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## **Nuclear Power in the United States**

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### **Introduction**

Nuclear power currently provides almost 20% of the electricity generated in the United States (U.S.), surpassed only by coal. Although the nuclear option continues to be faced with problematic issues, there are indications that it is beginning to be recognized in some quarters as an environmentally friendly energy source. For example, the 103 nuclear plants currently in operation, result in the avoidance of U.S. carbon emissions by an amount equivalent to the burning of approximately 300 million tons of coal.

In order to meet the increasing energy demands and environmental constraints of the future, it will be necessary to use a mix of energy sources. It will not be sufficient to develop cleaner fossil fuel technologies and find more efficient and cost effective ways of obtaining energy from the renewables: solar, wind, geothermal and biomass. The U.S., as well as other countries, must continue to use nuclear energy to the maximum possible extent in order to come even close to meeting its carbon emission obligations. This will require, among other things, that nuclear plant life be extended to the greatest extent possible and that advanced nuclear plant technology be developed to eventually provide new capacity.

### **Current Status**

The U.S. electricity generation of 3,533 billion kiloWatt-hours in 1997 was provided by the following sources (according to the DOE-Energy Information Administration):

Coal	53%
Nuclear Power	18%
Natural Gas	14%
Hydroelectric Power	10%
Other (Petroleum & Renewables)	5%

Approximately 88% of the total generation was by utilities with the remainder being produced by non-utility power producers, primarily for industrial requirements.

In 1997, the U.S had 107 licensed light water reactors (LWRs) with a capacity of 100.8 GigaWatt-electric (GWe). However, shutdowns in the past year have reduced the number of operating U.S. reactors to 103 with a capacity of 95.6 GWe. The DOE has concluded in its

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*1998 Annual Energy Outlook* that nuclear energy's contribution to U.S. electricity generation could drop to about 9% by 2020, if current trends persist, and if plant licenses are not extended.

The existing 103 U.S. plants are licensed and operated by 44 different utility companies, 19 of which only operate a single reactor. It is anticipated that within the next 5 to 10 years the number of licensees for the then remaining 90 to 95 plants will be reduced to between 5 and 10 nuclear power generating companies. The Philadelphia Electric Company (PECO Energy) and British Energy joint venture, AmerGen, is currently acquiring the operating TMI Unit 1 plant and PECO has stated that it plans to own up to 25 GWe of operable nuclear capacity within five years. As the U.S. electric utility industry continues to restructure, so also will the ownership of its operable nuclear capacity. A factor affecting the acquisition of nuclear plants is the lengthy regulatory process for the transfer of licenses, which is being revised so that it will in the future take only 6 to 8 months.

### **Industry Issues**

Chief among the major issues facing the U.S. nuclear industry today are generating cost, high level waste disposal, regulatory reform, and public perception. While safety is often cited as a major issue, today's U.S. plants have an excellent record, though public perception continues to be skeptical, a situation which will only diminish with time and continuing industry diligence:

**Generating Cost** -- Nuclear power generating costs are being reduced, but more can probably be achieved. In this regard, regulatory reform could be contributing. The nuclear industry has also recently begun to claim that it is entitled to fossil fuel emissions credits earned by pollution avoidance. The large capital requirements for new capacity will have to be reduced before new commitments can be expected in the future. This may require that vendors develop compact modularized standard designs, in a number of demand compatible sizes.

**Waste Disposal** -- The high level waste (HLW) disposal issue in the U.S. is unique in that electric utilities and their customers have committed more than \$14 billion to pay for federal waste disposal, \$12 billion of which has been paid to the U.S. Department of Energy (including interest), and the utilities have received nothing in return. Under the Nuclear Waste Policy Act of 1982, the DOE was to have an operating facility and begin accepting utility spent fuel by January 31, 1998. The DOE has no facility and cannot accept spent fuel, but continues to collect annual waste fee payments totaling about \$600 million. The \$600 million fee is collected through contracts for the payment of 0.1 cents per kilowatt-hour of electricity generated and sold by the utilities. The DOE has spent almost \$6 billion on program studies, contractors and on tunneling and shafting at the Yucca Mountain Project in Nevada, where it hopes it will get regulatory approval to bring a high level waste storage facility into operation by 2010 or soon thereafter. The DOE is currently planning for hearings

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on its NRC license application and awarding contracts for spent fuel movement around 2003. Approximately \$8 billion of the total payments made by utilities to DOE have gone to the U.S. Treasury and been used to offset the Federal government's annual budget deficit.

Frustrated by the DOE's lack of program progress, utilities and state agencies have filed a series of law suits since 1995 against the DOE. For example, in January 1997, 42 utilities and 61 state and municipal commissions and agencies sued the DOE for nonperformance of its obligations under the law, and sought among other things, to have their payments held in escrow and not given to the DOE. The government is currently exposed to damages amounting to many tens of billions of dollars.

The Administration's response to the utility industry's appeal for a resolution of the waste dilemma has ranged from non-existent to obstructive. The Administration does not support interim storage proposals, and in fact, opposes them. In the meantime, a group of 12 utilities is pursuing a possible private interim storage facility on the Goshute Indian reservation land in Utah.

