

Keeping the nuclear option viable

THE NOTION THAT safe and efficient operation of nuclear facilities should face no political borders was a motivating factor behind the Meeting of the Americas: Nuclear Science, Technology, and Applications. This meeting, held concurrently with the ANS Winter Meeting, provided an opportunity to gather industry leaders from North, Central, and South America and to discuss the experiences, problems, and issues encountered in nuclear technology operations. "I am convinced that face-to-face communication helps to build trust and interest among the parties," said technical program chairman Jorge Spitalnik, of Electronuclear, in Brazil, during the meeting's plenary session.

Titled "Opportunities and Challenges for Nuclear Science and Technology in the Americas," the plenary session provided a snapshot of the latest developments and future plans of the participating organizations, which included Canada's Department of Natural Resources, Brazil's Ministry of Science and Technology, the International Atomic Energy Agency, the U.S. Department of Energy, and the U.S. Department of State. The continued development and implementation of peaceful nuclear technologies, it was agreed, are vital to the well-be-



Spitalnik

ing of both developing and developed countries. Moreover, the speakers emphasized, if the demands of the Kyoto protocol for limiting greenhouse gas emissions are to be met, nuclear technology *must* play an increased role in global energy production. That said, none of the speakers, however, were blind to the obstacles that are currently preventing this. Public acceptance of nuclear technologies, their economic viability, and the resolution of waste management issues were the shared-and familiar-themes of the afternoon.

Ernest Moniz, undersecretary of the U.S. Department of Energy, spoke on the role of nuclear power in the United States in meeting energy challenges of the next century. He admitted that even though nuclear power today represents about 100 million tons of avoided carbon emissions each year in the United States, the future of nuclear technology, particularly nuclear energy, is unclear. "There are

external questions, such as the persistent public concern⁵ over safety, proliferation, economics. So the question before us is, what action, if any, we should take to face these challenges," he said.

He divided the DOE's role in meeting challenges for nuclear technologies into two areas. The first is to help create and sustain an adequate infrastructure for research, development, and implementation, and the second is to pursue R&D, often in partnership with industry, that will provide options for future energy sources to meet the environmental challenges of the next century.

Using the telephone industry as an example, Moniz described how deregulation can effect the technologies of an industry and how this will be an additional challenge for nuclear energy. "In that [regulated] environment, it appeared to many that it was a law of physics that voice communications were carried out on wires that were tied together. It didn't take very long after deregulation to notice that there were satellites and computer stations and fiber optics—a whole introduction of new technologies which not only made [communicating] less expensive for consumers, but of course developed whole concepts of what it

meant to communicate.

"I personally believe that [deregulation] is going to be a major stimulus . . . for looking at alternate technologies, alternate ways for providing services in this industry . . . and nuclear energy must find its place."

Canada has been involved in the nuclear industry for more than 50 years, according to Michael Cleland, assistant deputy minister in the energy sector of the Department of Natural Resources in Canada. As a leading world exporter of nuclear power plants, Atomic Energy of Canada Limited (AECL) Candu reactors are in operation or under construction in Argentina, Korea, Romania, and China, as well as Canada, where Candu reactors supply about 15 percent of the country's electricity. Canada's MDS Nordium is the world's major supplier of molybdenum-99, according to Cleland, and Canada itself produces and exports about one-third of the world's uranium, valued at about \$600 million Canadian per year, Cleland said.

In Canada, nuclear energy has helped restrain annual growth in greenhouse gas emissions since its first nuclear power plant came on line at Pickering in 1971, said Cleland. In 1996, avoided greenhouse gas emissions through the use of nuclear energy totaled more than 80 million tons, according to Cleland. Canada's energy sector already emits about 100 million tons of carbon dioxide each year, or about 17 percent of the country's total emission of around 600 million tons each year, he added.

"The question of whether or not new nuclear plants are built in many Western countries will depend very much on the ability of the industry to demonstrate that nuclear power is economic," Cleland said, sounding a familiar theme of the afternoon. High up-front capital costs, the need to ensure long-term efficient operation, and long construction schedules are obstacles to nuclear's economic viability. The nuclear industry in Canada is hoping to counter this through new reactor designs and standardized construction methods. Indeed, AECL/Hanjung's recently completed Wolsong-3 unit in Korea was in service within 65 months of the contract signing, according to Cleland—an industry eyeblink.

Safety, though, remains at the heart of people's concerns about nuclear energy. "Regardless of whether they are [false] perceptions or not, we need to do our utmost as operators, regulators, the like, to achieve, maintain, and advertise a strong safety culture," Cleland said.

Richard Stratford, director of the Office of Nuclear Energy Affairs in the U.S. State Department, pointed out that even though the State Department officers are generally not scientists or engineers, they still have long believed that peaceful uses of nuclear technology can make significant contributions to agriculture, industry, medicine, and the production of electricity. Yet the utility industry is finding itself at a crossroads. On one hand, it is looking for the easiest and cheapest way to deliver electric power to the end-user, and on the other hand, it is facing the growing realization that the burden of carbon emissions in the at-

mosphere can potentially lead to devastating changes in our daily lives as a result of global warming.

