# Making the nuclear renaissance a reality

BY GEORGE V. VOINOVICH

*Ohio's senior senator elaborates on support from Capitol Hill for nuclear power's growth.*

IN SEPTEMBER, FOR the first time in over 30 years, a license application to build a new nuclear power plant was filed with the Nuclear Regulatory Commission. Three more applications soon followed. The NRC expects to receive 18 more applications within the next two years for a total of more than 30 new reactors. Although no applicant has yet made a firm commitment to build, a number of them have made significant investments, such as ordering long-lead construction items. Internationally, the resurgence seems to be moving at a faster pace. According to the International Atomic Energy Agency, there are 34 reactors in various stages of construction in 14 countries.

The underlying political climate for nuclear power has changed over the past several years, influenced by a confluence of factors: the growing demand for electricity, sharp increases in the prices of natural gas and oil, and the increased emphasis on clean energy. Recent government policies, such as the Energy Policy Act of 2005, have certainly helped in stimulating private sector investment for new nuclear as part of a portfolio of "environmentally clean" energy projects. At the state level, legislation has passed or is being considered in Georgia, Iowa, Wisconsin, Florida, Virginia, Kansas, South Carolina, and Texas recognizing the value of a diverse energy portfolio that includes new nuclear plants. These factors have created an environment in which nuclear has once again emerged as a viable (perhaps one of only a few) energy source for baseload generating capacity.

Currently, 50 percent of our electricity comes from coal, 19 percent from nuclear, 19 percent from natural gas, 9 percent from renewable sources such as hydro, solar, and wind, and 3 percent from oil. Of these, coal and nuclear (with average capacity factor of about 90 percent) have been the backbone of baseload generating capacity, since they are capable of providing a steady flow of power to the grid at low cost and high efficiency. Solar and wind power plants produce electricity only when conditions are right; when the sun sets or the wind calms, their output drops, regardless of the demand for electricity. Natural gas power plants are too expensive to run as baseload plants due to volatility in natural gas prices.

According to the Energy Information Agency, U.S. electricity consumption is projected to grow from 3821 billion kilowatt-hours in 2005 to 5478 billion kilowatt-hours by 2030, an increase of more than 43 percent. To be sure, we must have greater efficiency, more demand-side management, and more renewable energy, but we must also have clean coal and nuclear generating capacity to sustain our $11-trillion-a-year economy. With increasing environmental constraints, particularly the desire for caps on carbon emissions, expanding nuclear's share of baseload seems logical. The 104 nuclear power plants operating today represent over 70 percent of the nation's emission-free generation portfolio, avoiding 681 million metric tons of $CO_2$, compared with 13.1 million tons for wind and 0.5 million tons for solar.

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So it is no accident that there is a growing realization among environmentalists, scientists, the media, think tanks, and policymakers that nuclear power must play an important role in harmonizing the country's need for energy independence, economic competitiveness, and a healthy environment. Sen. Barbara Boxer (D., Calif.), chairwoman of the Environment and Public Works Committee, recently stated: "I am a pragmatist. The vast majority of the members on my committee support nuclear power, and so do the majority in the Senate. . . . I don't think there is any question that we are going to be seeing new plants." Patrick Moore, one of the founders of Greenpeace, also caused a stir last year when he declared that "nuclear energy is the only large-scale, cost-effective energy source that can reduce emissions while continuing to satisfy a growing demand for power . . . and these days it can do so safely." They have come to a similar conclusion: If we are to meet the growing electricity needs in this country and also address global climate change, nuclear power has a crucial role to play.

Despite these positive developments, a number of formidable challenges to realizing a nuclear renaissance remain, particularly in the areas of regulatory uncertainty, financing, availability of human capital, expansion of the domestic supply chain infrastructure, and nuclear waste management. I intend to take steps, together with other stakeholders, to turn these challenges into opportunities. My hope is that these steps will serve as a road map to making the nuclear renaissance a reality.

## Regulatory uncertainty

Processing 22 or more new plant license applications concurrently on schedule in a thorough manner will be a monumental challenge for the NRC, which has not seen this type of major licensing action in the past 25 years or so. That is why as chairman of the Senate Environment and Public Works Committee's Subcommittee on Clean Air and Nuclear Safety between 2003 and 2006, and now as ranking member, I have focused a great deal of time and effort on making sure that the NRC is gearing up to meet this challenge and avoid a bottleneck. My management philosophy since my days as mayor of Cleveland and governor of Ohio hasn't changed: Place the right people to run the agencies and departments, provide them with the resources and tools necessary to do their jobs effectively and efficiently, and then hold them accountable for results.

