Utility execs peer into the crystal ball

Ensuring a steady supply of workers for the nuclear industry is among the most pressing issues facing the field in the coming years.

NEARLY 70 NUCLEAR utility executives escaped to the warming sunshine of Scottsdale, Ariz., in late January for a few days to discuss the issues that will be facing the industry in the coming years. Looking a step beyond today—which some are calling a renaissance in the field of nuclear energy—utility officials began to identify and wrestle with the needs of tomorrow's nuclear industry.

"We've had the theme in various conferences around our industry of a renaissance in our industry," said Gary Gates, vice president of nuclear operations at Omaha Public Power District, during the opening session of the ANS-sponsored Utility Executive Conference: Future Vision, held January 26–29. "But we need to start talking about a vision of the future in many of the areas that influence us."

The industry needs to press for clean-air legislation to help nuclear energy remain viable in the coming century, one speaker emphasized. The field must not turn away from the possibilities of hydrogen production, stressed another. One insurance company executive discussed the challenges of insuring nuclear power plants in an age when multisite sabotage is now plausible. A representative from the Nuclear Regulatory Commission addressed the emerging challenges of license renewals and early site permits.

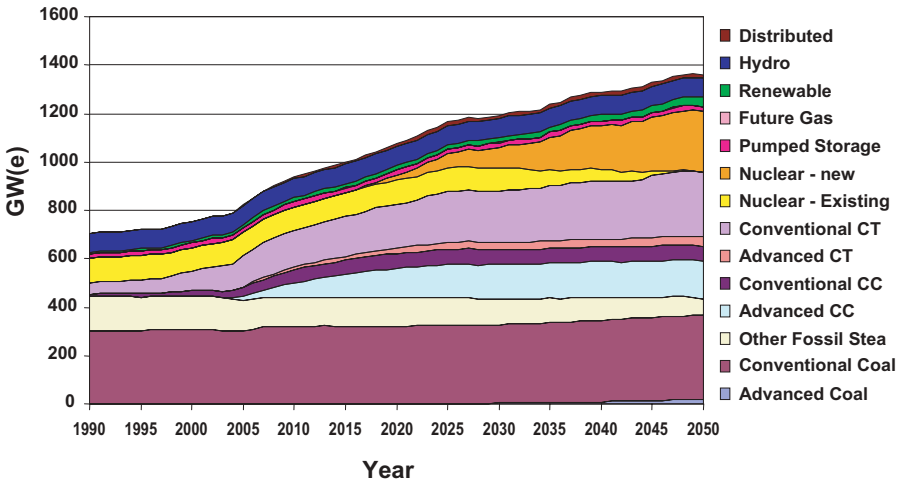
Another speaker from the Institute of Nuclear Power Operations presented an overview of the organization's most drastic makeover in its history, which is occurring this year. The transformation reflects the changes in the nuclear utility industry since INPO's inception in 1979 and attempts to ensure the nation's nuclear power plants will meet the performance needs of the upcoming century.

It was clear, however, what the greatest challenge for the nuclear industry will be in the coming decades: attracting workers. Amid their presentations, two speakers cycled through numerous statistics on the staffing needs of the nuclear industry and expected supply of workers in the next half-century or so. The picture that emerged, if trends continue, was not one to bolster immediate hopes for the health of the industry. There are steps that can be taken, however—such as marketing a better image for the industry—to attract young bright minds to the field.

"We've all heard that we're in a nuclear industry renaissance," said Omaha Public Power District's Ross Ridenoure. "And that's wonderful. But it's not going to happen unless we have people that can continue to operate these plants and fuel cycles and engineering cycles and everything else that's needed for the industry. . . .

Ridenoure

"If the people aren't there to run the plants, what we're doing today simply won't matter. We have to take more aggressive steps to attract and retain the workers that we want."



Base case ($4.12-per-million Btu price for gas) to 2050 (EPRI)

Clean air legislation

At 69 percent, nuclear energy currently accounts for the largest segment of emission-free generation in the United States, more than doubling its nearest competitor, hydro power, according to the Nuclear Energy Institute. And the nuclear industry stands to increase its presence among the country's energy mix in the coming decades if certain environmental legislation is passed in the United States. Layla Sandell, manager of new nuclear plant development for the Electric Power Research Institute, described the results of a revised EPRI study that predicts new nuclear power plant deployment by 2016, with growth in the industry through at least 2050.