**Regulatory Reform** -- The U.S. utility industry views the Nuclear Regulatory Commission's (NRC) manner of processing license applications as being inefficient and out of date. For example, it has been known for some years that many utilities would seek to extend their existing 40 year operating licenses to 60 years. The two utilities that began this process in 1998, Baltimore Gas & Electric and Duke Power, have discovered that the NRC has not yet revised its severe accident mitigation alternatives and environmental justice application requirements. In the case of environmental justice, for example, the industry believes that the NRC does not have the authority to impose additional environmental justice requirements for extension of the use of an existing site. With five more plants about to be entered into the license renewal pipeline, and with possibly as many as 50 to 60 plants coming up for license extensions in the next several years, the regulatory process must be reformed quickly.

The Congress, led by Senator Frank Murkowski has been holding hearings and pressuring the NRC to discipline its licensing process. There are indications that NRC Chairperson Shirley Jackson may be getting the NRC staff moving on this critical issue and that renewals may take no more than 2 to 3 years.

**Public Perceptions** – Recent polls show that the percentage of the U.S. public who say they favor nuclear power is higher now than at any time since 1983, 61% of the general public and 65% of college graduates registered to vote. After those polled were informed about the potential environmental benefits of the nuclear power option, these percentages increased to greater than 65% and to 75%, respectively. More than 80% favored extending the licenses of existing nuclear plants that meet federal safety standards.

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However, in spite of the high level of support just indicated, the nuclear option continues to be hampered by a vocal minority from the activist sector, many of whom also oppose the use of fossil fuels and favor only the renewable sources of energy. Fortunately, the activist opponents in the U.S. do not have the political support that they have managed to garner in Sweden and Germany.

### **Greening of U.S. Nuclear Power**

The U.S. nuclear industry is currently publicizing its potential for contributing to the reduction of fossil fuel pollutants. The Nuclear Energy Institute (NEI) claims that though nuclear plants met 40% of the increased demand for electricity in the U.S. between 1973 and 1996 and prevented the emission of 80 million tons of sulfur and 34 million tons of nitrogen oxide, it got no financial or other recognition for this service. The NEI notes that the Environmental Protection Agency's preferred method of regulating fossil fuel emission is the "cap and trade" compliance system. Unfortunately, it notes further, in order to participate a company must actually pollute the atmosphere, which nuclear power does not. NEI believes that tradable credits should be earned not only on the basis of reduced emissions but through displaced emissions as well.

### **Supply Industry Restructuring**

The past 10 to 20 years have seen considerable restructuring of the nuclear supply industry, both in the areas of nuclear plant equipment and nuclear fuel.

When the ongoing joint acquisition of Westinghouse by Morrison Knudsen and British Nuclear Fuels Limited is completed, General Electric will be the only completely U.S. reactor vendor company. The other reactor vendors, Framatome and ABB-Combustion Engineering are subsidiaries of European companies.

On the nuclear fuel fabrication side, General Electric is again the only completely U.S. company, with Framatome, ABB, Siemens and Westinghouse being subsidiaries of European companies.

Only about 12% of the uranium used in U.S. reactors in 1997 was produced in the U.S., and more than half of that percentage was produced by companies that are subsidiaries of non-U.S. companies. Most of the uranium used in the U.S. in recent years has come from Canada and Australia.

The U.S. has a single conversion plant that meets about half of domestic requirements. Most of the remainder is provided by a single plant in Canada. Limited supply comes from the two Western European plants and from Russia.

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The U.S. has a single large enrichment supply company, USEC, which was until its privatization in July 1998, a government monopoly. USEC meets approximately 80% of U.S. needs and provides substantial supply to Japan, Taiwan, Korea, and several European countries. By the end of 1999 USEC will be obtaining about 45% of its enrichment supply from Russian weapons' highly enriched uranium (HEU) under a complex 1993 "swords for ploughshares" agreement.

The Tennessee Valley Authority will obtain fuel for two reactors throughout the next decade from U.S. government weapons HEU. In addition, the government also plans to fuel 3 or 4 U.S. reactors with U.S. weapons plutonium mixed oxide (MOX) fuel in the next decade and dispose of 30 to 35 metric tons of weapons plutonium at the same time as Russia disposes of a similar amount of weapons plutonium.

### **Conclusions**

- Nuclear power is an essential component of the U.S. energy mix and should be maintained through all means possible including public education opportunities and research and development programs.
- Nuclear power can make a valuable contribution toward meeting U.S. greenhouse gas obligations.
- The U.S. regulatory system should be reformed so that it can efficiently administer license renewal, license transfers, federal waste storage, and perhaps new reactors in the coming decades.
- Those existing U.S. nuclear power plants that are economic to operate and can meet federal safety standards, should be licensed for a total of up to 60 years.
- The federal government should live up to its legal obligation to accept spent nuclear fuel by supporting the near-term development of federal interim storage until a permanent repository at Yucca Mountain or its successor site is ready to accept spent fuel for disposal.
- In order to maintain the U.S. nuclear option it is necessary that it continue to be cost competitive to the maximum extent possible, and thus, it must take advantage of economies of scale (e.g. PECO/BE AmerGen plan), emissions trading credits and multinational vendor innovations.