Together with Sen. Tom Carper (D., Del.) and Sen. Jim Inhofe (R., Okla.), I introduced a number of bills—the Nuclear Fees Reauthorization Act of 2005 (S. 858), the Nuclear Safety and Security Act of 2005 (S. 864), and the Price-Anderson Amendments Act of 2005 (S. 865)—to provide the NRC with what it needs in terms of legislative reforms, human capital, and other resources

to do its job effectively and efficiently. These pieces of legislation were enacted into law as part of the Energy Policy Act of 2005. Among other things, these bills authorized the NRC to take innovative steps to attract both young talent and retired experts to address the agency's anticipated shortages in technical capabilities.

The NRC's licensing process has been completely overhauled. All regulatory approvals are now received up front based on a completed plant design, before construction starts and significant capital is placed at risk. Under the old process, repeated construction delays and massive cost overruns were common as applicants struggled to stay ahead of evolving regulatory requirements and design changes. The old process required two separate permits—one to begin construction of the plant, and one to operate it—allowing multiple opportunities for delay. Some multibillion-dollar facilities stood idle for years while licensing proceedings ground slowly to completion. The new process requires only a single combined construction and operating license (COL) for both functions. There are opportunities for public participation in the new process, but most of those occur before construction begins, when such participation is most productive.

While the new licensing process is a significant improvement over the old process, a level of healthy skepticism remains by virtue of the fact that the new process has not yet been tested. Given the complexities involved, it is perfectly reasonable to expect some wrinkles during the NRC's review of the first few applications under the new process. In my view, the level of success and certainty in the process will depend in large part on the discipline with which the process is implemented by both the NRC and the applicants.

Finally, and perhaps most important, the composition and the stability of the commission will be more critical than ever before. Senator Carper and I will work with the administration and the Senate leadership to ensure that future appointees have a balanced and objective view regarding nuclear power and its role in harmonizing the country's need for energy independence, economic competitiveness, and a healthy environment.

## Financing

The nuclear industry's major financing challenge is the cost of new baseload nuclear power plants relative to the size of the companies that must make those investments. Unregulated generating companies and regulated integrated utilities represent different business models, and those differences influence how these companies approach nuclear plant financing. Regulated companies expect to finance nuclear plants in the same way they finance all major capital projects, with state regulatory approval and reasonable assurance of investment recovery through approved rate charges. These companies must know—before construction begins—that their investment in a new nuclear plant is judged prudent and can be recovered. Unregulated companies rely on debt financing with a highly leveraged capital structure. Since the estimated cost of a new nuclear plant ($5 billion to $6 billion) is a significant fraction of the company's assets, it is in effect a bet-the-company decision.

To help overcome these obstacles, the Energy Policy Act of 2005 provides key incentives for investments in new nuclear plants: a production tax credit of $18 per megawatt-hour for the first 6000 megawatts of new nuclear capacity; regulatory risk insurance against delays in commercial operation caused by licensing or litigation for up to $500 million for the first two plants and $250 million for the next four; and loan guarantees up to 80 percent of the cost of projects, such as nuclear plants, that reduce emissions. While the production tax credit certainly improves the financial attractiveness of a project during its commercial operation, and regulatory risk insurance provides a safety net in case of regulatory delays, it is the loan guarantee provision that makes the difference for unregulated companies in deciding whether or not to build. Properly implemented, this loan guarantee program allows unregulated companies building nuclear plants to employ a more leveraged capital structure at reduced financing costs, which then benefits consumers through lower rates for the price of electricity.

I have worked hard to make the loan guarantee program perform as Congress intended in the Energy Policy Act of 2005—that is, to attract sufficient private capital at low cost. In addition to meeting with key administration officials, including then Office of Management and Budget Director Rob Portman and Energy Secretary Sam Bodman, in 2007 I introduced the Voinovich-Carper-Inhofe Amendment (SA-1575) to the Energy Bill (H.R. 6) to allow loan guarantees of 100 percent of the loan amount for capital-intensive projects such as nuclear and clean coal, provided that the borrower pays for the loan subsidy costs. Although this amendment did not make it into the final version of the Energy Bill, the administration recently issued a final rule that in effect adopts the intent of the Voinovich-Carper-Inhofe amendment.

