

**THE NUCLEAR ENERGY RENAISSANCE  
AND THE ROLE OF  
THE RADIATION SAFETY PROFESSIONAL**

The Robert S. Landauer, Sr. Memorial Lecture

*by*

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*at the*

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Good morning. I'm pleased to be here this morning, and I am privileged and honored to have been asked to deliver this year's Robert Landauer Memorial Lecture.

We stand today on the brink of an exciting and historic time for nuclear energy and nuclear energy technologies—fully as exciting and historic as in the mid-1950s when Robert Landauer founded the company that still bears his name out of his house in Park Forest, Illinois.

We hold our future in our own hands. We have the opportunity to shape that future and, in the process, to sweep away the myths and prejudices that have dogged our industry from its earliest days.

People speak of a worldwide renaissance of nuclear energy. If “renaissance” means illumination, new growth, a new beginning and the flowering of innovative ideas and fresh thinking, then, yes, we are approaching a renaissance of nuclear energy and nuclear energy technologies.

I want to spend my time today sketching in the broad outlines of that renaissance and, equally important, discussing the critical role that all of you, as radiation safety professionals, must play in that renaissance. Please note that I said “must play”—not “can play” or “might play.” Your active participation and contribution is essential. You are as important to this enterprise as those who will design, build and finance America's next nuclear power plants.

America's nuclear power industry has come such a long way in such a relatively short time. Think back just 10 years.

In the mid-1990s, the common wisdom held that one-half of the nation's nuclear plants would shut down prematurely because of competitive pressures. Who would have guessed that 10 years later, the industry would be thriving, profitable and consistently operating at 90 percent of capacity, with the top quartile of plants operating above 97 percent?

Ten years ago, who would have guessed that, by 2006, three-quarters of the U.S. nuclear fleet would have obtained 20-year license extensions, or planned to do so?

In the mid- to late-1990s, who would have guessed that the President and the Congress would approve Yucca Mountain in Nevada as a suitable site for a used fuel storage and disposal facility?

Who would have guessed that Congress would provide financial incentives and risk insurance to stimulate investment in new nuclear capacity?

Who would have guessed that states and local communities would be competing among themselves, offering companies incentives to build new nuclear capacity?

Yes ... these are exciting times. For the first time in years, our industry is looking at building again. Today. Growing again. Today. Here are a couple of recent examples:

- o The Tennessee Valley Authority has 2,500 people on site at its Browns Ferry nuclear site working on refurbishment of Browns Ferry Unit 1. The company has spent \$1.4 billion of the \$1.8 billion project budget. System turnover has begun. Fuel is already being delivered. The project is 83 percent complete, and on budget, on schedule for startup one year from now. So much for the skeptics who think we cannot manage large, complex engineering and construction projects to cost and schedule.
- o Louisiana Energy Services received its draft license from NRC last Friday to build a new centrifuge enrichment project in New Mexico. Financing for this \$1.4-billion project should close this summer. Official groundbreaking is set for late August. When complete in 2013, this new enrichment plant will produce 3 million SWU annually, about 25 percent of U.S. demand.
- o Other industry suppliers are coming back, too. BWX Technologies, the major supplier of heavy nuclear components for our nuclear Navy, last month received its nuclear accreditation for commercial equipment from the American Society of Mechanical Engineers.

This accreditation authorizes BWXT to manufacture commercial nuclear-grade components at plants in Ohio and Indiana. The Indiana plant was placed in standby in the 1970s and has since been refurbished to world-class status. You'll remember that BWXT held N-stamp certification through the nuclear build cycle of the 1970s and 1980, then allowed it to lapse in the 1990s. This renewal of N-stamp certification is further evidence of nuclear energy's comeback.

But none of this astonishes me as much as the fact that nuclear power is becoming a unifying issue, rather than a divisive one.

Oh, we will always have skeptics, even downright opposition, but it's clear that nuclear energy is finding favor with growing numbers of people and institutions.

Who would have thought that a co-founder of Greenpeace, the author of the *Whole Earth Catalog* and a Republican president would be in lockstep on anything? Yet Patrick Moore, Stewart Brand and George W. Bush all agree: Nuclear energy—both today's plants and advanced designs—must be part of America's energy future.

The industry enjoys unwavering support at the highest levels of the Executive Branch. Earlier this year, the President unveiled his Global Nuclear Energy Partnership, a long-term vision of the global promise of nuclear power, born out of a conviction that substantial expansion of nuclear energy is the only way the world can meet its electricity needs in a sustainable way, while protecting our environment.

At the other end of Pennsylvania Avenue, on Capitol Hill, we see exceptional support from the Congress.

We see growing acceptance in the financial community, in part because of the tremendous earnings potential of low-cost nuclear plants in a market dominated increasingly by high-cost, gas-fired capacity.

