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RETHINKING THE MORATORIUM ON NUCLEAR ENERGY

Nuclear power has been an important part of Wisconsin's energy mix since the 1970s, but the Public Service Commission (PSC), the agency responsible for regulating public utilities in Wisconsin, has not approved the construction of a new nuclear power plant in over 30 years. This is due in part to a conditional moratorium on new nuclear power plant construction in Wisconsin since 1983. Wisconsin law requires that before the PSC can approve construction, two prerequisites must be met: a new nuclear power plant must be economically advantageous to ratepayers, and a federal nuclear waste repository must exist. Some view these requirements as overly burdensome, and legislation was introduced in both the 2003 and 2005 legislative sessions that would have eliminated these statutory constraints on the PSC.

This brief provides an overview of nuclear power, discusses both the history of and the current debate over the moratorium, and highlights some nuclear initiatives and future energy alternatives.

NUCLEAR POWER OVERVIEW

Most nuclear power plants utilize a process of splitting uranium or plutonium atoms to create large amounts of heat which, when mixed with water, produces enough steam to turn a turbine engine and generate electricity. Nationally, nuclear power accounts for about 8% of total energy consumption, and for Wisconsin and the nation, nuclear energy accounts for about 20% of energy production.

There are 104 nuclear power plant units in operation in the U.S. Wisconsin has three operational units: two at Point Beach and one at Kewaunee. All three reactors were granted 40-year licenses in the early 1970s, but are expected to operate well past their initial license expiration dates. Point Beach nuclear plant units 1 & 2 were given license renewals of 20 years by the Nuclear Regulatory Commission (NRC) on December 22, 2005, and the Kewaunee power plant is expected to submit an application for license renewal between April and June 2008. While existing nuclear power plants will likely continue for decades, the current debate revolves around the construction of new nuclear power plants.

HISTORY OF THE MORATORIUM

To better understand the current debate, it is helpful to look at the events which led to the 1983 moratorium.

At about 4:00 a.m. on March 28, 1979, a main feedwater pump malfunctioned in a turbine building at the Three Mile Island Nuclear Generating Station near Middletown, Pennsylvania. This began a string of mechanical and human errors that led to the most serious accident in U.S. nuclear power plant history. While scientists contend that no significant health effects have been linked to the nuclear core meltdown that occurred, the effects on the nuclear industry have been long-standing and detrimental.

In response to the Three Mile Island accident, legislation was introduced in the Wisconsin Legislature during the 1979 and 1981 sessions to place a temporary moratorium on nuclear power plant construction and require the PSC to conduct a study on the economic effects of the

Prepared by Anthony Gad, Legislative Analyst

Reference Desk: (608) 266-0341
Web Site: www.legis.state.wi.us/lrb

construction and operation of nuclear-powered electrical generating plants. These bills failed to pass, but the 1983 Legislature passed similar legislation.

1983 Assembly Bill 826, enacted as 1983 Wisconsin Act 401, created a conditional moratorium based on the economics of both the nuclear power plant and its nuclear waste. 1983 Wisconsin Act 401 prohibited the PSC from approving the construction of a new nuclear power plant unless it is economically advantageous to ratepayers compared to feasible alternatives, and not until a federally licensed repository for high-level nuclear waste is operating with enough capacity to handle the waste from all nuclear power plants in Wisconsin.

The drafting record for 1983 Wisconsin Act 401 indicates that the April 20, 1983 decision of the U.S. Supreme Court to uphold California's moratorium on new nuclear power plant construction [*Pacific Gas & Elec. Co. v. State Energy Resources Conservation and Development Comm'n,* 461 U.S. 190 (1983)] may have helped shape the language of the Wisconsin legislation. This 1983 Supreme Court decision found that without a permanent waste disposal site, nuclear waste management could lead to unknown negative economic consequences.

THE MORATORIUM DEBATE

The national energy outlook has changed a great deal since 1983. Current and forecasted energy needs have prompted some to question the logic behind continuing a moratorium on nuclear power plant construction. Demand for electricity is on the rise across the United States, and Wisconsin is projected to have a 6300 megawatt shortfall by 2016. In order to help meet expected energy demand, Wisconsin utilities plan on increasing generation by one-third from 2004 to 2010. A future increase in electricity demand and supply is almost assured, but the specific sources of this new energy have not yet been determined.

