

Insight

JULY 2007

Leading Public Policy, Business Groups Discuss Nuclear Energy



Report found agreement on many critical issues that position nuclear energy for the future.

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| <ul style="list-style-type: none"> American Electric Power Bradford Brook Associates British Embassy Clean Air Task Force Climate Solutions Duke Energy Environmental Defense Energy Corp. Exelon FPL Group GE Energy-Nuclear George Mason University Kansas Corporation Commission Maine Department of Environmental Protection | <ul style="list-style-type: none"> Michigan Public Service Commission National Association of Regulatory Utility Commissioners National Commission on Energy Policy National Wildlife Federation Natural Resources Defense Council Nuclear Energy Institute Pennsylvania Office of the Consumer Advocate Pew Center on Global Climate Change Southern Nuclear Union of Concerned Scientists |
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The Keystone Center hosted deliberative meetings among 27 experts over nine months to discuss the technically complex and sometimes politically controversial aspects of nuclear energy.

Nuclear 'Re-Emerging as Power Option'

Nuclear technology “is re-emerging as a power generation option in the face of concerns about climate change, energy demand growth and the relative cost of competing technologies.” So concludes a Keystone Center report issued last month.

The center is a nonprofit organization that facilitates cross-sector dialogues on pressing environment, energy and public health issues. It undertook the report, a “joint fact-finding on nuclear power,” to provide an assessment of nuclear energy amid growing discussion—in policy circles and among the general public—of the technology’s appropriate role in the nation’s energy future.

The 27-member team included representatives of environmental groups, state regulators, the elec-

tric utility industry and consumer advocates.

Following a yearlong evaluation, the experts identified many areas of agreement. Regarding the safety of nuclear power plants, the participants reviewed numerous factors, including improvements in plant equipment and worker performance, organizational and risk insights gained through experience, the implications of aging materials and components, and institutional changes in safety oversight.

The report found that “on balance, commercial nuclear power plants in the U.S. are safer today.” Centralization of the operation of U.S. reactors among utilities and plant operators has improved the “safety culture” at nuclear power plants.

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Texas, Pa. Utilities Explore Options For New Reactors

Two energy companies have taken steps to build new nuclear power plants in Texas and Pennsylvania.

Exelon Nuclear selected two possible sites in southeast Texas for a potential new nuclear plant. The company expects to submit a construction and operating license application to the U.S. Nuclear Regulatory Commission in November 2008.

The primary site is a 1,250-acre tract in Matagorda County, while the secondary site encompasses 11,500 acres in Victoria County. Exelon has not made a decision to build at either site. The company will conduct additional field investigation and research over the next 15 months to confirm the sites meet all NRC site suitability criteria.

Submitting a license application in 2008 will make Exelon eligible for federal production tax credits, financial risk insurance and loan guarantees.

“Nuclear energy is safe and clean and has a low operating cost,” said Tom O’Neill, Exelon Nuclear’s vice president of new-plant development. “That’s why we believe nuclear energy is a key part of Texas’ future energy mix.”



TOM O'NEILL

O’Neill noted that the Department of Energy projects electricity demand in Texas to rise 48 percent by 2030. The Lone Star State will need the

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Cassini Captures Saturn's Glow, With Help of Nuclear Technology

Saturn and its many rings came into brilliant focus when NASA's Cassini spacecraft sent a new series of images across 800 million miles. Nuclear-powered instruments onboard the spacecraft made the data transfer possible.

In a mosaic created from 25 images taken by Cassini's visual and infrared mapping spectrometer over a period of 13 hours, the spacecraft captured Saturn and its rings in both nighttime and daytime conditions. Three radioisotope thermoelectric generators—commonly referred to as RTGs—provide power for the spacecraft, including the instruments like the spectrometer, as well as computers and radio transmitters.

Radioisotopes provide power to the RTGs. As the radioisotopes decay, they release heat, which the generators convert into electricity.

The Cassini obtained the mosaic's images when the spacecraft was about 1 million miles from the planet.

Although it is the fourth NASA explorer to reach the ringed planet, the Cassini spacecraft is the first to explore Saturn's system of rings and moons. Cassini entered orbit in 2004 and immediately began sending back intriguing images and data.