In March, a report from the Fitch Ratings agency said what would have been unthinkable just a few years ago: *QUOTE* It is no longer a question of whether there will be new nuclear plants in the industry's future. Now the discussion has shifted to predictions of how many, where and when. *UNQUOTE*

And nuclear energy's value is not lost on the American public. In a March survey by Bisconti Research, 88 percent of college-educated voters and 86 percent of the public at large agreed that nuclear energy will play an important role in our energy future.

What's going on here?

Why are we seeing this unmistakable trend of growing favorability?

Undoubtedly, because nuclear power casts a broad shadow, under which many people of many different persuasions can find shelter.

Remember that nuclear power plants have three distinguishing characteristics.

First, they produce large volumes of low-cost electricity around the clock at extremely high levels of safety and reliability.

Second, they produce electricity at a stable price, without the punishing volatility we see with gas-fired generating capacity

Third, nuclear plants help maintain our air quality.

Three attributes: Reliable, affordable electricity at low cost. Price stability. Clean air.

Other sources of electricity have one or two of these attributes, but only nuclear plants have all three. That is what makes nuclear energy a unique value proposition. That is why so many people, of so many different persuasions, can find a place in our tent.



We have worked hard to earn this trust, and we must work equally hard to maintain it.

We will not be able to build new reactors unless there is consensus among stakeholders that today's nuclear plants are safe and reliable. Continued excellent plant performance is an unconditional imperative.

The numbers demonstrate that we're doing well, and that the high performance levels

can be sustained:

- In 2005, the industry achieved the fewest number of automatic shutdowns since we began collecting this data.
- In 2005, we achieved the second-highest electricity production ever—782 billion kilowatt-hours of electricity. We've retired more capacity than we've added in the last 15 years but, still, nuclear energy has maintained its 20 percent share of U.S. electric supply, despite growth in electricity demand of over 25 percent.
- In 2005, production costs were 1.7 cents per kilowatt-hour. That's a 33 percent decline over the past 10 years. More important, nuclear production costs have been stable over the last several years. This is remarkable because we have invested heavily in new security-related improvements—1.2 billion dollars since 9/11—and in new steam generators and reactor vessel heads.

Like any industry operating in a competitive market, we face challenges. And we must respond to them appropriately.

We cannot shave investment in staff.

We cannot skimp on preventive maintenance.

We must anticipate potential challenges to our systems and components.

We must plan for the future.

Because if we don't look ahead of us, we will never keep the public behind us.

Our challenge now is to sustain our excellent performance: To anticipate threats to reliability. To maintain our focus on safety. To continue to earn the public trust.

We will move quickly and proactively to address emerging issues like the tritium discovered in groundwater at some nuclear plants.

We know that the much-publicized, unintentional tritium releases near these facilities pose no risk to public health. But the findings and disclosures came as a surprise to the public and our community leaders, and such surprises can erode public confidence in the safety of our plants. This is an issue of public trust and confidence, not health and safety.

The industry has taken the initiative—and rightly so—to disclose voluntarily to state and local officials and residents near our plants inadvertent releases that fall well below the regulatory reporting limits. Chief nuclear officers from each nuclear utility have unanimously approved a voluntary policy to enhance detection, management and communication about inadvertent radiological releases to groundwater that are below

federal reporting standards. More to follow later this year on voluntary transparency in our plant operations.



Our political leaders, policymakers, and even the general public, have rediscovered the strategic value of nuclear energy as part of a diversified fuel and technology portfolio. Our performance must justify that confidence.

But market forces played a role, too: declining electricity reserve margins; growing need for new baseload generating capacity; unsustainable pressure on natural gas supply, resulting in chronic price volatility; growing clean air compliance pressures on fossil-fired electric generation; mounting environmental concerns about climate change and greenhouse gas emissions.

All of these forces have brought us to the brink of this nuclear renaissance.

With the Energy Policy Act of 2005, the federal government has given us the investment tools to undertake the massive capital investments that will be required to build the next generation of nuclear power plants.

That legislation extended the Price-Anderson Act for another 20 years.

It authorized almost \$3 billion for nuclear energy research and development programs.

And it provided loan guarantees for new, low-emission projects, production tax credits for new reactors and other clean energy sources, and protection against unforeseen delay in the regulatory process.

These incentives will propel new nuclear power plants into the market quicker than would otherwise be the case.

Thanks partly to the financial incentives in the Energy Policy Act, and partly to the market imperatives that demand new nuclear generating capacity, we have 11 consortia or companies pursuing licenses for as many as 22 new reactors, investing over 1.5 billion dollars in design and engineering work, development of license applications, and ordering of long-lead equipment.

So we have public and political support. We have momentum. We also have unfinished business.

Let me touch on one such item: Used nuclear fuel management.

I don't believe I've ever been involved with a program that has so many moving parts, and is so confusing to the public. Let me quickly review the state of play.

