POLICY BRIEF

Nuclear Energy: A Key Tool in Reducing Greenhouse Gas Emissions

January 2007

Key Points

■ Nuclear power plants generate electricity for one in five homes and businesses in the United States without producing or emitting any greenhouse gases, including carbon dioxide. Nuclear power plants generate 73 percent of all carbon-free electricity in America and are an essential mitigation tool for reducing greenhouse gases.

■ Nuclear energy accounted for 54 percent of voluntary greenhouse gas reductions (142 million metric tons of carbon dioxide) reported by the electric power sector in 2004, according to a recent Power Partners report submitted to the U.S. Department of Energy. The electric power sector reported more carbon dioxide reductions than any other reporting sector—63 percent of 445 million metric tons.

■ Several analyses show that life-cycle emissions from nuclear energy are comparable to other non-emitting sources of electricity, such as solar, wind and hydropower.

■ U.S. and international policymakers are increasingly recognizing that nuclear energy has a significant role to play in current and future greenhouse gas emission-reduction policies.

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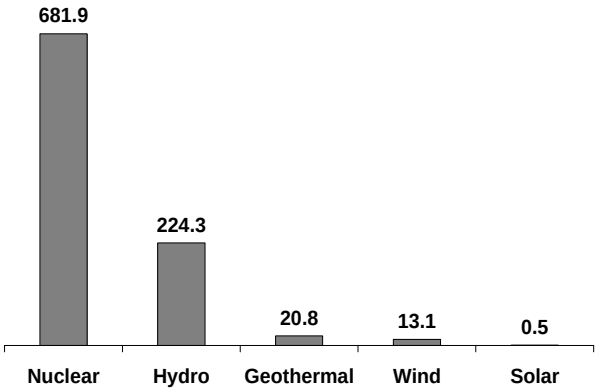
Nuclear Energy's Vital Role in Reducing Greenhouse Gas Emissions

Carbon dioxide—the greenhouse gas mainly emitted by human activity—is the major focus of policy discussions to reduce emissions. Many scientists believe that carbon dioxide emissions increase the 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.

Carbon Dioxide Prevented by U.S. Electric Power Industry
(in million metric tons)



Source: Emissions avoided in 2005 calculated using regional and national fossil-fuel emission rates from the U.S. Environmental Protection Agency and plant generation data from the U.S. Energy Information Administration.

Nuclear power plants produce large amounts of electricity without emitting carbon dioxide or other greenhouse gases. America's commercial power reactors provide about 20 percent of our electricity—and nearly three-quarters of the nation's clean-air electricity generation.

By using nuclear power instead of fossil fuel-based plants, the U.S. nuclear energy industry prevented 681.9 million metric tons of carbon dioxide emissions in 2005. For perspective, the volume of greenhouse gas emissions prevented at the nation's 103 nuclear power plants is equivalent to taking 96 percent of all passenger cars off America's roadways.

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In 1994, the electric power industry teamed with the U.S. Department of Energy to create "Climate Challenge," a joint government-industry partnership that eliminated 237 million metric tons of carbon dioxide-equivalent greenhouse gas emissions in the year 2000 alone. Power sector actions comprised about 70 percent of the total reductions and offsets reported to the government that year.

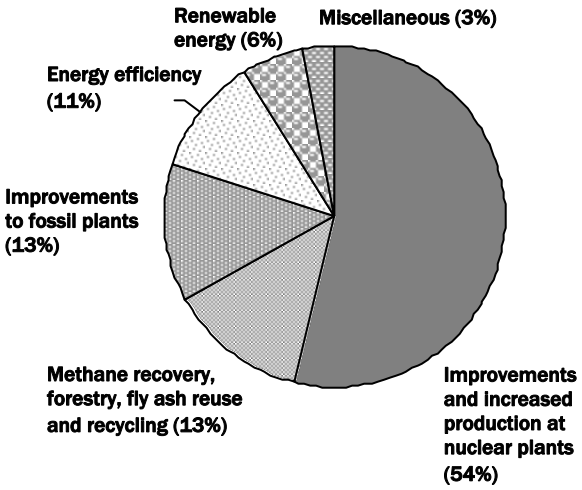
Building on the success of the Climate Challenge partnership, the electric power sector made a new voluntary commitment to reduce greenhouse gas emissions intensity in the United States. In 2003, through a new initiative named Power Partners, the industry pledged to reduce the power sector's greenhouse gas emissions intensity during the 2010-2012 period by the equivalent of 3 percent to 5 percent (measured as greenhouse gas emissions per unit of electricity produced in our sector) below the 2000-2002 base period average.