EPRI's Energy-Environment Policy Integration and Coordination—or E-EPIC—study investigated the potential effects of future regulation on sulfur dioxide, nitrogen oxide, and carbon dioxide emissions on the U.S. electricity generating system from present day to 2050. The study utilized the National Energy Modeling System (NEMS), developed by the Department of Energy's Energy Information Administration.

The original E-EPIC study showed a poor prognosis for nuclear power, with the energy source disappearing by 2050. EPRI, however, took a careful look at the assumptions used by NEMS and, after consideration, decided that some of the assumptions were based on information that is "not consistent with the current industry thinking," Sandell said. As a result, EPRI modified some of the assumptions used by NEMS, mostly in the areas of plant capital cost, improved licensing expectations, existing plant performance, and the percentage of plants that will seek license renewal, Sandell said.

With the changes in assumptions, EPRI ran several scenarios for the E-EPIC study at a range of gas prices and carbon tax additions. Using a $4.12-per-million Btu (British thermal unit) price for gas, existing nuclear capacity begins to increase through power uprates and plant life extension, according to the revised study. Also, new nu-

clear power plants begin to be deployed around 2016, Sandell said.

"When you look at the base case scenario for generating capacity out to 2050, you see that existing nuclear will close out at about 2045. That's when all the plants will have lived out their 60-year life expectancy. And new nuclear power plant deployment [begins] in about 2016, increasing through 2050," Sandell explained.

Sandell then outlined in numerous scenarios the projected new nuclear power plant additions through 2020. If gas prices rise to $4.50 per million Btu, nuclear capacity would increase in the United States by 40 gigawatts. A 10 percent reduction in capital costs for nuclear plants coupled with a gas price as low as $3.60 per million Btu would make way for 60 GW of new nuclear generating capacity, Sandell said. And, with a $50-per-metric-ton carbon tax imposed, the nuclear market share could go up as high as 30 percent by 2020 (it currently stands around 20 percent).

"The role of nuclear plants in clean air can be significant," Sandell said. "If we're serious about controlling carbon emissions, we will need to deploy a portfolio of nonemitting generating options, including advanced fossil plants. Nuclear should be a major part of that portfolio. We need to work with our legislative community to educate them on the environmental benefits of nuclear power and work with [the Nuclear Energy Institute] to introduce appropriate legislation.

"In summary, indicators tell us that the future for nuclear is positive. . . . We do recognize that there are still significant hurdles that need to be overcome for that first new plant order to be placed. Those hurdles range from capital cost reductions to working with the government on construction loan guarantees and demonstrating a new and unproven regulatory process. But these hurdles can be overcome and we're working to overcome them. Clean air legislation for nuclear will help level the playing field."

New insurance challenges

Of the parts of the nuclear industry affected by September 11, 2001, one area that has not been given much attention is insurance. Quentin Jackson, president and CEO of Nuclear Electric Insurance, Ltd. (NEIL), gave an overview of his company's history and provided a glimpse into how the events of that day have forever changed the perception of risk—and model for insurance coverage—at nuclear power plants.

NEIL is a Wilmington, Del.–based mutual insurance company, owned by the utilities, that has steadily grown through the past three decades. The company's previous incarnation, Nuclear Mutual Limited, insured about one-third of the nuclear power stations in the United States after setting up shop in 1973. The policy limit at the time was $100 million. By 1984, the company's property limits exceeded $1 billion,

Jackson

and by 1997, "we were insuring virtually every nuclear power station in the United States," Jackson said. NEIL currently provides more than $3 billion of insurance coverage. "If [the accident at Three Mile Island] occurred today, we could provide up to $3.24 billion to the affected utility and still be in business to carry on for everyone else," Jackson explained.