- We have a site at Yucca Mountain in Nevada that was judged suitable by the President and the Congress some years ago, and we have over six billion

dollars worth of scientific investigation and 20 years of scientific study standing behind that suitability determination.

- We have the Department of Energy working hard to develop a new schedule for the project, including a firm date for filing the license application with the Nuclear Regulatory Commission.
- We have a recent legislative proposal from the Bush Administration, introduced in the House and the Senate that makes needed mid-course corrections to the Yucca Mountain program. It includes provisions for Nuclear Waste Fund budget reform, removes the artificial capacity limit on the repository, and seeks a legislative determination of waste confidence. This legislative proposal is well-aligned with the industry's priorities, with the exception of one big missing element: A plan to move used nuclear fuel from our plant sites either to Yucca Mountain or to interim storage facilities. To be blunt, what's missing is the fundamental government obligation that has not been satisfied since 1998.
- We have a much abbreviated legislative calendar in Congress this year, owing to the mid-term elections, so the prospects for this comprehensive legislation are difficult, at best.
- We have the Bush Administration's Global Nuclear Energy Partnership, or GNEP. GNEP is a long-term vision for global expansion of nuclear energy, designed to minimize concerns about proliferation. GNEP also contemplates development of new technologies to close the nuclear fuel cycle, by recovering from used nuclear fuel those elements that still have energy value, and recycling those materials through a new generation of reactors—thereby reducing the volume and radiotoxicity of the waste by-products that require long-term disposal.

The key question for our industry is this: Given all these factors and developments, where do we go from here? How do we reconcile these objectives and priorities? How do we stitch together a coherent and credible program from these different threads?

At NEI, we have reflected at length on the progress—or lack of it—in this program since passage of the Nuclear Waste Policy Act in 1982, and the 1987 amendments to that Act. We have examined where and when and why the program has failed to meet statutory deadlines. We have asked ourselves what went wrong.

With the benefit of perfect hindsight, we think we see part of the answer. We have created, and then pursued, a monolithic program that lacked the flexibility necessary for long-term technical or political success. We pursued with single-minded fixation the licensing, construction and operation of a deep geologic repository designed for a once-through nuclear fuel cycle—without considering other options, other intermediate steps, that might improve the prospects for technical and political success.

We are in the process of redefining our nation's used nuclear fuel management program—repositioning it, creating new and more realistic technical approaches and options. The end-point—disposal of waste by-products deep underground in a geologic repository—has not changed. But we now recognize the need for multiple paths toward that long-term objective and multiple schedules to achieve it.

Flexibility and agility must be our guiding principles.

We must have an integrated national policy for used fuel management that provides long-term certainty and a clearly defined end-point, but is flexible enough to accommodate advances in technology that could, in the longer-term, have a profound impact on repository design and on the waste forms that we must isolate for extended periods of time.

What do I mean by “long-term certainty” and “flexibility?”

The “long-term certainty,” the “clearly defined end-point,” as I just indicated, means deep geologic burial of the final waste form that must be isolated at Yucca Mountain—and we do not know today what that final waste form will be.

The “flexibility” involves preserving the asset value of the used fuel and the long-term operational viability of our 103 operating nuclear reactors, while also preserving the ability to build new nuclear plants—without fear that the used fuel issues will somehow disrupt or derail our business planning. So “flexibility” may involve consolidating today's waste at a smaller number of interim storage sites, while investigating new technologies that could substantially reduce the toxicity and volume of the final waste form.

Higher burn-up fuels, advanced recycling technologies, advanced fuels, new reactors able to extract energy from today's used fuel—all these could change the character, timing, size and scope of the nation's used fuel management program. We should leave final decisions to future generations by allowing technologies to develop, while carefully monitoring the material placed in storage facilities and the repository. We should remind people that the repository itself should be kept open for monitoring and retrievability for at least the 300 years discussed in DOE's Final Environmental Impact Statement. And we should stop talking in terms of a “solution to the used fuel issue.” The so-called “solution” even 20 years from now will almost certainly be different from the “solution” we define today.

We must consider this program an evolving process, not a single event, and not an inflexible, monolithic program. It is a process that will be influenced by advances in technology, by politics—particularly election outcomes—and by how agile we are in defining our priorities, seizing opportunities and executing plans to achieve them.



Health physicists and radiation protection professionals will play a strategic role in all of the nuclear energy initiatives I've discussed so far. And here, the numbers tell a chilling

story and present us with a major challenge.

Like the rest of the nuclear industry, the health physics profession suffers from an aging workforce and few programs exist to train replacement professionals. According to NEI's 2001 Workforce Study, demand for health physicists will be 209 percent of available supply through 2011. In NEI's 2005 workforce study, we determined that 26 percent of radiation protection workers at nuclear utilities will be eligible for retirement within five years; 24 percent will likely be promoted into supervisory, training or other areas, and another 13 percent will likely leave our industry for other opportunities. This may leave us with only 38 percent of our current workforce in five years' time.