I have also been working with the Senate appropriators to increase the fiscal year 2008 cap on the aggregated value of the guaranteed loans. On June 15, together with Senators Carper and Inhofe, I sent a letter to the appropriators urging them to increase the cap from $9 billion (as called for in the president's budget) to an amount sufficient to cover all qualified and worthy energy projects, including new nuclear, clean coal, renewable energy, and energy efficiency projects. The appropriators responded by increasing the cap to $38.5 billion, with $18.5 billion for new nuclear, $6 billion for clean coal–based power generation and gasification plants that incorporate carbon capture and sequestration, $2 billion for advanced coal gasification, $10 billion for renewable energy, and $2 billion for a uranium enrichment facility.

Another critical factor for the successful implementation of the loan guarantee program is a transparent methodology for calculating the credit subsidy cost to be paid by project sponsors. Such costs should be reasonable and commercially viable. I will continue to work with my Senate colleagues and the administration to make sure the loan guarantee program is working the way it is intended to work. The need for government-sponsored investment incentives should be only temporary. Once it is shown that new plants can be built to schedule and budget, the sector will take care of itself. I don't want to create a ward of the state, but rather to overcome initial hurdles and nurture a sector that makes economic and policy sense on its own.

## Human capital and job opportunities

Senator Carper and I recently held a nuclear energy roundtable with representatives from organized labor, industry, academia, professional societies, and government agencies. The roundtable was very productive as it raised an awareness of the impending shortage of the skilled workers needed to support the nuclear renaissance. Government, industry, and labor efforts in the development of a skilled workforce must be coordinated in order to align with anticipated investment in new plants. Each new nuclear plant will require 1400–1800 workers during construction, with peak employment of as many as 2300 workers. Skilled tradesmen in welding, pipefitting, masonry, carpentry, sheet metal, and heavy equipment operations—among others—all stand to benefit. If the industry were to construct the 30 reactors that are currently projected, 43 400 to 55 800 workers would be required during construction, with peak employment of up to 71 300 workers. Everyone at the roundtable agreed that the construction of more than 30 new reactors over the next 15 to 20 years could present an enormous challenge for the nuclear industry.

The roundtable resulted in a number of recommendations to turn this challenge into an opportunity, including the following: (1) use recent retirees as instructors, mentors, and advisors; (2) provide more flexibility to a younger generation of workers; (3) invest in building a pipeline of future workers by front-loading recruitment

and training—the philosophy of "just-in-time" inventory does not work with human capital; (4) identify all existing public and private-sector training programs, and then leverage and fund those that are successful (e.g., Helmets to Hardhats and the Building Construction Trade Department's training program); and (5) provide adequate and consistent funding in science and technology for universities and colleges.

Successful follow-through on these suggestions requires a collaborative effort from the federal and state governments, industry, organized labor, and academia. Congress has demonstrated leadership in addressing some of these workforce challenges. The recently enacted America Competes Act establishes a solid policy framework for addressing the science, technology, engineering, and math workforce challenges identified in the National Academies' report, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future.* Sen. Jeff Bingaman (D., N.M.) and I fought to restore federal funding to support nuclear science and engineering programs at universities across the country in FY 2007 and FY 2008.

Senator Carper and I are planning a follow-up roundtable in mid-2008 to align investment and workforce development initiatives to ensure the collaboration and coordination of government, industry, and labor efforts in developing the energy-related skilled work force, and to solicit input on legislative support.

## Expanding the domestic manufacturing base

In the three decades since the last nuclear plant was ordered and the two decades since the bulk of the nuclear plant construction was completed in the United States, the nuclear design, manufacturing, and construction industry has significantly declined. The leading U.S. firms have either ceased operation, consolidated, or become subsidiaries of non-U.S. parent companies. The companies that remain have survived by retrofitting and maintaining existing U.S. plants.

Initially, it will not be possible to manufacture all of the major plant components required of new nuclear plants in the United States. Successfully bringing the planned 30 or more new nuclear reactors on line, however, requires the reestablishment of the construction and component supply industries, as well as the supplier network needed to support those industries—from the steam generators and reactor vessel heads to the thousands of valves, pumps, heat exchangers, and other parts used in a nuclear plant. The potential for growth in the manufacturing sector and manufacturing jobs to support the construction of 30 new nuclear plants is staggering.

