

Nuclear Technology Milestones 1942-Present

February 2008

The '40s

Dec. 2, 1942 Dr. Enrico Fermi achieves the first controlled nuclear chain reaction with the first demonstration reactor—the Chicago Pile 1.

July 16, 1945 Trinity Test of the first atomic explosive device at Alamogordo, N.M.

Aug. 6, 1945 The United States drops an atomic bomb on Hiroshima, Japan, and three days later drops another bomb on Nagasaki. World War II ends days later.

Aug. 1, 1946 President Harry S. Truman signs the Atomic Energy Act of 1946, putting the fledgling nuclear energy industry under civilian control and creating the powerful Joint Congressional Committee on Atomic Energy.

Oct. 6, 1947 The U.S. Atomic Energy Commission first investigates the possibility of peaceful uses of atomic energy, issuing a report the following year.

The '50s

Dec. 20, 1951 An experimental reactor produces electric power from the atom for the first time, lighting four light bulbs.

June 14, 1952 The keel for the Navy's first nuclear submarine,

USS Nautilus, is laid at Groton, Conn.

March 30, 1953 The *USS Nautilus* first starts its nuclear power units.

Dec. 8, 1953 President Dwight D. Eisenhower unveils his “Atoms for Peace” program, proposing an international agency to develop peaceful nuclear technologies.

Aug. 30, 1954 President Eisenhower signs the Atomic Energy Act of 1954, the first major amendment of the original Atomic Energy Act, giving the civilian nuclear energy program further access to nuclear technology.

Jan. 10, 1955 The Atomic Energy Commission announces the beginning of a cooperative program between government and industry to develop nuclear power plants.

July 17, 1955 The first U.S. town—Arco, Idaho, population 1,000—is powered by nuclear energy from the experimental boiling water reactor BORAX III.

Aug. 8-20, 1955 The first international conference on the peaceful uses of nuclear energy is held in Geneva, Switzerland, sponsored by the United Nations.

July 12, 1957 Electricity from a civilian nuclear unit is generated for the first time by the Sodium Reactor Experiment at Santa Susana, Calif. The unit provided power until 1966.

Sept. 2, 1957 President Eisenhower signs into law the Price-Anderson Act, legislation to protect the public, utilities and contractors financially in the event of an accident at a nuclear power plant.

Dec. 2, 1957 The first full-scale nuclear power plant at Shippingport, Penn., goes into service. Twenty-one days later it reaches full power, generating 60 megawatts of electricity (MWe).

May 22, 1958 The keel is laid for the first nuclear-powered merchant vessel, *Savannah*, at Camden, N.J. She is launched on July 21, 1959, and operates for 12 years, calling at most major ports of the world.

Oct. 15, 1959 Dresden 1 Nuclear Power Station in Illinois, the first U.S. plant built entirely without government funding, achieves a self-sustaining nuclear reaction.

The '60s

Early 1960s Small nuclear-power generators are first used in remote areas to power



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weather stations and to light buoys for sea navigation.

March 17, 1962 President John F. Kennedy asks the Atomic Energy Commission to report on the role of nuclear energy in the economy.

Dec. 12, 1963 Jersey Central Power and Light Co. announces its commitment for the Oyster Creek nuclear power plant, the first time a nuclear plant is ordered as an economical alternative to a fossil-fuel plant.

Aug. 26, 1964 President Lyndon B. Johnson signs the Private Ownership of Special Nuclear Materials Act, which allows the nuclear energy industry to own the fuel for its units. After June 30, 1973, private ownership of the uranium fuel is mandatory.

October 1964 Three surface ships powered by the atom—*USS Enterprise*, *Long Beach* and *Bainbridge*—complete a round-the-world cruise without any logistical support.

Dec. 16, 1964 The Atomic Energy Commission issues Oyster Creek nuclear power plant's construction permit.

April 3, 1965 The first nuclear reactor operates in space.

November 1965 The Atomic Energy Commission gives the Liquid Metal Fast Breeder reactor highest priority and decides to build the Fast Flux Test Facility. The facility begins operation in April 1982.

Nov. 9, 1965 The first major electrical blackout occurs in the northeastern United States.

The '70s

April 20, 1970 The first Earth Day is celebrated.

Sept. 23, 1970 Electricity “brownouts” hit the Northeast during a heat wave.

June 4, 1971 President Richard M. Nixon announces a national goal of completing the Liquid Metal Fast Breeder unit by 1980.

June 29, 1973 President Nixon proposes to replace the Atomic Energy Commission with the Energy Research and Development Administration and the Nuclear Regulatory Commission.

