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Bill Loveless, editorial director for U.S. energy policy at Platts and editor of *Inside Energy*, has 30 years of experience reporting and writing about energy policy.

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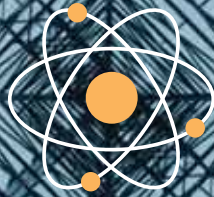


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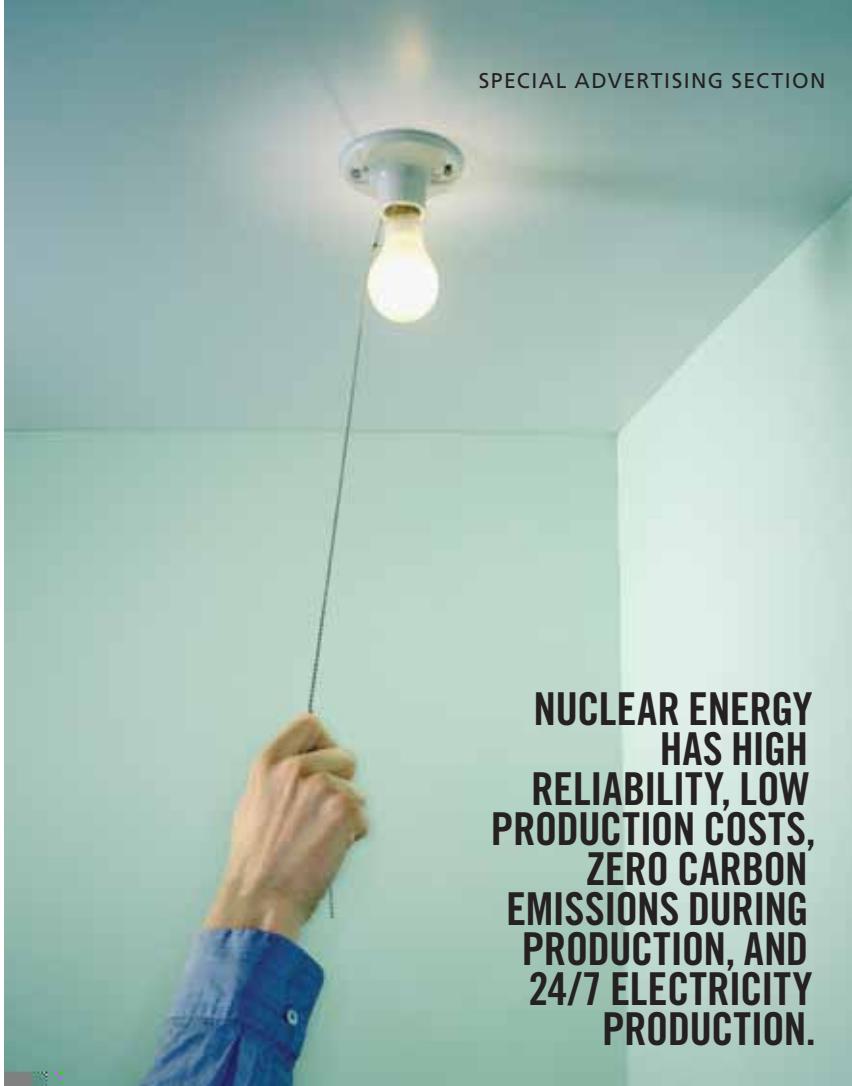
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A NEW FUTURE FOR NUCLEAR ENERGY



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NUCLEAR ENERGY HAS HIGH RELIABILITY, LOW PRODUCTION COSTS, ZERO CARBON EMISSIONS DURING PRODUCTION, AND 24/7 ELECTRICITY PRODUCTION.

Nuclear energy may be getting the break it's been waiting decades for, as a result of the sobering realization that the world needs a better, large-scale alternative to fossil fuels. "Worldwide electricity generation is projected to rise 77% by 2030," U.S. Department of Energy Secretary Steven Chu noted in February. "If we are serious about cutting carbon pollution, then nuclear power must be part of the solution."