In the contract Radiation Protection technician workforce, we already see demand for workers exceeding supply by roughly 15 percent this year. These are the workers that support our plant outages and are a key part of the commercial power industry's workforce.

So what does that mean, and what are we doing to address these challenges?

Ensuring that we have effective training programs in place for radiation protection technicians, and the educational infrastructure for training the next generation of degreed health physicists, is a top-priority for us.

NEI works closely with your Health Physics Society on this issue and Kevin Nelson, your HPS President-Elect, serves on NEI's Workforce Issues Task Force to provide us with insights and guidance from the health physics community.

NEI is helping to develop new programs. We are coordinating efforts with the University of Missouri consortium to support deployment of model RP technician training programs nationally. In this effort, NEI worked closely with the U.S. Department of Labor to ensure that RP was a funding priority for the agency, and reached out to our membership to provide information about this important initiative. The University of Missouri received \$2.3 million from the Department of Labor to launch this program, involving numerous utilities, community colleges, and vendors. NEI's Chief health Physicist, Ralph Andersen, gave the commencement speech for the first class graduating from this program in May.

We are working closely with HPS to include Health Physics programs in the Department of Energy's University Programs within the Office of Nuclear Energy. NEI is leading efforts to have funding for this important program restored after the program was zero'ed in the Bush Administration's FY07 budget request.

NEI is also building support for an amendment to the PACE legislation that is working its way through Congress. PACE stands for Protecting America's Competitive Edge, and the legislative amendment we support provides increased funding at the U.S. Department of Energy for the expansion of university nuclear science programs, including health physics. This amendment has been included in the Senate version of

the bill and we hope to see similar language on the House side.

NEI operates a student program in association with the Health Physics Forum—the annual meeting of Radiation Protection Managers in the nuclear power industry. For the fourth year, NEI has coordinated this program that has brought as many as 17 health physics students to the forum, introduced them to the industry and included a tour of one of our facilities. Each year students who have participated in this program have been recruited into our industry.

Health Physics and Radiation Protection are key professions in the nuclear energy industry. NEI looks forward to a continuing fruitful relationship with the Health Physics Society as we pursue our mutual goals -- ensuring the next generation of health physics professionals has excellent educational opportunities, and building the educational infrastructure to support this community.

You have a significant role, and a solemn responsibility, in all the issues I've covered today. Teaching and mentoring younger generations is critical. These are the principles that Robert Landauer Senior practiced throughout his life, and that we celebrate with this annual lecture. They are as important today as ever. Perhaps more important.

I know of few issues that are more widely misunderstood than radiation, that are attacked more often with emotion rather than fact. Few issues are more extensively demonized. Lack of factual understanding and education about radiation has seeped into our country's collective subconscious. Fear of radiation is at the root of people's concerns about nuclear power plant safety, and about used nuclear fuel management and disposal.

And this is our second challenge: As we create programs to attract young people into the health physics and radiation protection professions, we must also become ambassadors for the benefits and facts of nuclear technologies. We must educate people about the manifold blessings available from nuclear technologies, in power generation, in the use of nuclear medicine for diagnosis and treatment, in eliminating disease and pestilence, in improving agricultural yields, in manufacturing and extractive industries, and so on.

We must educate people about the immense body of knowledge available about the effects of radiation, and about the disciplined programs in place across our professions to control the use of radioactive materials. Social science research demonstrates convincingly that awareness of need and benefits is the first step toward acceptance and understanding, and that people do not fear what they understand.

The facts are on our side. We must redouble our efforts to lay those facts in front of our policy-makers and political leaders, in front of the media, and in front of those to whom we entrust the education of our children.

I worry that we tend to consign our health physics and radiation protection professionals to the back room. That's not where you should be. You are the point of the spear in our campaign to counter misinformation, and defeat ignorance.

I know everyone in this room understands that our economy is inextricably linked to affordable, abundant electricity.

The United States is using more and more of its energy in the form of electricity and this trend will continue.

Electric power sales represent only three to four percent of our gross domestic product. But the other 96 to 97 percent of our \$11-trillion-a-year economy depends on that three to four percent.

So we cannot afford to gamble with something as fundamental as electricity supply, and the biggest problem we face with nuclear energy is not having enough of it.

Today's situation reminds me of Winston Churchill's words in a radio address to the English people during World War II. His words were directed at U.S. President Franklin Roosevelt. "Give us the tools," he said, "and we'll finish the job."

That's where we stand today. Last year's energy legislation gave us many of the tools. Now it's up to us to finish the job.

We have a lot to do.

We can ... we will ... get it done.

Failure is not an option. Our nation's energy security and national security depend on our success.

Thank you.