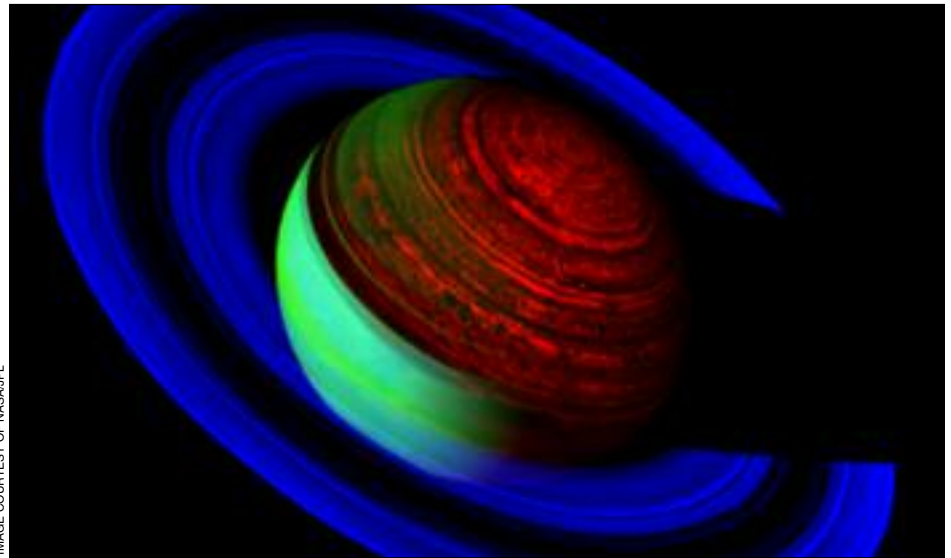


IMAGE COURTESY OF NASA/JPL

Flying over the unlit side of Saturn's rings, Cassini captures Saturn's glow, represented in brilliant shades of electric blue, sapphire and mint green, while the planet's shadow casts a wide net on the rings.

The European Space Agency's Huygens probe, Cassini's companion spacecraft, dove into Titan's thick atmosphere in 2005. The sophisticated instruments on both spacecraft are providing scientists with vital data and the best views ever of this mysterious, vast region of our solar system.

Cassini-Huygens is an international collabora-

tion between three space agencies. Besides NASA and the European Space Agency, the Italian Space Agency provided one of Cassini's communication antennae.

More than 250 scientists worldwide are studying the data streaming back from Saturn on a daily basis.

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Further, new reactors are likely to be advanced light-water reactors, "incorporating features that improve both safety and security," the report said.

The group also discussed various approaches to climate change, including an economywide cap-and-trade program for greenhouse gas emissions, a sector-specific cap-and-trade approach, and a carbon tax. Each confers different economic advantages to nuclear power in comparison to other electricity sources. The specific provisions of U.S. climate policy will affect the level of economic benefits to nuclear energy, the report said. The more stringent the policy, the greater the relative advantage bestowed on low-emission generation sources such as nuclear energy, the group noted. Nuclear energy generates about 70 percent of all clean-air electricity in the United States.

The Keystone analysis follows reports on

nuclear energy from two business groups. Maintaining a viable and growing nuclear power sector is critical to U.S. energy policy objectives, concluded a report from the Business Roundtable, an association of 160 chief executive officers of leading U.S. companies.

The analysis, "More Diverse, More Domestic, More Efficient: A Vision for America's Energy Future," calls for increased energy efficiency and greater investment in new technologies to achieve the diversified, domestic energy supply mix the report's title envisions.

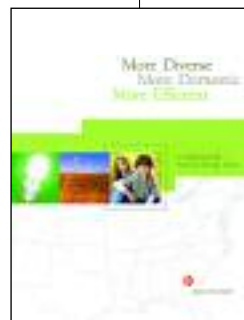
Expanding nuclear capacity "is essential to relieve pressure on fossil fuels ... and to reduce the U.S. [greenhouse gas] footprint," the report said.

Nuclear power also is among the energy sources

at the top of many utility companies' growth agendas, according to a new analysis by PricewaterhouseCoopers' Global Energy, Utilities and Mining Group.

