

Proposal for nuclear power development on the basis of serial medium capacity NPP in non-proliferation conditions

*Evgeny Velikhov, Vyacheslav Kuznetsov, Vladimir Shmelev
Russian Research Centre “Kurchatov Institute”, Moscow, Russia*

International Conference on Nuclear Disarmament, February 26 - 27, 2008
Oslo, Norway

The international community has livened up its efforts in developing proliferation-safe international approaches to the forthcoming large-scale nuclear power (NP) development in the world.

At the UN Millennium Summit in September 2000, the President of Russia Vladimir Putin has urged the countries to cooperate in developing innovative nuclear power systems, which would reduce the risk of critical technologies and materials' proliferation.

In January 2006, the President of Russia has put forward the initiative to establish international nuclear fuel cycle centers under the auspices of the IAEA, in order to assure safe and guaranteed access of developing countries to NP services.

Taken together, Presidential initiatives are aiming to solve the issues of: providing energy for the sustainable development of mankind; assuring equal access to NP services for all countries; maintaining non-proliferation; and safely handling nuclear materials and waste, as well as developing and supplying fuel for large-scale nuclear power industry.

Russian President's initiatives were reflected and developed in the IAEA international project “Innovative Reactors and Fuel Cycles” (INPRO) implemented since 2001 with participation of 28 countries – both nuclear technology owners and developing countries wishing to join the circle of NP users.

Similarly, the U.S. initiatives – Global Nuclear Energy Partnership (GNEP, 2006) and the developments in the framework of “Generation-IV” International Forum (GIF) – are aiming to join efforts of countries in developing innovative reactors and fuel cycles, as well as in organizing supplies of NP equipment and services to countries interested in developing their own NP without contributing to nuclear arms' proliferation risks.

In the INPRO framework, the IAEA considers different scenarios of large-scale NP development on the basis of closed nuclear fuel cycle, thermal and fast reactors and international nuclear fuel cycle centers, with NPP capacities of 1 GW or more, as well as scenarios of nuclear energy development based on serial medium reactors intended for the developing economies. These two groups of scenarios have the same focus on NP development while restricting the requirements to critical materials and technologies' non-proliferation.

It seems that the tasks of energy supply to the developing countries would/could be solved using, in particular, medium NP capacities:

- more and more designs of such facilities appear as time passes;
- Russia began constructing the pilot floating NPP based on submarine reactors;
- the U.S. GNEP program outlines intentions to produce a considerable number of exportable medium reactors for the countries with small energy programs. Russia has joined GNEP;
- in the INPRO framework, the IAEA explores the issues of nuclear energy uses, including small and medium capacities intended for supplying energy to the developing countries;
- the program of Russia-U.S. Working Group for Civil Nuclear Energy established in accordance with the decision of Presidents of Russia and U.S.A. – Putin and Bush – made at St. Petersburg G8 Summit in 2006, provides for the joint exploration of possibilities to produce exportable medium nuclear power plants (NPP); for this purpose the Parties have established Working Subgroups.

The concept of safe development of medium NP intended for supplying energy to developing countries is offered to the attention of the global community:

- Upon an agreement with the IAEA, the countries possessing developed nuclear power and nuclear fuel cycle technologies, would establish a corporation/corporations, which would realize the complete cycle of nuclear energy services: uranium mining and enrichment, fuel elements' fabrication, mass construction of medium NPPs and their operation (if required), spent nuclear fuel management and radioactive waste disposal, including all the necessary scientific, design, technological and industrial support.

- Countries not pretending to develop their own nuclear power would use the services provided by the above corporation/corporations and pay for the electricity, heat and desalinated seawater supplied to them.

Thus, the country that accepts the services from such a consortium would receive the energy it needs, while avoiding investments in nuclear energy R&D and in the creation of expensive enterprises and single (i.e., more expensive) NPP units units, as well as enjoy a series of other advantages resulting from the use of the consortium's services.

It seems that the proposed scenario would promote the solution of non-proliferation issues in conditions of revived interest to NP development, including many developing countries.

Economic factors would be an incentive for the developing countries to use the proposed nuclear energy supply pattern, since it could provide the cheapest nuclear energy services. Serial industrial production of medium nuclear power plants, including block-type and transportable facilities, would promote the reduction of capital investments.

It could be supposed that all the leading and interested countries will contribute in the creation and operation of the proposed international nuclear energy system based on medium nuclear power plants.

Establishment and operation of the proposed – and currently agreed with the IAEA – international nuclear energy system will put a reliable barrier to critical materials and technologies' proliferation. New international standards could be possibly developed in this connection.

Phase 2 of the INPRO Project is intended to explore the institutional issues of nuclear energy system's operation on the basis of medium reactors (including transportable nuclear power plants), which are common for different possible technical options and for all participants of the system.

These issues are:

- Licensing;
- Insurance;
- Liquidation of “gaps” between the laws of participating countries (producers/consumers);
- Guaranteed energy (fuel) supplies;
- Economic patterns/mechanisms (leasing, etc.);

- Transportation (including nuclear materials' transportation);
- Monitoring and control;
- Register of hazards taken into account to assure the due protection of small and medium NPPs;
- Safety;
- Physical protection;
- Legal support;
- Rules of announcing and providing small and medium NPP services (in particular, in order to prevent receipt of commercial advantages to the detriment of safety and non-proliferation);
- International standardization, certification and testing centers for small and medium NPPs;
- International components of the nuclear energy system based on small and medium NPPs;
- Non-proliferation aspects (related to politics, international law, etc.);
- Rules of site/water area selection and public relations;
- Personnel support;
- Experience of non-nuclear medium power industry.

The competition for new markets of medium NPPs among many countries having different political and social systems could involve serious undesirable consequences, such as concessions in non-proliferation requirements, tendering project costs unduly understated to the detriment of safety, etc. INPRO will explore, how to prevent those possible undesirable manifestations.

Standardized reactors could, in advance, provide for the technical equipment needed for implementing the IAEA safeguards, as well as for uniform control methods and procedures, which could considerably enhance the efficiency of the IAEA safeguards. No need for the country to build any nuclear fuel cycle enterprises under this NP development scenario would reduce the risk of nuclear arms' proliferation.

All the above favors the operation of the proposed international collaborative effort in the field of NP based on medium reactors.