Wind, solar, and hydroelectric power are pieces of the puzzle, but they simply can't touch the megawatt impact of the split atom. Electricity generated from the 104 nuclear reactors in the United States provides one-fifth of the nation's power today. This keeps almost 700 million metric tons of carbon dioxide from entering the atmosphere each year, according to the Nuclear Energy Institute,

while reactors worldwide keep 2.5 billion metric tons of carbon dioxide out of the air. "Nuclear energy has a unique set of attributes well suited to today's electricity market: high reliability, low production costs, zero carbon emissions during production, and 24/7 electricity production," says Marvin Fertel, the NEI's president and CEO. "This has generated strong, bipartisan support from policy-makers on the state and federal level."

Indeed, the George W. Bush administration created incentives for the development of new reactors, including production tax credits and federal loan guarantees of \$18.5 billion. This sparked the launch of the first new nuclear power plant in 30 years, located in Burke, Ga. and built by Southern Company. President Obama announced in February that his administration was requesting an additional \$36 billion in loan guarantees from the U.S. Department of Energy,

pushing total incentives for the industry to \$54.5 billion. The goal is to chip away at the stranglehold that coal and natural gas have on the utilities. Garnering 20% of our annual electrical consumption from nuclear—107,000 megawatts—pales in comparison to the industry's predominance in other countries. France, for example, is nearly 80% nuclear, with its plants producing 68,000 megawatts of power annually.

But as tempting as the nuclear option is, the subject remains a political and social hot button. The U.S. population has a long memory when it comes to this controversial topic. Incidents like the near-meltdown at Three Mile Island in 1979 and the Chernobyl disaster of 1986 haven't left the collective consciousness, notes Tom Harrison, chief editor for nuclear publications at Platts, a provider of information and intelligence on energy and related commodities. "The drawbacks to the technology include high construction costs, securing financing for new reactors, and the lack of a resolution for disposal of spent nuclear fuel." Throw in concerns about terrorism, and you have what remains a terrific PR challenge standing in the way of the nuclear movement.

LAYING THE GROUNDWORK

Still, when you consider that a single kilogram of U-235 uranium can produce as much electricity as 3,000 tons of coal—without the collateral greenhouse gases—well, that's a compelling argument. That's why one key step in this nuclear renaissance will be securing the nation's supply of uranium. The U.S. only produces four million pounds of uranium annually, but its reactors consume 55 million pounds. Producers such as Casper, Wyo.-based Uranerz Energy Corp. are seeking to expand domestic supply through exploration programs; it recently discovered the first new deposit found in 35 years in Wyoming's uranium-rich Powder River Basin. "There's a major market right here at home," says

FINDING THE PERFECT SOLUTION

Advances in technology minimize the risks associated with nuclear waste.

EnergySolutions operates one of the largest nuclear waste disposal facilities in the nation in Utah's remote western desert. But according to the company, visiting the site is no more dangerous—radioactively speaking—than strolling through downtown Salt Lake City. That's because a number of buildings in the city are built from granite from Utah's Rocky Mountain range, and granite is a common source of naturally occurring uranium.

"Even in these buildings, it's in such small doses that it doesn't pose a health hazard," says EnergySolutions CEO and president Val Christensen.

Christensen's point, of course, is that most nuclear waste can be turned no more threatening than a few slabs of granite. And as the long-controversial power source claws its way back onto the grid, with its proponents still working to convince a wary public that nuclear energy is safe, that point will likely be heard early and often. EnergySolutions, headquartered in Salt Lake City, says the problem is well in hand. "While some high-level waste stays dangerous forever, lower-level material, which represents 98% of radioactive waste, is very manageable," says Christensen. "It's safe to transport and easy to stabilize and shield."

Its disposal does, however, require experience and know-how. The 5,500-person company, which handles processing, recycling, and disposal of nuclear material around the world—and even operates several nuclear power plants in Britain—has developed plenty of it. EnergySolutions is a consortium of nine separate companies that joined together in 2007. Its combined resources give it the power to manage spent nuclear fuel on-site, prepare ultra-dense depleted uranium for use as armor in tanks and fighter jets, and convert decommissioned nuclear facilities to contamination-free "greenfields." What's more, it's



VAL CHRISTENSEN
CEO AND PRESIDENT.

done this more than 3.5 million man-hours without a lost-time accident, Christensen says.