Forty-five percent of the worldwide utility companies polled expect nuclear power to provide an increasing share of their market's energy production in the next five years. Last year, 19 percent said they were looking toward nuclear power.

Meanwhile, three-quarters of electric company chief executives in the United States and Canada believe nuclear power will be an important technology in climate change strategies. However, regulatory uncertainties and high capital costs could hinder progress toward new reactors, according to GF Energy LLC's 2007 Electricity Outlook.



Bush: No Climate Change Solution Without Nuclear Power Plants

For the third time in his presidency, George Bush toured a nuclear power plant, where he reiterated the administration's support for the clean-air electricity source. "We need nuclear power to play a greater role in our future," the president said.

Bush last month toured the Tennessee Valley Authority's restarted Browns Ferry 1 nuclear plant in Alabama, the first reactor brought on line in the 21st century. The reactor restarted after a five-year refurbishment project by TVA that culminated in May. Bush discussed national energy policy and touted the benefits of nuclear power.

"In order to keep pace with our nuclear energy needs, experts believe it will be necessary to build an average of three new plants per year starting in 2015," Bush noted. "As we tackle climate change, it may be necessary to have even more plants. ... It's time for our country to start building nuclear power plants again."

The president discussed financial incentives for new-plant construction in the Energy Policy Act of 2005, as well as the Nuclear Power 2010 initiative, a partnership between industry and the federal government to reduce regulatory and other barriers to the development of new nuclear plants.

"The 2008 budget I submitted would double

the requested funding for this initiative to \$114 million," Bush said. "In other words, it takes money to get this initiative moving. And we're asking Congress to spend money on it in order to help us put in a comprehensive energy strategy.

"I believe that it is essential that we have a comprehensive energy policy to be able to deal with the challenges we're going to face in the 21st century. ... At the core of such policy must be electricity generated from nuclear power," Bush said.

"I remind those who share my concern about greenhouse gases that nuclear energy produces no greenhouse gases. If you are interested in cleaning up the air, then you ought to be an advocate for nuclear power," Bush said. "There is no single solution to climate change, but there can be no solution without nuclear power."

Bush also noted that nuclear power is a "reliable source of low-cost energy" and praised the industry for its safe operations.

"The nuclear sector is one of the safest industries in the United States. Advances in science and engineering and plant design have made nuclear plants even safer than the last generation of plants," he said.

New Plants from page 1

equivalent of 24 new large power plants to meet that demand, he said.

The communities surrounding the potential sites responded favorably to Exelon Nuclear's announcement.

"We are delighted that Exelon Nuclear has selected Matagorda County as a potential site, and we are fully supportive of it being granted a combined operating license," County Judge Nate McDonald said. "We're impressed with Exelon's excellent safety record and expertise in the arena of nuclear-generated electricity."

"We'd be lucky to have [Exelon Nuclear] in our community and the state," said Victoria Mayor Will Armstrong.

Meanwhile, PPL Corp. last month took preliminary steps to build a third reactor at its Susquehanna plant in Pennsylvania. PPL's announcement means that 17 companies and consortia are pursuing more than 30 new reactors.

"This effort is just one element of the company's comprehensive plan to create options for future growth in our generating fleet," said James Miller, PPL's chairman, president and chief executive officer.



Those options, he said, also include the acquisition or construction of coal, hydro, natural gas and renewable energy facilities.

Miller emphasized that PPL would not undertake nuclear construction alone. "Given the market, construction and regulatory uncertainties, along with the large capital commitment for a nuclear project, we would proceed with construction only in a joint venture arrangement," he said.

The company has filed a request with the PJM Interconnection for preliminary transmission interconnection studies for the Susquehanna site. This is one of many studies necessary for PPL to evaluate the feasibility of any expansion.

Like Exelon, PPL is preserving the potential for federal production tax credits and federal loan guarantees.

"Given the growing concerns regarding climate change around the world and the growing need for power plants in the PJM, it absolutely makes sense to create this valuable option," Miller said.



PHOTO COURTESY OF THE WHITE HOUSE

"There is no single solution to climate change, but there can be no solution without nuclear power," President Bush said at the Browns Ferry 1 nuclear plant in Alabama.