Oct. 17, 1973 The Organization of Petroleum Exporting Countries (OPEC) agrees to use oil as a foreign policy weapon, cutting exports 5 percent until Israel withdraws from Arab territory occupied during the Yom Kippur War. Days later, Saudi Arabia cuts oil production by 25 percent and joins many other oil-producing nations in embargoing oil shipments to the United States.

1973 U.S. utilities order 41 nuclear power plants, a one-year record.

1974 The first 1,000-MWe nuclear plant goes into service—Commonwealth Edison's Zion 1 plant.

Oct. 11, 1974 President Gerald Ford abolishes the Atomic Energy Commission and creates in its place the Energy Research and Development Administration and the NRC to begin regulating the nuclear industry. The Joint Congressional Committee on Atomic Energy also is abolished.

Jan. 19, 1975 The Energy Research and Development Administration begins operating.

April 7, 1977 President Jimmy Carter announces a new policy banning reprocessing of used nuclear fuel.

Aug. 4, 1977 President Carter combines the Energy Research and Development Administration with the Federal Energy Administration, creating the Department of Energy.

March 28, 1979 A major accident occurs at Unit 2 of the Three Mile Island nuclear plant near Harrisburg, Penn. Damage is limited to inside the reactor, and no one is injured.

October 1979 The U.S. nuclear energy industry creates the Institute of Nuclear Power Operations to address issues of safety and performance.

The '80s

1980 Nuclear energy generates more electricity than oil does.

Oct. 8, 1981 President Ronald Reagan's administration lifts the ban on reprocessing used nuclear fuel and announces a policy that anticipates the need

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for a high-level radioactive waste storage facility.

Jan. 7, 1983 President Reagan signs into law the Nuclear Waste Policy Act.

Oct. 26, 1983 Funding for the Clinch River Breeder Reactor project is killed by Congress.

1983 Nuclear energy generates more electricity than natural gas.

1984 The atom overtakes hydropower to become the second-largest source of electricity, after coal.

1985 The Institute of Nuclear Power Operations forms a national academy—the National Academy for Nuclear Training—to accredit every nuclear power plant's training program.

1986 The Perry power plant in Ohio becomes the 100th U.S. nuclear power plant in operation.

1988 U.S. electricity demand is 50 percent higher than in 1973.

1989 America's nuclear power plants provide 19 percent of the electricity used in the United States; 46 units have entered service during the decade.

The '90s

1991 America's nuclear power plants set a record for amount of electricity generated, surpassing the 1956 level for all fuel sources combined.

1992 Nuclear power plants account for about 20 percent

of all electricity used in the United States.

August 1992 The fourth and final standardized nuclear power plant design is submitted to the NRC for certification and approval. Getting the plant designs approved by the NRC is a step toward building uniform nuclear power plants in the United States.

Oct. 24, 1992 President George H. W. Bush signs into law the Energy Policy Act, which sets the United States on course for planning its energy needs and reforms the licensing process for advanced, standardized nuclear power plants. The updated process affords the public more timely opportunities to participate in decisions to build new nuclear plants and is expected to create a more stable financial environment for investors.

March 1993 Sixteen nuclear utilities sign the first of two contracts with U.S. nuclear plant manufacturers—each agreeing to develop first-of-a-kind engineering on two advanced plant designs. General Electric signs in March and Westinghouse signs in June.

April 6, 1993 Another nuclear power plant—Comanche Peak 2 in Glen Rose, Texas—goes on line, providing 1,150 MWe to U.S. consumers.

December 1993 Two decades after the first oil embargo, the 109 nuclear power plants oper-

ating in the United States generate 610 billion kilowatt-hours of net electricity, providing about one-fifth of the nation's electricity.

July 1994 The NRC issues final design approval for the first two of four advanced nuclear power plant designs—General Electric's Advanced Boiling Water Reactor and ABB Combustion Engineering's System 80+. The approval means that all major design and safety issues have been resolved to the satisfaction of the NRC staff and the Advisory Committee on Reactor Safeguards. The two plants are the first to obtain final design approval under the NRC's new regulations for licensing standardized plant designs.

Feb. 9, 1996 The NRC grants the Tennessee Valley Authority a full-power license for its Watts Bar 1 nuclear power plant, bringing the number of operating nuclear units in the United States to 110.

Sept. 30, 1996 The first-of-a-kind engineering design is completed for the GE Advanced Boiling Water Reactor.