NEIL provides three types of policies that in various ways cover accidental property damage, decontamination expenses, and certain premature decommissioning costs, as well as the costs associated with some long-term interruptions of electricity supply. Conversely, "we do not cover corrosion, including intergranular stress corrosion cracking," Jackson said. "And we do not cover erosion pitting and cracking. For instance, we do not cover steam generator tube cracking issues. . . . We're here for the sudden and accidental loss."

Following September 11, for the first time the nuclear industry was faced with the possibility of having significant damage occur at multiple nuclear power plants within a short period. Such a scenario would stress an insurer that, up until then, had planned for the possibility of one accident occurring at a time, because "it was so unlikely that we could ignore it that we would have significant damage at multiple sites at the same time," Jackson said.

"We had a significant debate amongst the membership as to how we should respond to this," Jackson explained. "We didn't want to exclude terrorism completely," which was the reaction from many in the commercial insurance industry, he said. "NEIL, however, took the opposite tack. We said, 'We are mutual. We're here for the members. But we need to control the amount of exposure we would have as a result of terrorism losses.'"

NEIL decided to limit the amount of resources that it would commit to cover terrorism within one year. "In the event of there being multiple losses, we will pay $3.24 billion over a 12-month period. And if there's more damage than that amount involved at the utilities, then we would just share that amount amongst the affected utilities," Jackson said. "It's been an effective way of ensuring that there is coverage for terrorism without devastating NEIL's ability to continue in business."

Regulatory tasks

The freedom of nuclear electric utilities to increase the maximum power at which their reactors can operate and to renew the operating licenses of their reactors is good news for the industry. It is a challenge, however, to the agency that must approve those moves—not least because of the shroud of secrecy under which utilities often keep their plans in order to hold competitors at bay. "We have a predictive challenge with regard to our workload," explained David Matthews, director of the Division of Regulatory Improvement Programs for the Nuclear Regulatory Commission. "And it is exacerbated by the reluctance by many of the licensees to declare their intentions, for obviously many well-founded reasons. But it still makes our predictive capability very difficult when nobody will tell us when they're coming [for license renewal], because the resources are intensive." Matthews limited the scope of his outlook to the next three to five years, citing the difficulty of predicting trends in the nuclear industry from a regulator's perspective.

In 2002 alone, Matthews said, the NRC approved 18 power uprates, an area that will continue to challenge the NRC. "All of a sudden, we saw an onslaught of power uprates. The commission became aware of it and made it very clear to us that they saw that power uprates was one of our primary licensing challenges in the next few years, and also imposed on us some very strict requirements associated with the timeframes under which we would review these," Matthews said.

For each license renewal application that it receives, the NRC devotes the equivalent of 12-and-a-half staff members' full-time work over the course of a year. Another $350 000 to $450 000 is then needed for the environmental review. A complicating factor for the NRC is that many applications are being combined. "Duke [Power] came in with a combined application from acquiring Catawba [station]," Matthews said. "We're anticipating a combined application—and I get a headache just saying it—for Browns Ferry-1, -2, and -3. And why I say that is obvious: Browns Ferry-1 hasn't been operated in what, 12 years, 16 years now? We don't know what their licensing basis is, but they're going to bring it in at the same time as -2 and -3 at the end of this year, with the expectation that we grant three licenses simultaneously at the end of the 22-month period. So, we have some challenges."

An early site permit from the NRC allows a utility to build a certain class of a nuclear power plant and allows for early consideration of site suitability issues. Matthews said the NRC expects two early site permit applications by the middle of this year and one more at the end of the year. The relatively new process, however, will have some snags to be worked out in the coming years, such as how specific the permit can be in approving a type of reactor design. "There is a lot of contentiousness associated with the

degree to which an early site permit can appreciate the range of designs that might be installed on that site," Matthews said. "And that permitting is very dependent on many of those design considerations."

[NEI] set a bold target for the industry in its Vision 2020 outline: adding 50 000 megawatts of new nuclear generating capacity by 2020.

The NRC is weighing an approach suggested by the Nuclear Energy Institute for considering a range of design options: the site parameter envelope. "An SPE . . . would come in with each of these [early site permits] and would in effect outline the design-related features that we need to be able to evaluate in completing the site suitability review and the environmental review. Understand that the environmental review, by necessity of a federal court ruling, has to have a risk assessment associated with severe accidents. And that's very difficult to do for a design that you haven't defined yet. So, there's a real challenge for us in this area."