Revamped Research Reactor to Aid Materials, Medical Studies

America's 104 commercial reactors are electricity-generating behemoths that power one in five homes and businesses. But smaller research reactors dot the U.S. landscape, offering life-saving radioisotopes, enlightening studies of substances and providing vital materials for industrial analysis.

The U.S. Department of Energy's Oak Ridge National Laboratory is home to one of those research reactors. Thanks to \$70 million in renovations and more than a year of meticulous system checks, the lab's revamped High Flux Isotope Reactor (HFIR) is better than ever.

Built in 1966, the reactor is a neutron source for materials studies and isotope production. The reactor has a peak power of 85 megawatts, a fraction of the 1,000-plus megawatt nuclear plants that help power the nation's electricity grid.

The renovations include a suite of new experiment instruments, beam lines to channel neutrons and a new beryllium reflector. The lab also added powerful refrigeration systems to cool the reactor's neutron beams to minus 425 degrees Fahrenheit. The intense cold slows the neutrons and lengthens their wavelength, allowing scientists to study "soft" materials such as proteins and polymers and to analyze materials with certain magnetic properties.

Greg Smith, who leads the lab's Low Q Neutron



PHOTO COURTESY OF DOE/OAK RIDGE NATIONAL LABORATORY

Daniel Maierhafer and Katherine Atchley, research associates in the Neutron Scattering Sciences Division at Oak Ridge, examine a neutron scattering tank installed at the High Flux Isotope Reactor.

Scattering Group, said the facility has scheduled 49 science experiments this summer, including examination of how high-pressure carbon dioxide is absorbed by—and migrates through—different types of coal to help develop new and more efficient ways to sequester carbon dioxide to reduce greenhouse gases.

"HFIR users will soon be able to access thermal and cold neutron beams of world-class brightness," Smith added.

Neutrons are essential to research in physics, chemistry, engineering and other materials-related fields. At room temperature, they are ideal for use in special instruments to illuminate the atomic structure and dynamics of hard, dense materials.

The reactor also produces radioisotopes used in nuclear medicine and is the only domestic source of californium 252, an isotope used in industrial analysis.

Radiation Monitoring Goes High Tech at Pennsylvania Plant

The design, construction and management of every nuclear power plant combine with one objective in mind: to prevent the release of radiation, even in the event of natural disasters, operational accidents or terrorist acts.

Plant operators ensure public safety through a variety of measures, including the design and safety features built into the plant; multiple layers of physical barriers that protect the reactor; and highly trained, federally certified professionals who operate the plants safely and know how to respond in the event of emergencies.

The industry also continually works to improve its monitoring capabilities. For instance, Three Mile Island (TMI) has installed a real-time comp-

uter connection with two Pennsylvania state agencies that allows the agencies to have continued access to real-time radiation readings from in-plant monitors. The system also allows the use of real-time information from the plant simulator during emergency drills and exercises.

Plant operator AmerGen, the Pennsylvania Department of Environmental Protection and the Pennsylvania Emergency Management Agency worked together to install the connection, which began operating last month. It is the first such system linking TMI with the state and provides both agencies with radiation monitoring information from in-plant monitors on a real-time basis.

As a result, TMI discontinued the operation of

an outdated 16-location radiation monitoring system installed in the early 1980s during the TMI 2 cleanup program. The removal of the old monitors would not diminish the effectiveness of the monitoring program, mainly because of the real-time in-plant data provided to the state agencies.

AmerGen has a comprehensive environmental monitoring program in place around TMI 1 and its other nuclear power stations. TMI 1 annually performs about 1,700 analyses on approximately 1,300 environmental samples taken from the air, water, fish, cow's milk, soil and food products in the plant's vicinity. It also includes air monitors and "thermoluminescent dosimeters" at 90 locations.

G-8 Leaders Reassert Support for Nuclear Energy

Leaders of the Group of 8 (G-8) member countries last month endorsed nuclear energy as one of the methods to achieve global energy diversification that would enhance energy security and lower carbon emissions. The reaffirmation was contained in a summit declaration, "Growth and Responsibility in the World Economy," that the leaders signed in Heiligendamm, Germany.

"Those of us who have [considered] or are considering plans relating to the use and/or development of safe and secure nuclear energy believe that its development will contribute to global energy security, while simultaneously reducing harmful air pollution and addressing the climate change challenge," the declaration said.