Wisconsin will likely continue to rely heavily on fossil fuels, as coal accounts for about 70% of its electricity generation. Nuclear energy is an alternative to fossil fuels that has become a more prominent part of the national energy debate in recent years, but before a new nuclear power plant could be built in Wisconsin, either the moratorium conditions would have to be met or they would need to be repealed by law. 2005 Senate Bill 594 and 2005 Assembly Bill 1053 would have repealed these provisions, but died in their respective committees.

Regardless of the failure of these two bills, it is likely that the issue will continue to be debated. While the moratorium appears to have been originally created due to economic concerns, environmental, security, and safety issues also play major roles in the present discussion on nuclear power in Wisconsin.

ECONOMICS OF THE MORATORIUM

Wisconsin's moratorium on new nuclear power deals primarily with the economic side of two issues: nuclear waste management and comparative utility rates. Nuclear waste management includes both the storage of nuclear waste at the nuclear power plants and the creation of a federal nuclear waste repository.

On-site Nuclear Waste Management. After being used in three to four reactor cycles, spent fuel is considered high-level radioactive waste and must be stored in spent fuel pools for five to seven years before it can be moved into a dry storage unit.

Opponents of nuclear power contend that a typical nuclear reactor will produce 20 to 30 tons of high-level nuclear waste per year, with no current long-term waste management solution in place. The PSC estimated that by 2013, Kewaunee Nuclear Power Plant will have a total of 1,305 spent fuel assemblies, 100

more than current capacity. The PSC has also pointed out that the La Crosse Boiling Water Reactor, which was shut down in 1987, still has 333 spent fuel assemblies in its spent fuel storage pool waiting to be removed.

Proponents of nuclear power contend that all of this high-level nuclear waste will be transported out of Wisconsin when a federal repository is built.

Federal Nuclear Waste Repository. The quest to build a federally licensed nuclear waste repository large enough to handle most, if not all, of the current nuclear waste at the 131 nuclear waste sites around the country, usually at the nuclear power plants themselves, has been met with local opposition to every site that has been seriously examined. During the mid-1980s, the Wolf River Batholith near Wausau, Wisconsin was an early contender, but local opposition helped move the search out of Wisconsin.

In 1987, Congress placed a cap of 70,000 metric tons of nuclear waste at the current planned site, the Yucca Mountain in Nevada. Opponents claim that existing levels of waste almost exceed the 1987 cap, and the development of the Yucca Mountain Repository will likely continue to be pushed back, as it is embroiled in controversies, major delays, and accusations of falsified data that threaten to derail the project indefinitely.

Utility Rates. Reports that discuss the economic impact on ratepayers of a new nuclear power plant often do not include alternative energies or energy conservation as viable options, instead comparing nuclear energy rates with the rates of the two other major sources of electricity generation in the U.S. — coal and natural gas. The comparative cost of nuclear power versus coal and natural gas reveals a system that is weighted heavily toward the initial capital development stages.

In 2001, it was estimated that the operating cost of nuclear power was around 1.8 cents per kW-hr, compared to 2.1 cents for coal plants and 3.5 cents for natural gas plants. But the projected capital cost of a new nuclear power plant utilizing modern technology is around $2,000 per kW-hr, compared to $1,200 for coal and $500 for natural gas. Opponents reason that a new nuclear power plant would operate at a much higher cost than the 1.8 cents per kW-hr of the older plants, as these older plants have already recuperated their initial capital expenses.

Even though the U.S. has a large domestic supply of uranium and coal but a highly fluctuating supply of natural gas, both natural gas and coal may be more economically advantageous to ratepayers in the short-term.

ENVIRONMENTAL ISSUES

Environmental concerns have fueled the renewed interest in nuclear power. Nationally, reliance on fossil fuels is projected to increase from 85% in 2002 to 87% in 2025. The PSC has approved the construction of two new coal power plants in Oak Creek, Wisconsin, scheduled to be operational by 2009 and 2010. Due to coal power's heavy air pollution, some environmentalists have argued that nuclear power is the most realistic "clean air" alternative. Opponents counter by pointing out that nuclear power negatively impacts the environment through nuclear waste and uranium mining.