Vision 2020

The Nuclear Energy Institute set a bold target for the industry in its Vision 2020 outline: adding 50 000 megawatts of new nuclear generating capacity by 2020. Such an increase would be the equivalent of enough electricity for all of New York, Pennsylvania, and Illinois, and it would mean a 50 percent increase in electricity produced at nuclear power plants, explained Richard Smith, program manager for policy and planning at NEI, who reviewed the plan and emphasized the significance of hydrogen production for the industry's future.

Over the next decade, the industry can add 10 000 or so megawatts by becoming more efficient, Smith said. This can be accomplished through a combination of productivity improvements (3000 to 5000 MW), uprates (6500 to 8500 MW), and the restart of Browns Ferry station (over 1000 MW). Such improvements would help President Bush's plan to reduce the carbon intensity of the nation's economy. "When the White House made that announcement [to reduce greenhouse gas intensity by 18 percent by 2012], we submitted to them a letter outlining our efforts in that regard. It was warmly received, because that 10 000 MW by 2012 actually amounts to 21 percent of the president's goal," Smith said.

With hydro power expected to decline and only marginal increases in renewable energy forecasted, Smith said, the nuclear industry must add 60 000 MW simply to ensure that 30 percent of the nation's electricity continues to come from emission-free sources, as it does now. "Increasing nuclear energy production in the next 20 years is important to maintaining the diversity of our fuel supply in our electricity systems. Even more important . . . expanded nuclear energy will play [a vital role] in maintaining our current supply of electricity that is generated free of emission."

Nuclear energy also has a role to play in hydrogen production in the coming decades. Producing hydrogen requires significant amounts of energy and, moreover, many of the emission-free advantages of hydrogen are canceled out when it is produced from a fossil base, Smith pointed out. "It is my personal opinion that the industry needs to be thinking about how to be a player in the hydrogen economy—even at our current fleet of plants, even if it's a test facility, a demonstration project," he said. "Electrolysis with off-peak electricity producing parallel streams of pure hydrogen and pure oxygen could lay the foundation and provide the kind of information that we will eventually [need] in terms of storing, transport, and use of hydrogen.

"There are ready markets for industrial hydrogen already. There are ready markets for pure hydrogen. And there are certain commercial markets for pure oxygen.

"Now, Mr. Bush announced a $1.2-billion [hydrogen fuel initiative]. The Department of Energy has already budgeted significant amounts of money for hydrogen demonstration projects, partnerships between industry and government. And, I believe strongly that it's time to start looking into those to see what we can do to break out ahead of the curve. Because I can tell you now, the companies that are playing in the hydrogen arena are the major oil companies and the major automobile companies. They want to keep their current position. They don't care whether it's gasoline or hydrogen. They just want you buying it from them."

INPO, take 2

Amid the mergers and acquisitions and overall turbulent business environment of the nuclear industry during the past several years, the Institute of Nuclear Power Operations has seen itself, as Bill Webster explained, as "a beacon of stability in a sea of change." This year, however, INPO—which sets performance objectives, criteria, and guidelines for overall nuclear plant operations, and conducts regular evaluations of nuclear plants and monitors performance indicators—is undertaking "the most substantive and largest amount of change" in its history.

"[INPO] is an organization that's very motivated by the performance we've seen in the industry in the last several years and feel it's time to take these programs to the next level," said Webster, who is INPO's vice president of plant evaluation. "It isn't the same industry it was even five years ago. So, to think that the INPO programs from five years ago would be right for today isn't right. . . . And the idea of 'a beacon of stability in a sea of change' is an obsolete metaphor for INPO today."


Webster

The nuclear industry established INPO in 1979, following the accident at Three Mile Island. INPO essentially took the U.S. Navy's program for inspecting operational performance on warships and adapted it to the nuclear industry, Webster said. "It was kind of a program that was designed in the '60s for an early development fleet of warships in the '70s, and then applied [to the] utility industry in the '80s. And here we are in 2003, and one has to question, is that model, is that concept of how we want to do plant evaluations appropriate today?"