The declaration also said signers "are committed to the paramount importance of safety, security and nonproliferation in using nuclear power."

The G-8 leaders also reached an agreement to cut global carbon dioxide emissions in half by 2050. German Chancellor and G-8 President Angela Merkel called this "the most important decision for the coming two years."



ANGELA MERKEL

The climate change agreement is based on previous resolutions adopted by the European Union, Japan and Canada, but adds the U.S. approach of incorporating the biggest greenhouse gas emitters outside the United States, especially China and India.

The environment ministers of the United Nations Framework Convention on Climate Change now will negotiate details on how to achieve these global reduction goals, according to G-8 officials.

Prior to the summit, President Bush called on the world's major emitters and energy consumers to establish a new framework to reduce greenhouse gas emissions that would go into effect after the Kyoto Protocol expires in 2012. The proposal seeks to expand nuclear energy and other advanced energy technologies.

"In recent years, science has deepened our understanding of climate change and opened new possibilities for confronting it," Bush said in pre-



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Leaders of the G-8 nations last month declared their commitment to "safety, security and nonproliferation in using nuclear power."

viewing the climate change package for the G-8 summit.

The president based his proposal on the principle that a climate change strategy must foster both energy security and economic security by accelerating the development and deployment of "transformational" clean-energy technologies.

"My proposal is this: By the end of next year, America and other nations will set a long-term global goal for reducing greenhouse gases," Bush said. "To help develop this goal, the United States will convene a series of meetings of nations that produce the most greenhouse gas emissions,

including nations with rapidly growing economies like India and China."

Bush said America is leading the way with clean-energy technology and is increasing efforts to make advanced technologies commercially viable. He pointed to plans to expand the use of advanced energy technologies, including nuclear energy.

"We're spending a lot of money on clean, safe nuclear power. If you're truly interested in cleaning up the environment, or interested in renewable sources of energy, the best way to do so is through safe nuclear power," Bush said.

Now Hear This ...

I think it's disingenuous that folks who agree that global warming is such a serious issue could sort of dismiss [nuclear power] out of hand. It's got to be at least considered."

—Bill Chameides
Chief Scientist
Environmental Defense
July 1

The fuel of the future is going to be nuclear power. Got to have it; got to use it. It's clean."

—T. Boone Pickens
BP Capital chairman
Dallas Business Journal
June 1

Young Scholars Prepare for Future in Nuclear Energy Industry

Texas and Pennsylvania high school seniors poised to study nuclear energy and technology are receiving a helping hand from a nuclear power plant, an industry vendor, a labor union and a group that represents women in the nuclear energy industry.

The South Texas Project (STP), in conjunction with the International Brotherhood of Electrical Workers (IBEW) Local 66 and Women in Nuclear, awarded more than \$90,000 in scholarships to students throughout Matagorda County along the Gulf Coast of Texas.

"We are committed to making real contributions to our community by investing in the futures of local students," said STP President and Chief Executive Officer Joe Sheppard. "These scholars will have the chance to stay close to home while pursuing higher education."

Each year, the STP/IBEW Pipeline Scholarship Program awards 10 scholarships worth \$8,000 each to Matagorda County graduating high school seniors. The program gives scholarships to students pursuing associate degrees at academically approved junior colleges in Texas. Each scholarship provides \$2,000 per semester for four semesters, enough to cover the bulk of student tuition



PHOTO COURTESY OF WESTINGHOUSE ELECTRIC CO.

Westinghouse President and CEO Steve Tritch congratulates Melanie Worek, winner of a Westinghouse Women in Nuclear scholarship.

and book costs. Program officials select winning students based on academic achievement, extracurricular activities and future career goals.

The scholarship program prepares students to acquire the education and training needed for

careers in the nuclear energy industry. STP will need these workers if its plan to build two new reactors at the plant proceeds.

This year's scholarship winners include five graduating seniors from Bay City High School, three seniors from Tidehaven High School, and one each from Van Vleck High School and Palacios High School.