The company's primary mission, however, is the transport and storage of radioactive waste, and Christensen says many public misconceptions remain about what that means. "Here in Utah, more than half of the voters believe we're disposing of spent fuel," he says. "But there's a big difference between spent fuel and nuclear waste. Spent fuel never leaves the reactor site right now. Radioactive waste is everything else—all the pipes, valves, dirt, concrete, clothing, furniture, etc.—that's been contaminated." EnergySolutions, he continues, transports it safely and stores it permanently underground. And while workers at the facilities

handle this material daily, the radiation that each individual is exposed to in a year's time is less than the amount people routinely receive from a series of dental X-rays, he says.

With nuclear power potentially coming back into favor, EnergySolutions says it's ready for any future increases in workload. Its facility in Utah has the capacity to take all the low-level waste from existing U.S. plants, as well as any new plants built in the coming decades. "We're already prepared for the nuclear renaissance," Christensen says. "The real challenge is educating the public. As a society, we're already used to a lot of dangerous materials—there's mercury and arsenic in computer screens and lead in batteries, for instance. These things all help us enjoy the lifestyle-changing components of our industries. But the thinking is different with nuclear power. After all, those industries didn't start with a bomb."

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**ENERGYSOLUTIONS**

Uranerz chairman Dennis Higgs. “We’re completely focused on selling our future production to U.S. nuclear utilities.”

Uranerz’s timing couldn’t be better, as those utilities are set to expand in ways both big and small. Not only are there at least eight new full-size reactors being planned nationwide—boosting U.S. production by 37,000 megawatts—but there’s also a strong push for innovative new “small modular reactors” (SMRs) that could help increase electricity production around the nation. These ultra-efficient micro-reactors, which will cost less than \$750 million apiece, as opposed to billions for a full-sized reactor, will be factory-built, transported by rail, and easily installed and maintained. Modular Nuclear Energy, a division of longtime reactor builder Babcock & Wilcox, has plans to produce a 125-megawatt reactor, mPower, that can be scaled up to 750 MW when grouped with up to six units. “By comparison, most of the full-size reactor designs being considered for construction right now are at least 1,100 MW,” Harrison says. “But these small reactors are seen as filling a niche in isolated areas where the output from large reactors isn’t needed, or the transmission grid couldn’t handle the additional load.”

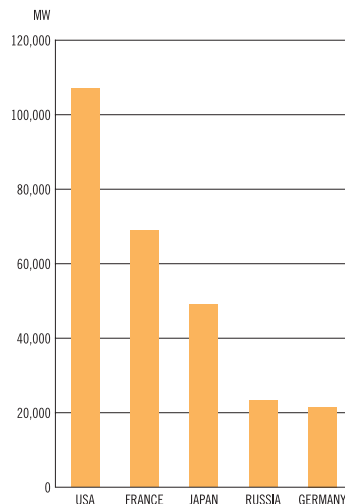
INDUSTRY IN TRANSITION

In spite of its promise, nuclear energy will remain effectively on probation for decades to come. Not only do the plants need to run consistently, cheaply, and safely, Harrison notes, but an accident at a nuclear power plant anywhere in the world would likely impact current plans for nuclear construction. “The first new nuclear units built in the U.S. are going to be very closely watched to see if they’re built on time, on budget, and safely,” he says.

Even if the nuclear resurgence goes full steam ahead, it will take decades to bring new plants online. In the meantime, the nation will need to make the best of what it has. Primarily, that’s coal, the most plentiful and inexpensive source of

electrical power—up to 14 times cheaper than alternatives. Utilities are hoping new innovations will help it clean up its act. Toward that end, Clean Coal Technologies, based in Coral Springs, Fla., has patented an efficient pre-combustion technology that reduces coal’s contaminants, pollutants, and moisture. Trademarked “Pristine,” the clean-burning fuel reduces greenhouse gases, including CO₂ and ni-

LEADING THE LEAGUE
The countries with the most nuclear capacity in operation.



Source: Platts' World Electric Power Plants Database, 2010

trogen oxide. “Our technology converts low-quality coals into efficient, clean-burning fuel,” says CEO Doug Hague. “It provides utilities with a high-BTU, inexpensive, and clean alternative to coal. It also eliminates enormous capital investments in scrubbers and reduces power plant maintenance costs.” The company hopes to license its technology to utilities and mines.

MYTH VERSUS REALITY

The final two pieces of the puzzle will be financing expansion and gaining public favor for this alternative energy sector. Securing the cash to build will be

a challenge—the industry is looking at a \$1.5 trillion to \$2 trillion capital outlay by the electric utility industry over the next 15 to 20 years, says NEI’s Fertel.