Among the reasons for the change, INPO sees the industry developing into two camps today, Webster said. The first camp is composed of the plants that are frequently assessed at the INPO 1 or 2 category, and have a good grasp of the fundamentals of operation and maintenance. "You don't need to spend a whole lot of time digging in there. And when you do, the issues that you find are enhancements, improvements, but not terribly worrisome," Webster explained.

The issues affecting these plants tend to be more subtle and and more complex. The issues are also more "cross-functional," affecting more than one area of plant performance. "So, in order to keep the [category] 1, 2 plants up at the 1, 2 level, to continue to drill and to look solely at the functional areas isn't probably the best approach," Webster said. "[Y]ou don't have to decline very far to be in a lot of trouble. So, those early signs are going to be apparent in the cross-functional areas: the teamwork, the attitude, the capability to improve performance, the direction, the engagement of the management team, the standards, and the reinforcement. You have to look differently than we did 15 years ago, when we could go in and we would find important issues in operations at most stations."

The other camp is made up of plants in

Continued

the INPO 3 or 4 category, which have struggled and been challenged to improve performance. Webster said these plants still have issues in fundamental areas such as operations, maintenance, chemistry, or radiological protection. Such plants perennially attempt to improve these areas but have trouble sustaining the changes. These stations will still benefit from a "functional" analysis, but they also may have organizational problems that are more deep-seated than the first group of plants. "We need to approach them a little differently in order to really provide the value and understanding of what needs to be done to improve performance," Webster said.

So, with the changed industry, the "template process" borne out of the Navy doesn't work, Webster said. Both the high-performing stations and the stations that are still working at getting the basics and fundamentals applied lead one to think "that maybe the process we've had for years isn't the most effective," Webster said.

The principal area of improvement for INPO will be in plant evaluations. But despite the need for change in this area, Webster listed the necessary elements of a plant evaluation that will go unchanged. These include in-field observations, in which skilled professionals go to a plant to watch work "where work really gets done at a time when work is really getting done," Webster said. Control room observations are another element: "We're not going to back off at all in our looks at control room crews in the control room and . . . at a simulator under off-normal, casualty situations." Plant evaluations need to be made with balanced, diverse teams, composed of one-third INPO employees, one-third loaned employees, and one-third peer evaluators, Webster emphasized. Also, the resulting plant evaluation report needs to offer the utility suggestions for improvement. And Webster stressed that the company CEO needs to be involved in the evaluation: "INPO serves at the pleasure of the CEOs of this industry. If the CEOs decide that their nuclear operational risk is small enough they don't need INPO anymore, we'd all go off and do something else. So, it's important that the CEO be involved in a very active fashion."

Webster was clear on what INPO is hoping to change: The organization will be focusing more sharply on operational excellence. In doing so, they hope to have plants achieve sustainable high levels of performance and sustainable event-free operations. They also want to better help plants avoid long, unplanned shutdowns, Webster said.

"When we're talking about excellence in nuclear safety and reliability, what we're really talking about is achievement as an industry, as an individual plant, of these . . . outcomes. And everything we do in terms of our cornerstone activities at INPO is in some fashion going to have a line of sight to facilitating and aiding and being a part of our members' achieving one of these outcomes."

Webster also stressed that anticipating site performance would be another goal for INPO—one that would be a great challenge. "Nobody is just keeping pace," he said. "That's not a stable position. Your station's either getting better or they're falling behind. What we've got to be able to do is develop a more credible position and discuss as to where we feel the plant is going. Where is it going to be two years from now when we come back for the next evaluation?"

One of the ways INPO will implement the changes is to shift from a functional focus to a cross-functional focus. Instead of team members analyzing operations, maintenance, engineering, chemistry, and radiological protection, the evaluation team will be made up of members who look at organizational effectiveness, equipment reliability, configuration management, and performance and improvement, among other matters.

