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 6.9 percent of our nation's electricity; wind energy, 0.6 percent; and solar energy, less than 0.01 percent.

Clean Air Act Targets Two Major Pollutants

Nuclear power plants do not burn anything when producing electricity, 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. Nuclear energy produces more than 25 percent of the electricity in half of these states. Without that electricity production, the EPA goals for reducing nitrogen oxide emissions would be harder to achieve.



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Nuclear Energy and the Environment

Page 2 of 3—October 2007

In 2006, U.S. nuclear power plants avoided the emission of 1 million short tons of nitrogen oxides—the same amount emitted by more than 51 million passenger cars in a year. This means that without nuclear energy, more than 51 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 2006, nuclear plants avoided the emission of 3.1 million short tons of this pollutant—more than twice that avoided by hydro electric 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. EPA, 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 total carbon dioxide reductions in 2005, the most of any sector.¹

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.²

In 2006, 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

¹ Most recent data available.

² 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.

nation's 137 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 2.6 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 in the United States. The Regional Greenhouse Gas Initiative (RGGI) program treats all emission-free sources of electricity, such as nuclear power and renewables, equally in its framework for greenhouse gas reduction. Today, RGGI includes 10 northeastern and mid-Atlantic states. In addition, six western U.S. states have formed a similar initiative.

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

Nuclear Energy and the Environment

Page 3 of 3—October 2007

certain quantity of the capped gas.

Policymakers are debating various approaches to address climate change and carbon emissions on a federal level. Although competing proposals have been offered, most expect the U.S. government will focus on climate change over the next few years.

The Nuclear Energy Institute in October released a position paper detailing the industry's position on climate change policy. The industry believes that an effective climate change policy depends on a portfolio of energy sources, such as nuclear energy, that help prevent greenhouse gases. The nuclear industry supports federal action or legislation to reduce greenhouse gas emissions. It also states that significant expansion of nuclear power in the United States requires sustained federal and state government policies relating to energy infrastructure and the environment. The complete paper is available at www.nei.org.

Protecting Resources For Future Generations

Nuclear energy has the smallest environmental impact of any clean-air electricity source. As a result, nuclear energy is well suited to meet the growing energy demands of the world's urban centers. 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. All companies that operate nuclear power plants have extensive environmental programs. Many augment these programs with voluntary initia-

tives to enhance natural habitats 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 www.nei.org.