Air Pollution. Many believe that the U.S. reliance on coal power has harmed both the environment and public health. The roughly 1,600 coal plants in the U.S. are estimated to cause about 10% of the world's greenhouse gases, and it has been projected that greenhouse gas emissions will grow in the U.S. by approximately 1.3 billion metric tons of CO_2-equivalent between 2010 and 2020. Many scientists link air pollution and greenhouse gases caused by burning fossil fuels to an increase in global warming.

The perceived long-term danger of global warming has been a major impetus for the renewed look at nuclear energy as a viable alternative to coal, though the immediate health dangers of coal plant air pollution are already well established. The Environmental Protection Agency has estimated that 26,000 deaths per year are correlated to the air pollution caused by coal plants in the U.S.

Electricity generation from nuclear energy, on the other hand, produces virtually no air pollution or greenhouse gases. Proponents contend that in 2004, the power generated from Wisconsin's three nuclear power plant units helped prevent about 12.3 million metric tons of carbon dioxide, 47,600 tons of sulfur dioxide, and 17,400 tons of nitrogen oxide emissions.

Nuclear Waste. High-level nuclear waste remains dangerously radioactive for about 250,000 years and although current technology contains the radioactivity, no technology currently exists to permanently deal with nuclear waste. Opponents contend that this is just pushing today's problems onto future generations without a foreseeable end in sight or an accurate knowledge of the environmental consequences yet to come.

Mining. Uranium mining at both underground and open pit mines has been deemed a major source of nuclear energy pollution. Some argue that emissions of radioactive gases and other elements caused by the the mining and milling of uranium ore have resulted in a significant increase in lung cancer deaths among uranium miners. Opponents also claim that radioactive waste left at the mines, such as thorium, which has a half-life of 77,000 years, has contaminated the air and water supplies of towns around the uranium mines and mills.

SECURITY AND SAFETY ISSUES

Nuclear plant security issues often refer to the threat of terrorists breaching a nuclear containment unit or obtaining nuclear waste for use in a "dirty bomb". While an increase in the production of plutonium would increase the risk of nuclear proliferation, some experts believe that the more realistic terrorist threats are attacks against nuclear waste sites or nuclear waste transportation. Even without the threat of terrorism, accidents are always a concern. Transporting nuclear waste is inherently dangerous, and although the risk of a nuclear core meltdown has decreased since the days of Three Mile Island and Chernobyl, human and mechanical errors still occur.

Nuclear Sites. Proponents contend that a terrorist attack on a nuclear power plant would not likely breach a nuclear containment structure; modern structures are protected by six feet of reinforced concrete with one-inch steel plates on both sides. A more likely target would be the nuclear waste storage units.

Nuclear waste sites store high-level nuclear waste in either underground cooling pools or above-ground cement casks. In the U.S., about two-thirds of the nuclear waste is kept in spent fuel pools, while one-third is in dry storage. The pools are typically about 45 feet deep, 40 feet square, and contain 100,000 gallons of circulating water. The dry casks use lead and steel and are considered more secure in the event of a terrorist attack, but are more expensive to use than spent fuel pools.

Although the strong construction adds to the safety, it has been noted that the buildings that house nuclear waste are clearly visible from the air, and experts warn that if a terrorist attack breached the spent fuel cooling pools, the result could be the release of large amounts of radioactive material.

Nuclear Waste Transportation. If a centralized, federally licensed nuclear waste

repository is constructed, nuclear waste from around the nation will be transported via truck or rail past many major population centers.

Proponents point to the over 2,700 shipments of spent nuclear fuel that have already been made throughout the U.S. over the last 30 years, with the coordination of various levels of government, as evidence that transporting nuclear waste is safe. It has been projected that Wisconsin will have close to 1,800 metric tons of spent nuclear fuel in storage by 2033.

The NRC has regulated the design of the nuclear fuel casks to be used during transport and require that they withstand a 30-foot fall onto a hard surface, a puncture by a six-inch diameter steel rod, 30 minutes engulfed in flames, and submergence under three feet of water. The planned shipments of nuclear waste to the Yucca Mountain Repository may have armed security escorts through heavily populated areas and, at the discretion of the governor, through the entire state.

Skeptics have estimated that 100 to 400 of the 4,200 shipments of nuclear waste to the Yucca Mountain Repository would likely be involved in some kind of accident that could potentially result in the deaths of some first responders, an increase in cancer rates for nearby residents, and the need to spend hundreds of millions of dollars to clean up contaminated areas.

