SUMMARY REPORT

SESSION No. 4: Drivers for Deployment of Sustainable and Innovative Technology

MODERATOR:
L. Echávarri, OECD Nuclear Energy Agency (NEA)

SPEAKERS:
V.Pershukov, Russian Federation
C. Bihar, France
P. Lyons, United States
R.K. Sinha, India

V. Pershukov, Deputy Director General of Rosatom, provided an overview of efforts in Russia to develop fast reactor technologies, starting from the beginning of development of commercial nuclear power. He presented the advantages of a closed fuel cycle from the viewpoints of efficient utilisation of resources, reduction of radioactive waste volumes and reduced possibilities for proliferation of fissile materials. He provided an overview of the fast reactor technologies that have been considered, as well as corresponding fuel systems and waste paths. He presented the "Breakthrough" project which is seeking wide deployment of fast reactor technology. He stated that international co-operation is useful and being pursued. "Breakthrough" is the top priority project for Rosatom creating new, inherently safe nuclear technologies for worldwide implementation.

C. Bihar, Director of the Nuclear Energy Division at the French Atomic Energy Commission (CEA), gave a presentation focusing on the role of the closed fuel cycle for nuclear technology. Today many countries are pursuing the nuclear option, not only as an option, but a necessity: nuclear energy provides security of supply, does not emit CO_2 and has stable costs. The industry will have to integrate lessons learnt in future designs, while taking care to ensure non-proliferation. The advantages of fast neutron technologies were stressed in terms of making efficient use of available resources, considering spent fuel as an energy resource, and reducing radioactive waste volumes requiring disposal. The French recycling strategy was presented, illustrating these points at the national level for France, but also the possibilities for recycling services at the international level. The possibility of multinational waste repositories was also raised, in the context of comprehensive fuel services (CFS). Reaching a consensus on this subject will not be without challenges. From a sustainable development perspective, it will be necessary to master the plutonium stockpile, to use the total potential energy of natural uranium to preserve uranium resources, and to minimise the volume and radiotoxicity of nuclear waste. Fast neutron reactors provide a means to do so (Russia, Korea, China, Japan, United States are leading work on such technologies). In France, the ASTRID prototype is being developed, a 600 MWe Generation IV sodium-cooled fast reactor. At the European level, countries are looking at the gas-cooled fast reactor. International co-operation is being pursued beyond Europe as well. With strengthened nuclear safety, international partners developing fast reactor technology lead to a "responsible" approach to the fuel cycle.

P. Lyons, Assistant Secretary for Nuclear Energy, US Department of Energy (DOE), provided an overview of the role of the DOE in conducting research, development and demonstration to reduce regulatory, technical and financial risk; improve economics; manage nuclear waste; minimize the risks of nuclear proliferation and terrorism; and foster international and industry collaboration. He

reviewed ways of obtaining cost and regulatory risk reductions, including through cooperation with the regulatory body, and outlined opportunities and government incentives. He referred to cost sharing with industry, and specifically the SMR Licensing Technical Support Program and an agreement with mPower on certification and licensing. DOE also has strong ties with universities through its Nuclear Energy University Program (NEUP). He stressed that international cooperation is essential, and cited several bilateral and multilateral frameworks as vital to nuclear safety. In concluding, he also referred to the need to find solutions to the combined challenges of meeting energy demands, protecting the environment and making the world safe for future generations. He considered that nuclear energy is an important part of the energy mix, and saw a strong role for government.

R.K. Sinha, Chairman of the Atomic Energy Commission of India, briefly reviewed projections of future development which would be concentrated among emerging economics and new entrants. He noted that the cost of implementation of IAEA safeguards for increased levels of deployment could be substantial, and added that thorium-based fuel cycles could offer opportunities for substantially reducing these costs. He stressed the importance of making innovative nuclear energy systems unattractive for acquiring fissile material. Some important characteristics of thorium-based fuels are that they do not have fissile isotopes as their basis, and can be used in current reactor types and in various forms (MOX pellets, particle types and molten salt types). He referred to three stages for enhancing the global reach and volume of deployment of nuclear power using thorium: immediate growth in existing reactor types with enriched uranium-based fuels, a transition phase using breeder concepts with mixed uranium/thorium fuels in currently established or new designs, and long-term sustainability. He explained that these have been investigated in many countries, including India, Germany, the United Kingdom and the United States, adding that currently there is a large volume of development work in India, Russia and China. Generally, large-scale nuclear development will require higher levels of safety and security against internal and external threats, commensurate with the greater number of NPPs, and ensuring that there are no unacceptable radiological impacts outside the plants' boundaries. In the post-Fukushima context and regarding the case of the AHWR under development, decay heat can be removed without any electrical power, external source of water or operator action for 110 days.

During the question and answer session, participants and panellists referred to issues in relation with nuclear safety, early and regular participation of regulatory authorities in nuclear technology development including the establishment of technology-neutral licensing frameworks, potentially lengthy timescales for development of SMRs and Generation IV technologies, access to such technologies by developing countries, non-proliferation concerns, the availability of energy resources, the importance of clear and transparent communication to foster public understanding of nuclear technology, and international cooperation.

All panellists agreed that international cooperation is essential for the future development of clean, safe, affordable and sustainable nuclear energy technologies. A number of multinational initiatives provide effective fora for cooperation, through the sharing of experience among experts, research and analyses, and development work, through such organisations as the IFNEC, GIF, NEA, IAEA and INPRO. Several bilateral cooperation efforts are also being pursued. In addition, cooperation should be ensured at the same time between those pursuing technology development and independent regulatory bodies. Such cooperation is important not only to safety, but also provides greater effectiveness in the development approaches and programmes, with the possibility of integrating safety analyses and questions that could arise much earlier in the process.

New technologies -- notably closed-cycle fast breeder reactors, small modular reactors and thorium-based fuel cycles -- can provide innovative options for meeting electricity demand in both developed and developing countries. Although still requiring concerted efforts and time, moving from demonstration to commercial deployment is essential.

Fast reactors present particular advantages in terms of the efficient use of uranium resources and the reduction of the radiotoxicity and volumes of the radioactive waste requiring disposal.

Small modular reactors present features of interest for remote, small or off-grid applications. They can be implemented more flexibly than larger reactors, breaking down capital investment so as to make it more manageable, and in a number of cases, offering the possibility of modular development. Series construction in factories is such an option, which also increases economies of learning as well as providing very systematic approaches to quality control.

Thorium-based fuel cycles and technologies under development present enhanced passive safety features, utilisation of natural resources and proliferation resistance. Co-operation is underway in a number of countries and opens the perspective of a much wider resource base for future nuclear technology development.

The enhanced safety and radioactive waste management characteristics of the technologies cited will be fundamental in obtaining public approval to continue pursuing the development of nuclear energy in the post-Fukushima context.

As new, innovative technologies continue to be developed, governments have a role in helping to reduce certain associated financial, regulatory, and technical risks and helping to reinforce non-proliferation. Governments are often a necessary part of the equation in fostering research and development, programmes for ensuring the availability of qualified specialists throughout all stages, and streamlining licensing and regulatory approaches, in order to allow for the development of a low-carbon nuclear option which contributes to the mitigation of climate change for the benefit of all.