The electric utility industry is on track to meet its reduction targets, with adjusted power-sector carbon intensity approaching a 3 percent reduction compared to the baseline level. The industry has reached this milestone only three years into the 10-year program.

Increased electric generation by nuclear power plants accounted for 36 percent of the total carbon dioxide reductions in the Power Partners program and 54 percent of reductions from the electric sector in 2004, the highest for any fuel source.

Voluntary efforts by U.S. industry to reduce greenhouse gases and international emission-reduction efforts, such as the Kyoto Protocol and the Asia-Pacific Partnership, would be hampered significantly if nuclear power production were reduced, and made nearly impossible if nuclear power were eliminated. For example, achieving a 20 percent renewable portfolio standard in the United States would have no impact on the nation's greenhouse gas emissions if production of electricity at nuclear power plants were simultaneously reduced or eliminated.

Electric Power Greenhouse Gas Reductions by Project Type



Source: Energy Information Administration

Analyses Reveal Low Life-Cycle Emissions of Nuclear Energy

Critics claim that nuclear power's air emissions are comparable to those of fossil-fuel sources of electricity generation when the "life-cycle" impacts of nuclear power are considered. Although nuclear power plants do not emit greenhouse gases when generating electricity, certain processes used to build and fuel the plants do. This is true for all energy facilities.

However, numerous studies demonstrate that nuclear power's life-cycle emissions are

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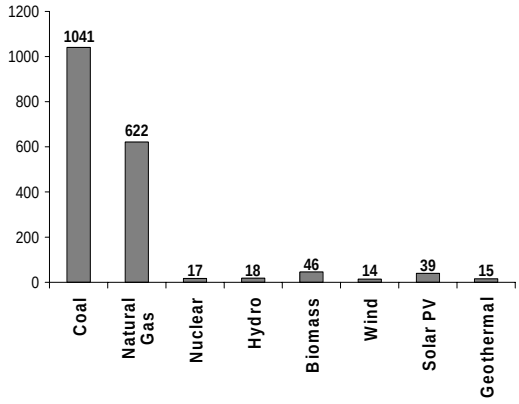
Comparison of Life-Cycle Emissions
(in tons of carbon dioxide-equivalent per gigawatt-hour)



Source: University of Wisconsin-Madison

comparable to renewable forms of generation, such as wind and hydropower, and far less than those of coal- or natural gas-fired power plants.

An International Energy Agency (IEA) analysis found that nuclear power's life-cycle emissions range from 2 to 59 gram-equivalents of carbon dioxide per kilowatt-hour. Only hydropower's range ranked lower, at 2 to 48 gram-equivalents of carbon dioxide per kilowatt-hour. Nuclear energy's life-cycle greenhouse gas emissions are lower than wind (7 to 124 gram-equivalents) and solar photovoltaic (13 to 731 gram-equivalents), according to IEA. The life-cycle emissions from natural gas-fired plants ranged from 389 to 511 gram-equivalents of carbon dioxide per kilowatt-hour.

Policymakers Recognize Nuclear Power's Climate Benefits

Climate change increasingly is important to U.S. and international policymakers considering energy supply and greenhouse gas mitigation. Given that concern and the need for baseload electricity production, policymakers and energy industry leaders are evaluating an expanded role for nuclear power.