Besides these awards, STP awarded a scholarship to Katie Crenshaw to pursue a four-year degree. Crenshaw, along with fellow Bay City senior Sara Kee, also won a \$500 Women in Nuclear scholarship. The company presented its Volunteers' Scholarship, a \$2,000 award for outstanding community service, to Trevor Brown, also a senior at Bay City.

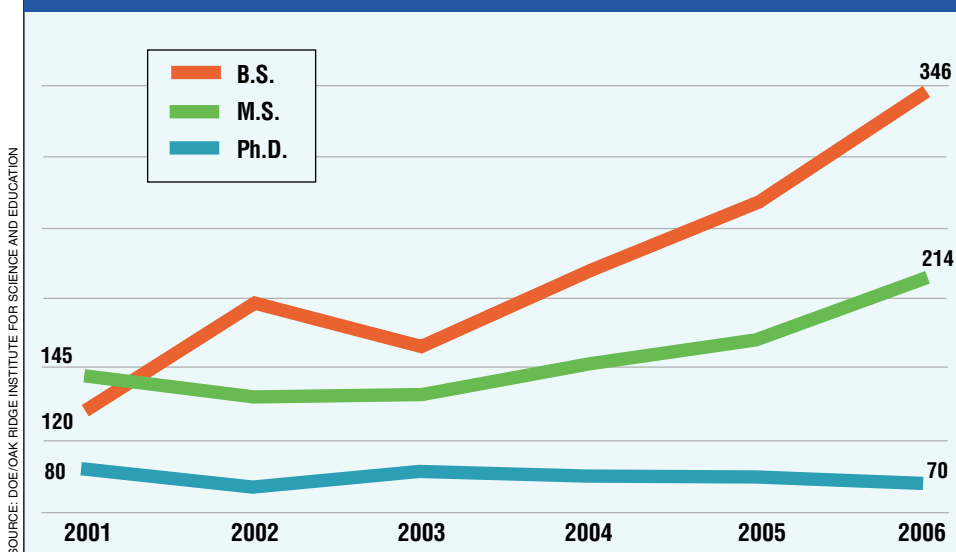
Meanwhile, the Westinghouse Electric Co.'s Women in Nuclear chapter awarded its inaugural scholarship to Melanie Worek of Kiski Area High School in western Pennsylvania. Worek will use the \$1,000 award to help finance her academic career at Case Western Reserve University, where she intends to study mechanical or chemical engineering.

The Women in Nuclear chapter selected Worek based on her answers to two essay questions and a review of academic achievement, extracurricular activities and letters of recommendation.

She credits her parents and her AP chemistry teacher with helping her decide to pursue an engineering-related field of study. "I feel very fortunate to already know what I want to be for the rest of my life," Worek said. "I know that I have the capability to become an engineer because I have the work ethic, willpower and support to attain my goal."

Westinghouse Women in Nuclear is an association of Westinghouse Electric Co. employees that provides a network through which women in nuclear energy and nuclear technologies can further their professional development. The awarding of this scholarship supports the association's mission to educate the public on the benefits of nuclear and encourage young people to explore careers in engineering and science.

Graduates in Nuclear Engineering on the Rise



SOURCE: DOE/OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

Thirty-one universities reported having nuclear engineering programs during 2006.

Nuclear Energy Draws Attention of Nations Around the Globe

As U.S. energy companies continue examining their new-plant options, construction and planning activities are under way in nations across the globe, with even more reactors on the drawing board.

The International Atomic Energy Agency is keeping track of the construction crescendo. The group reports that 31 new reactors are under construction today. Another 74 are in the planning stages, while countries have proposed building 182 additional reactors.

Four reactor design companies have begun the pre-licensing process in the United Kingdom. AREVA and GE-Hitachi Nuclear Energy (GEH) each submitted a design—the EPR and ESBWR, respectively. In addition, Westinghouse Electric Co. submitted its AP1000 design, and Atomic Energy of Canada Ltd. (AECL) asked U.K. regulators to review its ACR-1000 Advanced CANDU Reactor. The companies applied to U.K. regulators to consider the reactors in a forthcoming generic design assessment as the country considers whether to build a new fleet of reactors. The review process should take three and a half years.

An EPR is currently under construction at the Olkiluoto plant site in Finland and at Flamanville in France. The design is in the pre-license review stage by the U.S. Nuclear Regulatory Commission.