Whether one subscribes to the theory of the greenhouse effect, Stratford said, there is a growing consensus that the world cannot continue to wait until all uncertainties have been resolved. Nations need to focus on prudent steps that can be taken to reduce carbon emissions, and of particular concern in developed and developing countries alike—that proposed solutions need to take into account not just a safe environment but continued economic development as well.

"But if there is to be less reliance on fossil fuel combustion, does that open the door to greater reliance on nuclear power?" Stratford asked. "Maybe. I have to say, maybe."

He cited several circumstances that will have to occur before utility executives in the U.S. order new nuclear facilities: There will have to be a significant increase in the need for base-load power, the licensing process will have to be perceived as more streamlined and predictable, the issue of long-term spent fuel disposal will have to be resolved, and the U.S. government will have to be seen as favoring the construction of additional nuclear power reactors.

Last, Stratford highlighted a problem that, even if the world's power plants were converted to nuclear and headlines around the globe sang their praises, would still plague the industry. His office, he said, is a kind of microcosm of the nuclear establishment, containing diplomats, lawyers, nuclear engineers, and other persons highly specialized in the business of nuclear cooperation. "I have to tell you," Stratford said, "that the majority of those officers are eligible to retire. Where the next generation of specialists will come from is a concern for us because there are fewer and fewer young officers who choose to specialize in nuclear issues. I think the situation in my department is symptomatic of the situation in other nuclear programs."

Hugo Rodrigues, director of the Financing Agency of Projects and Studies in the Ministry of Science and Technology in Brazil, provided an overview of nuclear activities in that country. He pointed out that nuclear engineering was the first field of engineering to have its own postgraduate course in Brazil. Today, nuclear researchers account for about 10 percent of the 26 000 qualified scientific researchers in the country. Among Brazilian nuclear accomplishments, he cited the pioneering of geophysical surveying from the air for prospecting uranium, and the fact that the country is currently capable of carrying out 75 percent of nuclear power plant construction—supplying 60 percent of its equipment and 100 percent of the civil construction and assembly.

David Waller, deputy director general of the International Atomic Energy Agency, provided an overview of the agency's work around the world with particular attention to its work in Latin America. He focused on two primary aspects of the IAEA's function: power and technology transfer.

Currently, there are 437 reactors operating in 31 countries around the world, accounting

for approximately 17 percent of global electricity—and avoidance of about 8 percent of local carbon emissions—according to Waller. Accumulated operating experience has reached 8500 reactor years.

With local electricity demand growing as a result of expanding industrialization, economic development, and increases in global population, the impact of human activity on global climate will also continue to grow. And Waller pointed out, except for nuclear and hydro—with its own currently forbidding limitations—there are at present no economically viable options for base-load power generation that will minimize greenhouse gas emissions to meet the Kyoto conference targets. Nonetheless, the latest projections by the OECD Nuclear Energy Agency show that the proportion of electricity generated by nuclear power will fall to 12 percent by 2010, and continue to fall to 8 percent by the year 2020.

"Since there are not viable alternatives, it would be a great disservice to the world if this important source of energy were rejected on purely subjective grounds," Waller said. "The challenge therefore is to ensure that the nuclear power option is given a fair and full hearing."

Keeping nuclear energy viable will require action on at least three fronts, according to Waller: restoration of public confidence in the safe use of nuclear energy, with particular emphasis on plant safety and resolution of waste management issues; demonstration of its economic competitiveness—and further technological developments.

The transfer of technology for exclusively peaceful purposes is an integral part of the international consensus on the peaceful use of nuclear energy, Waller said. The IAEA's technical cooperation is modest, he said, but results have been encouraging. The sterile insect technique, in which male insects sterilized by irradiation are released into a population to achieve a means of birth control, has been increasingly applied. The technique's eradication of the Mediterranean fruit fly from Mexico, Chile, parts of Argentina, Guatemala, and the United States has resulted in substantial economic savings, Waller said. In Chile alone, national authorities estimate the economic benefits at \$500 million per year due to the reduction in what had otherwise been required in the way of post-harvest treatment and also the opening of additional export markets. The program is currently being expanded into southern Peru, and in Jamaica a project to eradicate the new world screwworm using the same sterile insect technique has recently attracted an \$8-million loan from the U.S. Department of Agriculture, according to Waller.

In addition, it is estimated that fresh water scarcity could affect as much as two-thirds of the world's population by 2025, Waller said. The IAEA has employed artificial tracer techniques using isotopes in the assessment of water resources and the investigation of water leakage in dams and reservoirs. In Venezuela, the technique has led to the location and subsequent drilling of 50 new wells, adding 25 million litres of water per day to the region, Waller said.—Patrick Sinco