Carbon mitigation strategies from Princeton University, Columbia University's Earth Institute, Harvard University and the Pew Center on Global Climate Change, as well as energy studies by the governments of Finland and the United Kingdom, have reached a similar conclusion: A clear path toward meeting the global challenge of reducing greenhouse gases relies in part on an expanded portfolio of low-emission sources of electricity, including nuclear power.

A 2006 report by the Progressive Policy Institute said that expanding nuclear power should be part of a plan that would help avert a dangerous long-term energy crisis and address air-quality issues. The institute's "Progressive Energy Platform" said that nuclear energy "holds a great potential to be an integral part of the diversified energy portfolio for America. It produces no greenhouse gas emissions, so it can help clean up the air and combat climate change. And, new plant designs promise to produce power more safely and economically than first-generation facilities."

Nuclear energy also is part of the strategy for combating climate change in an energy security plan released by the Center for American Progress, a progressive think tank. The center recommends that the United States establish a "renewable portfolio standard" mandating that 10 percent to 25 percent of electricity be produced from renewable resources and nuclear energy by 2025.

Seven northeastern states in 2006 approved the first mandatory regional cap-and-trade program for carbon dioxide. The program treats all clean-air sources of electricity, such as nuclear power and renewables, equally in the framework for awarding credits for greenhouse gas reduction. Nuclear plants generate about one-third of the region's electricity.

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California passed legislation in 2006 to reduce carbon dioxide emissions by about 25 percent by 2020. In January 2007, Gov. Arnold Schwarzenegger asked state regulators to require oil refiners and gasoline sellers to cut by 10 percent the emission of greenhouse gases from their production facilities. Under this life-cycle emissions reduction approach, electricity from nuclear plants to power plug-in hybrid vehicles could play a significant role in the state's future transportation sector.

Globally, more than 440 reactors generate 17 percent of all electricity. Construction is under way on 29 reactors, and many countries have announced plans to build more than 200 reactors in the next 30 years.

Without nuclear energy in today's portfolio, greenhouse gas emissions would be dramatically higher. In the European Union, a recent study of the region's carbon avoidance shows that an additional 704 million metric tons of carbon dioxide would be emitted if all nuclear power plants in these countries were removed from the electricity grid. Worldwide, nuclear energy prevents the emission of more than 2 billion metric tons of carbon dioxide each year.

This policy brief also is available at www.nei.org*, where it is updated periodically.*

On Nuclear Energy's Environmental Benefits

"Nuclear energy may just be the energy source that can save our planet from another possible disaster: catastrophic climate change. … Nuclear energy is the only large-scale, cost-effective energy source that can reduce [carbon dioxide] emissions while continuing to satisfy a growing demand for power.

—Patrick Moore
Co-founder of Greenpeace
Co-chair of Clean and Safe Energy Coalition
The Washington Post
April 16, 2006

"[The United States should] provide opportunities for nuclear power to play a continuing role in a future low-carbon electricity sector. … Because nuclear power is one of the few options for no-carbon electricity production, efforts should be made to preserve this option."

—Pew Center on Global Climate Change
Recommendation in "Agenda for Climate Action"
February 2006

"I was reminded again of the amount of carbon dioxide that nuclear power plants do not put into the air … the amount of dollars that reliance on nuclear energy does not add to our trade deficit … the reduction in imported oil that a reliance on nuclear power for the generation of electricity affords us. It is important that we continue to maintain and strengthen going forward our reliance on nuclear energy."

—Sen. Thomas Carper (D-Del.)
Hearing, U.S. Senate, Committee on Environment and Public Works
May 20, 2004

"I firmly believe that nuclear power is a key technology for addressing climate change. As we develop strategies to reduce greenhouse gas emissions, we simply cannot ignore this emission-free technology."

—Sen. John McCain (R-Ariz.)
Clean Cities Congress and Exposition
May 8, 2006