INPO will also augment the review teams based on the needs of the plant. "If we go to a station where, from our pre-review . . . of that station, we're worried about some of the fundamentals and functional areas being weak, we'll augment this team. We'll put a maintenance person on it. We'll put an ops person on it. We'll put a chemistry person on it for a couple of weeks, so that we do the right job for the station," Webster said.

Webster said INPO will also be improving its process of observing control room crews in simulators. INPO typically looks at crews in training mode for each plant evaluation, Webster said. It is now going to look at two crews in a performance mode and "through the eyes of the operations leadership," Webster said. "It's not just how does the crew perform, which we're also going to look at. But we're going to keep one eye on the operations leadership in terms of how they interact with that crew to improve and sustain performance of those crews."

And INPO will be conducting more pre-evaluation observations during times of stress. For any plant outage that has an evaluation following it within three to five months, Webster said INPO hopes to have a maintenance evaluator, a radiological protection evaluator, and an organizational effectiveness team manager on-site for several days. "If you really want to see how an organization performs, be in the control room as they go into mode 4," Webster

Workforce challenges

The number of entry-level workers needed in the next 10 years to maintain the current level of operations in the nuclear industry is an astounding figure: 90 000. And that is assuming no new construction of nuclear power plants. In addition, 30 percent of workers in the industry can retire within five years, and half of the workforce can retire within 15 years.

Ross Ridenoure, division manager of nuclear operations at Omaha Public Power District's Fort Calhoun station, described these statistics, as well as several more harrowing ones:

- There were only 160 bachelor of science nuclear engineering degrees given in 2000, a 20 percent drop from the year before.
- Undergraduate and graduate enrollment in nuclear engineering programs is half of what it was 10 years ago.
- Universities offering a nuclear engineering program have shrunk in the last decade from 60 to 30.
- At the Nuclear Regulatory Commission, workers in their 60s outnumber workers in their 20s by a five-to-one ratio.

"I hate to say it, but we've been knocked off our pedestal as the new cool technology," Ridenoure said. "The neat stuff [is now] computer engineering, software engineering, nanotechnology, genetic engineering. Those are the things that are the cutting edge technologies, not nuclear anymore."

But one of the best ways that the industry can interest young people in nuclear technology is to ensure that the internship programs are engrossing. "The key here is to take a personal interest in students," Ridenoure explained. "Reevaluate those intern programs not only at universities but also [for] summer co-op students at power plants. We have these folks [at Fort Calhoun]. They come in for six to nine months, work for a semester or a summer.

"What are you doing to make sure that their job is a rewarding experience at the nuclear power plant? Hopefully you're not sticking them in a cube like Dilbert and giving them some menial task to do for six to nine months. Because I can guarantee you, if their experience is not rewarding, they're going to go back to their campus and they're going to tell everybody they know—when they're asked, 'Hey, how was your internship at the co-op at Fort Calhoun?'—they're going to go, 'Boy, that was just awful. They put me in a cube and I felt like Dilbert.'

"So, you need to go out of your way to make sure that your experience is rewarding. Take a personal interest. Make sure it's a rewarding experience."—*P.S.*

said. "That's really where you see the organizational effectiveness, the skill set. Look at the plant when it's challenged. We go in for two weeks, and if everything is 100 percent power, [with] nothing much going on, we draw one conclusion. I'm not sure that's the best conclusion if we're really trying to explain to this utility how this organization performs. . . .

"We're not going to be putting 15 people on-site during the outage. We're talking two or three highly skilled professionals that don't need anybody to hold their hand. [They can] talk to the plant manager on their way out and come back and roll that information into the broader array of information that we'll look at at the plant."

The upcoming changes, Webster said, will present a burden for INPO staff. "We're going to be asking them this year to do things entirely different, in terms of how they approach their job and in terms of what they do. That's going to be probably the heaviest lift for us at INPO."

Attracting workers

J. P. Sakey began his presentation by asking for a show of hands of white males in the room under the age of 45. A total of three hands went up, including the one of the reporter who was there to cover the meeting. The incident underlines perhaps the single greatest threat to the future of the nuclear power industry: the drying up of the pipeline of nuclear engineers.