Nov. 7, 1996 Kashiwazaki-Kariwa 6, the world's first Advanced Boiling Water Reactor, begins commercial service in Japan—ahead of schedule and under budget.

May 12, 1997 The NRC issues design certification for the GE Advanced Boiling

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Water Reactor. It is valid for the next 15 years.

May 20, 1997 The NRC issues design certification for the ABB Combustion Engineering System 80+. It is valid for the next 15 years.

Jan. 12, 1998 President Bill Clinton certifies that China supports international nuclear nonproliferation efforts, paving the way for the sale of U.S. nuclear technology to China.

April 10, 1998 Baltimore Gas and Electric Co. submits an application to the NRC to renew the license of its two-unit Calvert Cliffs nuclear power plant—the first U.S. company to apply for a 20-year extension of its 40-year license.

July 13, 1999 Entergy Nuclear closes on its purchase of the Pilgrim Station from Boston Edison Co., the first completed nuclear plant sale in the nation.

2000: First Decade

March 23, 2000 The NRC issues the first-ever license renewal to Constellation Energy's Calvert Cliffs nuclear power plant, allowing an additional 20 years of operation.

May 17, 2001 The George W. Bush administration unveils its proposed national energy policy, which calls for the expansion of nuclear energy, saying it must be "a major component of the United States fuel mix."

Sept. 11, 2001 Terrorists attack on U.S. soil. The nuclear

industry immediately places security at all nuclear power plants on highest alert.

Feb. 14, 2002 Energy Secretary Spencer Abraham recommends to President Bush that the Yucca Mountain site in Nevada be developed as a geologic repository for used nuclear fuel and high-level defense waste. Abraham also announces a public-private partnership to explore potential sites for new nuclear power plants.

Feb. 15, 2002 President Bush recommends Yucca Mountain, Nev., as the site of a geologic repository for the disposal of used nuclear fuel and high-level defense waste.

Feb. 25, 2002 The NRC issues the first in a series of orders to the nuclear energy industry to heighten security readiness.

June 24, 2002 DOE awards funds to Dominion Resources, Entergy and Exelon to demonstrate early site permitting for potential new nuclear power plants.

May 8, 2002 The U.S. House of Representatives votes 307-117 to approve the resolution designating Yucca Mountain in Nevada as the site for a national used fuel repository. The U.S. Senate follows in early July with a 60-39 vote.

May 23, 2004 DOE announces it will cooperate with an industry team led by the Tennessee Valley Authority to study

potential construction of a two-unit, advanced-design nuclear power plant at the Bellefonte site in Alabama. DOE will fund 50 percent of the estimated \$4.3 million study.

July 9, 2004 The U.S. Court of Appeals for the D.C. circuit affirms Congress' 2002 endorsement of the planned repository at Yucca Mountain. Ruling in a group of consolidated cases, the appellate court rejects all but one of the legal challenges raised by the state of Nevada. The one exception regards the U.S. Environmental Protection Agency's 10,000-year compliance period during which the repository design must be able to limit the presence of radionuclides within several miles of the site. The court rules that EPA's standard improperly deviated from the National Academy of Sciences' recommendation in a 1995 report that compliance should encompass a period longer than 10,000 years.

Aug. 10, 2004 Exelon Corp. reaches a settlement with the Department of Justice and DOE under which the federal government will reimburse the company for DOE's contractual failure to begin accepting used nuclear fuel by Jan. 31, 1998, as required by the 1982 Nuclear Waste Policy Act. Exelon receives \$80 million immediately in reimbursements for storage costs already incurred, with additional amounts reimbursed annually for future costs.

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Aug. 23, 2004 USEC Inc. submits a license application to the NRC to build and operate its American Centrifuge Plant in Piketon, Ohio. The plant is expected to be operational by the end of the decade.

Nov. 4, 2004 DOE announces \$13 million in awards to two utility-led consortia to test the NRC's new process for combined construction and operating licenses (COL).

Nov. 22, 2004 DOE announces that it will not meet its schedule for filing a license application for the Yucca Mountain, Nev., used nuclear fuel repository with the NRC in December 2004.

2005 Several companies and a consortium announce their intent to file COL applications with the NRC.

Feb. 2, 2005 President Bush declares the need for "clean, safe nuclear energy" in his State of the Union address to Congress.

June 22, 2005 President Bush visits the Calvert Cliffs nuclear power plant in Maryland and gives a major speech in support of nuclear energy. He is the first president to visit a nuclear power plant in more than 20 years.