Wisconsin Power Plant Shutdowns. Opponents point to the plant shutdowns and violations that have occurred at Wisconsin's nuclear power plants over the last 10 years as evidence that nuclear power is still vulnerable to potentially dangerous accidents.

Some examples of problems at the Kewaunee Nuclear Power Plant include a January 16, 2004 shutdown when lake weeds and silt were found obstructing the heat exchangers in the core's cooling system. In February 2005, the plant shut down after an NRC inspection determined that a substantial risk of flooding due to seismic activity or equipment failure existed, resulting in major modifications to the system.

Problems that have occurred at the Point Beach Nuclear Power Plant include a small explosion inside a dry cask of nuclear waste, resulting in the plant closing for 20 months between 1996 and 1998, and one of the Point Beach units being manually shut down in December 2005 when a circulating water pump failed.

NUCLEAR ENERGY INITIATIVES

No new nuclear power plants have been constructed in the U.S. since the accident at Three Mile Island, but that may soon change, as an application for a new nuclear power plant in Cherokee County, South Carolina, is expected to be filed with the NRC in late 2007 or early 2008. If a new nuclear power plant is built in the U.S., it may very well employ radically different technology than what was used 30 years ago. Initiatives that would affect nuclear power plant production are being developed to reprocess spent fuels and to utilize new nuclear reactor technology.

Global Nuclear Energy Partnership. The federal government has proposed the Global Nuclear Energy Partnership (GNEP) to develop nuclear waste reprocessing stations that would service nuclear power plants in the U.S. and overseas. This process would result in less nuclear waste at the nuclear reactor sites around the country and has the potential to alleviate some of the demand for a central federal nuclear waste repository. The estimated cost for GNEP is $250 million for planning and development, $3 to $6 billion to create demonstration facilities, and $20 to $40 billion overall.

Critics of this plan argue that transporting nuclear waste overseas would greatly increase the risk of terrorists obtaining the components for a nuclear weapon.

Pebble Bed Nuclear Reactor. The pebble bed reactor is a relatively new design for a more safe and efficient nuclear power plant. It replaces the current steam management design, which relies on water, with spherical graphite pebbles cooled by an inert gas. While this design results in spent fuel that is less radioactive, it produces more absolute nuclear waste. The outcome of the Yucca Mountain Repository may play a large part in this technology's future in the U.S.

NON-NUCLEAR ALTERNATIVES

Realistically, the fate of nuclear power is tied to the success or failure of alternative energy sources. Utility companies are looking at new ways to use coal, wind power, and hydrogen technologies. Many of these alternatives already have major research and funding, but are either not yet fully developed or are still in the early stages of implementation. These technologies have the potential to affect all future U.S. power consumption.

Clean Coal. A nearly $1-billion project funded by the federal government and an alliance of energy companies has begun developing a power plant using coal gasification technologies to produce energy with virtually zero emissions. It has been estimated that coal is the most abundant fossil fuel in the U.S., with enough to maintain current energy levels for the next 250 years. While the technology is promising, clean coal has yet to be proven as a functional alternative to "dirty" coal power.

Wind Power. Renewable energy was recently bolstered by the passage of 2005 Wisconsin Act 141, which included a nonbinding goal that renewable energy account for 10% of total electricity in Wisconsin by 2015 and mandated electrical utility companies to increase the use of renewable energies by six percentage points over their 2001-2003 averages. In response, utilities are turning more toward wind power versus other sources, such as solar or biomass.

It has been projected that Wisconsin will need to build 700 to 1,100 new wind turbines to meet the new goals. The high cost of steel and the short supply of wind turbines have increased the construction costs of projects such as the proopsed 88-turbine wind farm in Fond du Lac County, which has seen its estimated costs rise from $250 to $346 million. Although capital costs have risen, the absence of fuel costs keeps investments in wind power attractive. Some environmentalists have argued that the negative impact on migratory birds and other wildlife should rule out certain sites, such as the proposed 133-turbine wind farm at the Horicon Marsh.

Hydrogen. Hydrogen fuel cells, which use hydrogen and oxygen in an electrochemical process to create electricity with water as the only by-product, have been touted as the future of energy production. The costs involved with this new technology are often cited as the primary obstacle to its implementation, and unless hydrogen fuel cells become economically feasible, its future remains uncertain.