“Southern Company has already begun preliminary construction on the two reactors in Georgia, which are expected to begin operating in 2016 and 2017,” Fertel says. “They are doing so through a combination of a conditional loan guarantee that President Obama announced in February, and rate recovery from consumers as project construction progresses.” The loan guarantees will cut building costs by reducing finance costs; rate recovery means part of the price tag will be covered by increasing customer rates during construction.

The public-acceptance quotient is an even tougher dance: Recent Gallup polls show growing support—62% as of late March—for the use of nuclear power, but there are still widespread misunderstandings regarding nuclear waste. Currently, spent fuel, which represents less than 2% of radioactive materials, is safely stored at reactor sites until a permanent site can be developed by the U.S. government. The rest of the material, which is far less dangerous than spent fuel, is shipped to remote storage facilities such as those run by EnergySolutions in the desert outside of Salt Lake City. “Public acceptance of nuclear power is gaining—it’s clean, reliable energy,” says EnergySolutions CEO and president Val Christensen. “But there hasn’t been acceptance of what the nuclear waste stream really is. Once people understand these facts, they’ll realize that a semi-tanker filled with diesel fuel is far more dangerous.”

This, Christensen says, is the greatest challenge—educating the population about what they’re dealing with. If they can’t win that fight, nuclear power will fizzle once again. ●

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TAPPING INTO A POWER SOURCE

Domestic uranium mining is key to the future of the U.S. nuclear energy industry.

Just as the U.S. struggles to release itself from the grip of foreign oil, it must also release itself from the grip of foreign uranium. The nation only produces about 8% of the approximately 55 million pounds its 104 reactors consume annually, according to the Nuclear Energy Institute (NEI).

Uranerz Energy Corp. hopes to change that. The Casper, Wyo.-based company controls 186 square miles of uranium-rich land in Wyoming and is now completing the permitting process to begin mining the critical mineral. Permits should be granted this year, and the mines can be operational within 15 to 18 months—the time it takes to construct the mines, says company chairman Dennis Higgs.

Higgs says this boost in uranium production on the home front will help fuel the expansion of U.S. nuclear power and insulate it from volatile international markets. “Utility companies in the U.S. prefer diversity of supply, but they like stability even more,” Higgs says. “Many uranium mines in the world are located in unstable countries where contracts may be voided, prices boosted, and supply interrupted.”

Wyoming has the country’s largest known uranium reserves, according to the U.S. Energy Information Administration. “Deposits tend to be spotty and small,” adds Uranerz CEO Glenn Catchpole. “Instead of a 15-million-pound deposit, you’ll likely have several two- to four-million-pound deposits in a row, like pearls on a necklace.”

For this reason, instead of blasting or retrieving the mineral via underground mining, Uranerz will use in-situ mining. It will drill water wells, inject a solution to dissolve the uranium, and then pump out the solution with the dissolved uranium. The company plans to either construct pipelines between mining sites and the central processing facility



DRILLING A MONITOR WELL IN POWDER RIVER BASIN, WYO.

or construct satellite plants, which is more cost-effective than building a full processing facility at each deposit. In-situ mining is also considered more environmentally friendly than traditional mining methods.

From there the uranium will be transported to other facilities for fabrication into fuel for nuclear power plants nationwide. A single kilogram of uranium has the same potential energy as 3,000 tons of coal, according to the NEI. Unlike coal and oil, uranium quality and consistency don’t vary from country to country or mine to mine. “There’s good coal and

there’s bad coal—high-sulfur, low-sulfur, etc.,” Higgs says. “But all uranium has the same characteristics worldwide.”

If you add in the worldwide surge of interest in nuclear power, Catchpole adds, it becomes even more critical for the United States to boost its own uranium production. “The U.S. is not the main driver of the worldwide nuclear renaissance,” he explains. “It’s China, India, Russia, and the Middle East, along with South Korea and Japan. There are 20 new nuclear facilities under construction in China alone, and the United Arab Emirates is planning construction of eight new reactors over the next 10 years. So, on a worldwide scale, the nuclear renaissance is happening right now. The Uranerz mission is to give U.S. nuclear utilities the opportunity to fill more of their uranium needs from domestic sources at competitive prices, thus increasing the security of their supply and decreasing the nation’s foreign trade deficit.”

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