I am a strong advocate for government policies that encourage private-sector investment in the manufacturing of various components and pieces of equipment for the energy sector. This includes the nuclear industry, as well as other energy technologies the nation will need, such as carbon capture and sequestration. The United States has long been a leader in innovation and advanced manufacturing. We need to promote policies that take advantage of the growth of our energy sector and of American ingenuity, productivity, and entrepreneurship by encouraging the manufacturing industries that will support future energy development to produce their products in the United States.

I introduced the Voinovich-Carper-Inhofe Amendment (SA-1683) to the Energy Bill (H.R. 6) to make American-manufactured nuclear components, parts, and service-related jobs available to foreign markets. The support of our House colleagues—Chairman John Dingell (D., Mich.) and Ranking Member Joe Barton (R., Tex.) of the House Energy and Commerce Committee—was instrumental in getting this piece of legislation passed and signed into law. This legislation is anticipated to spur growth in U.S. manufacturing for new international commercial nuclear power plants, create highly skilled jobs across the United States, and provide

American companies and workers access to foreign markets that have long been dominated by foreign competitors.

## Managing nuclear waste

The U.S. high-level radioactive waste management program under the Department of Energy has faced several challenges for many years. First, a redirection of the program has occurred with every change in administration. Second, a majority of the Nuclear Waste Fund revenues are consistently applied to support congressional budgetary priorities rather than their intended purposes. Third, the annual appropriations process provides for ongoing opportunities for those opposed to the direction of the program to interfere with its success.

At the time the Nuclear Waste Policy Act was signed into law in 1982, the direct disposal of spent fuel as a national policy was established on the premise that the existing fleet of nuclear plants would operate only through their initial 40-year license and then be retired, with no new plants being built. This was during the post–Three Mile Island accident era, when nearly 100 planned nuclear plants were canceled. Today, the story is vastly different, with most nuclear plants likely to extend their operating lives to at least 60 years. Also, there may be as many as 30 new nuclear power plants planned in the next 15 to 20 years.

I held a subcommittee hearing in September 2006 to examine both short- and long-term options for the nuclear waste issue. One of the options discussed was a program to determine whether the reprocessing of spent nuclear fuel should be adopted in some form, rather than the current policy of direct disposal. Through reprocessing, uranium and plutonium recovered from spent fuel can be recycled into new fuel. Reprocessing also serves to significantly reduce the volume of material requiring geologic disposal. Reprocessing technology has been used on a commercial scale for many years in a number of countries. The renewed interest in an expanded role for nuclear power in the climate change debate further emphasizes the importance of reexamining U.S. policies related to the nuclear fuel cycle. I believe we should not remain solely fixated on a waste solution that was designed for a different day.

Another idea presented at the hearing involves long-term interim storage perhaps complementing a spent fuel recycling program. While permanent disposal at Yucca Mountain or a similar facility remains a long-term imperative, the combination of short-term on-site storage and longer-term interim storage of spent fuel gives us time to complete the technology development needed to safely and securely recycle spent nuclear fuel.

Senator Carper and I plan to hold a roundtable to solicit input from various stakeholders to help us develop a legislative proposal with the following objectives in mind: (1) implement an accountable and sustainable governance structure to execute the federal government's responsibilities under the Nuclear Waste Policy Act; (2) enable the investigation of recycling spent nuclear fuel with appropriate consideration of safety, nuclear proliferation, environmental, energy supply, and economic factors; and (3) ensure that the fees paid into the Nuclear Waste Fund are applied for their intended purpose—i.e., the disposal of radioactive wastes produced by the generation of electricity from nuclear power—in a manner insulated from political influences.

I believe that the safe and secure growth of nuclear energy is essential if we are to harmonize the country's need for energy independence, economic competitiveness, and a healthy environment. Nuclear power is growing in the world, and our own energy needs can serve as a springboard to rebuild U.S. technology and manufacturing capabilities to something approaching the leadership the nation once enjoyed, contributing to foreign markets as well as supporting our own. I intend to work with my colleagues in the Senate to build bipartisan support and leadership for making the nuclear renaissance a reality. NN