Sakey, senior vice president of TMP Worldwide—which calls itself the world's largest recruitment advertising agency and which runs the Internet job-seeking resource Monster.com—addressed some of the current patterns in the labor force and stressed the need for the industry to improve its marketability by establishing a distinctive brand image for itself.

The nuclear industry, however, is not alone in facing worker shortages in the coming decades. As a measure of people entering the workforce, in the past 15 years the labor force in the United States grew at an annual rate of 1.6 percent, Sakey said. Over the next 50 years, however, the labor force is expected to grow only by 0.6 percent. "Now, across a 300-million population, you begin to multiply those numbers out and you begin to see that there's really going to be a shortage of people entering the workforce," Sakey said. By the year 2006, two workers will exit the workforce for every one entering.

What are the key elements that have made way for this trend? Declining births are one aspect, Sakey said. Families no longer have three children. Also, now in their mid-40s up to their mid-50s, baby boomers are aging, and many will be able to afford to retire. And there is also a squeeze in the supply of foreign workers, with the United States not as open to foreign labor as it once was, Sakey said.

Looking at age makeup, 13 percent of the labor force is now made up of people over the age of 55, Sakey said. By 2020, that proportion grows to 20 percent. "We've got an older workforce. That really means more experience, more knowledge, expectations for higher income, probably expectations for more leisure time. . . . This is a very important trend," Sakey explained.

But what does it all mean for employers?

"It really means tremendous competition for workers," Sakey said. "It means that the next decade, if you look at any kind of economic growth at all and you look at unemployment declining to the 4 percent level . . . there is going to be tremendous competition for jobs. There will be 2.6 new jobs created for each new person entering the American labor market. That means other choices. There will be a dizzying array of job opportunities."

Such a forecast may not be the best news for the field of nuclear power, which is already struggling to infuse itself with new nuclear engineering graduates. "I don't want to misunderstand the nuclear industry, but I don't believe people can easily flip careers into your industry," Sakey said. "A healthcare worker can't all of a sudden become an SRO [senior reactor operator]. I'm not sure

that these sorts of things can happen.

"So, you've got a career issue to think about—more of a career issue as opposed to software workers who can move. If you're familiar with certain types of software applications, you can move within industries. I mean, Oracle is Oracle is Oracle. . . .

"This is going to create tremendous competition. The competition to retain new employees and retain existing personnel will reach dimensions that are unthinkable in today's environment."

Sakey cited a study by the Bureau of Labor Statistics that found that 21 percent of all jobs will go unfilled within the next decade. In white collar industries, 1.5 out of every 10 jobs will go unfilled, Sakey said—something American industries are already familiar with. "When I used to visit the nuclear power plants and walk around and talk to people, I was always told, 'We could use two or more of these [workers] or three more of these. We don't have them right now. It's not in the budget,' et cetera. I think we're kind of used to, in our American work culture, to be short positions."

Far removed from the esteemed image it held in the public's eye in the 1950s and 1960s, the nuclear industry will face increasing competition from other, newer high-technology industries. "I wanted to go to a local high school where I live and give them a list of 10 careers and see how many chose nuclear power as a career," Sakey said. "I would be willing to wager . . . it's not at the top of anybody's list. It really is not, which is really a shame, for a couple of reasons. I'm not a scientist, but isn't this one of the most advanced industrialized operations known to man, the production of electricity from the splitting of the atom? It's pretty high-tech. It's pretty far out there on the physics scale."

The nuclear industry needs to create an enticing branding image for itself to attract the youngest and brightest minds, Sakey said. "You ever see the Nike employee branding ads? They're phenomenal. It's high-speed, lots of flash. You say to yourself, 'That's a really neat company. That's something I might be interested in.'

"[The nuclear] industry doesn't do a lot to brand itself. It's not mainstream. Maybe it requires thinking to attract people in their 20s."

Part of the industry's appeal is its stability, which can be capitalized on in a marketing campaign, Sakey said. "If you're a software engineer, you might work for 10 companies in 10 years. But if you're going to be a nuclear engineer, you might have a really good long-term career. It may not be for everybody. But the reality is I'm not sure this industry has actually portrayed the stability that is there in the workforce. You've got to use that for recruitment."—*Patrick Sinco* NN