AREVA intends to manage the licensing project jointly with Electricité de France (EDF). In addition, AREVA will head an alliance of the major utilities considering construction of an EPR in the United Kingdom. They include British Energy, EDF, E.ON UK, Iberdrola, RWE npower and SUEZ, who sent letters of support with AREVA's application.

The GEH application included endorsements for the ESBWR from several European nuclear power operators. Meanwhile, GEH has begun adding staff to its U.K. nuclear project development team.

AECL's ACR-1000, a Generation III-plus, 1,200-megawatt reactor, is a successor to the company's line of CANDU 6 reactors. Six companies operate 11 CANDU 6 power plants in five countries.

Westinghouse's AP1000 is another advanced



ARTIST RENDERING COURTESY OF AECL

ACR-1000, by Atomic Energy of Canada Ltd., offers enhanced safety equipment and improved operability.

design. U.S. companies have chosen the AP1000 for 12 new-reactor license applications to the NRC.

Additionally, China recently chose the AP1000 for four new plants, and the European Utility Requirements Committee certified the design as having passed all steps of analysis for compliance with its requirements, confirming that the AP1000 can be deployed in Europe. Entry into the U.K. market by Westinghouse has the support of several

of the nation's utilities, including E.ON.

Teollisuuden Voima Ltd. (TVO) has submitted to Finland's Ministry of Trade and Industry a program for the environmental impact assessment of a new reactor at TVO's Olkiluoto power plant. If approved, the new reactor will be the fourth at Olkiluoto. TVO is considering a reactor with a production capacity of 1,000 to 1,800 megawatts. The plant's third reactor is under construction.

Also in Finland, a consortium of industrial and energy companies has teamed to construct another nuclear plant. The group consists of Outokumpu Oyj, a Finnish steel company; Sweden's Boliden AB; Rauman Energia; Katternoe; and E.ON AG. The consortium, called Fennovoima Oy, aims to build a new 1,000- to 1,800-megawatt nuclear plant that would begin operating by 2018.

Across the globe, Brazil announced that it would finish building a third reactor. Brazil's two nuclear power plants, Angra 1 and 2, provide 3 percent of the nation's electricity. Work on the unfinished Angra 3 began in 1984, but came to a halt because of financial difficulties and security concerns. Late last year, Brazil announced that it would build four new reactors, each capable of generating 1,000 megawatts, beginning in 2013.

Reactor Construction Worldwide	
Country	# of Reactors
Argentina	1
Bulgaria	2
China	5
Finland	1
India	6
Iran	1
Japan	1
Pakistan	1
Romania	1
Russia	7
South Korea	1
Taiwan	2
Ukraine	2

SOURCE: INTERNATIONAL ATOMIC ENERGY AGENCY

Rapid-Fire Pulse Brings Z Method Closer to High-Yield Fusion

An electrical circuit that should carry enough power to produce the long-sought goal of controlled high-yield nuclear fusion has undergone extensive preliminary experiments and computer simulations at Sandia National Laboratories' Z machine facility.

Z, when it fires, is already the largest producer of X-rays on Earth and has been used to produce fusion neutrons. But rapid bursts are necessary for future generating plants to produce electrical power from sea water. That achievement was not possible until now.

A fusion machine must deliver energy to fuse pellets of hydrogen every 10 seconds and keep that pace up for millions of times between maintenance. That is so, at least, for the fusion method at Sandia's Z machine and elsewhere known as inertial confinement.

Unable to produce fusion except episodically, the method has been overshadowed by a technique called magnetic confinement, which uses a



PHOTO COURTESY OF DOE/SANDIA NATIONAL LABORATORIES

Sandia researcher Bill Fowler tests circuits on a device able to produce large electrical impulses for the Z.

magnetic field to enclose a continuous fusion reaction from which to draw power.

The electrical circuit emerging from the research may change the balance between these systems. The new circuit is easily able to fire every

10.2 seconds in brief, powerful bursts.

"This is the most significant advance in primary power generation in many decades," said Keith Matzen of Sandia's Pulsed Power Center.

NUCLEAR ENERGY *Insight*

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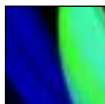
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