July 28, 2005 The U.S. House of Representatives approves the Energy Policy Act of 2005 by a vote of 275-156. The U.S. Senate follows a day later with a 74-26 vote.

Aug. 8, 2005 President Bush signs the Energy Policy Act of 2005 into law. The bill contains several measures supporting new plants, including production tax credits, loan guarantees and "standby support" for the first six reactors to offset the financial impact of potential delays beyond industry's control prior to plant startup. The legislation also extends the Price-Anderson Act for 20 years and authorizes \$2.9 billion for nuclear energy programs.

Aug. 24, 2005 GE Energy's nuclear unit submits a design certification application to the NRC for its 1,500-MW Economic Simplified Boiling Water Reactor.

Sept. 16, 2005 Constellation Energy and AREVA Inc. announce the formation of UniStar Nuclear, a joint enterprise designed to provide the business framework through which new advanced-design nuclear plants can be built in the United States.

Sept. 21, 2005 USEC Inc. announces the Megatons to Megawatts program has eliminated weapons-grade uranium equal to 10,000 nuclear warheads. The low-enriched uranium fuel produced through this U.S.-Russian program is used by commercial nuclear reactors to generate about 10 percent of U.S. electricity supplies each year.

Dec. 21, 2005 Seven northeastern states sign the Regional

Greenhouse Gas Initiative to reduce carbon dioxide emissions from power plants. The agreement includes all non-emitting sources, meaning nuclear energy and renewables are treated equally.

Dec. 30, 2005 The NRC approves a final design certification rule for Westinghouse's AP1000 advanced reactor design. The certification, which signifies the resolution of design safety issues, is valid for 15 years.

Jan. 31, 2006 President Bush unveils the Advanced Energy Initiative in his State of the Union address. A major component is the Global Nuclear Energy Partnership (GNEP), which supports international cooperation in nuclear fuel reprocessing.

May 24, 2006 President Bush delivers an energy and economic speech at the Limerick generating station—his second visit to a nuclear plant in less than a year.

June 23, 2006 The NRC issues a license to Louisiana Energy Services to construct and operate the National Enrichment Facility in New Mexico. This is the first license for a full-scale uranium enrichment plant.

Aug. 15, 2006 Southern Nuclear files an early site permit application with the NRC for a potential new reactor at the Vogtle nuclear plant. The company also plans to submit a

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COL application for two Westinghouse AP1000 reactors at Vogtle in 2008.

Sept. 30, 2006 The U.S. Court of Federal Claims awards owners of three related companies—Maine Yankee, Connecticut Yankee and Yankee Atomic Electric—that own shutdown nuclear plants \$143 million in damages over the federal government’s failure to remove used nuclear fuel from the sites.

Nov. 8, 2006 The NRC renews the operating license for the Monticello plant in Minnesota for an additional 20 years, until 2030. This brings the total number of reactors that have received renewed licenses to 47.

Dec. 9, 2006 Congress passes the United States-India Peaceful Atomic Energy Cooperation Act. The bill would allow shipments of nuclear fuel and technology to India for use in its civilian nuclear power program.

March 27, 2007 The NRC grants early site permits for Entergy’s Grand Gulf plant and Exelon’s Clinton plant.

May 22, 2007 The Tennessee Valley Authority restarts Browns Ferry 1 after a \$1.8 billion refurbishment is completed on schedule.

August 2007 The nuclear sector is the first to complete the Department of Homeland Security’s Risk Analysis and

Management for Critical Asset Protection security review process, which analyzes plants’ abilities to withstand different threat modes and terrorist-attack scenarios.

Oct. 4, 2007 DOE issues final regulations for the clean-energy loan guarantee program authorized by the Energy Policy Act of 2005. The legislation allows the secretary of energy to provide loan guarantees for 100 percent of debt and up to 80 percent of total cost for projects that use “innovative technologies” that avoid, reduce or sequester greenhouse gas emissions. In December, President Bush signs H.R. 2764 into law, implementing DOE’s loan guarantee program and funding key nuclear energy programs totaling more than \$970 million.

Oct. 19, 2007 DOE certifies the regulatory compliance of the Yucca Mountain Licensing Support Network, a massive electronic database of documents that all parties will use during the course of the repository’s licensing process.

Dec. 13, 2007 Duke Energy Corp. submits a COL application for two AP1000 reactors in South Carolina. The submittal brings the total number of complete COL applications to four, including South Texas Project Nuclear Operating Co. and NRG Energy Inc., the NuStart consortium with the Tennessee Valley Authority, and Dominion. UniStar

Nuclear also submits a partial COL in July.

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