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VIEWPOINT

Russia's nuclear power safety – an alternative proposal

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The major part of Western proposals to the G-7 meeting on increasing the safety of Russian nuclear energy was based on the shut down of all Chernobyl-type RBMK reactors as the essential first step and increased safety levels in producing WWER reactors. It is therefore relevant to examine the possible repercussions on electricity generation supply and demand if this course of action is approved.

Keywords: Russia; Nuclear safety; Proposals

There are nine nuclear power stations now operating in Russia. Their total installed capacity is equal to 20.2 million kW. Virtually all of them are concentrated in the European part of the country: in central, north-western and middle Volga areas. These are industrial regions where the nuclear share of electricity is between 14 and 34%.

There are virtually no reserve capacities in Russian electricity production and the lowest levels of these reserves (from 0.4 to 4.5%) are found in the regions where nuclear stations are located. Moreover, significant volumes of conventional (fossil fuel) electricity generating capacities in these regions need to be substituted or reconstructed. For Russia as a whole more than 20 million kW of non-nuclear capacity needs to be replaced every five years.

The Western proposals concentrate mainly on the direct substitution of Russian RBMKs with an adequate quantity of Western nuclear reactors and others produced by Russian and Western collaboration. The proposed solutions are thus being sought within the nuclear industry itself.

It is quite evident that the major beneficiaries from such a decision will be the Western producers of nuclear energy equipment. Financially the scheme appears to be a programme of investment support of the Western nuclear power industry by Western governments. But the consequences of these proposal will be both positive and negative for Russia.

The major positive consequence, in my view, will be the substitution of RBMK-type reactors by existing Western technology, which will cause the least disruption to energy supply and demand. This timing will depend upon the production cycle for manufacturing and marketing the reactors needed to substitute RBMK. But, obviously, this also has some negative effects for Russia.

First, because the technical parameters of Russian and Western-type power stations are incompatible, large hard currency funds will have to be set aside for maintenance and servicing. This would mean not only that Western countries would be providing long-term financial support for their nuclear energy industry, but also for Russia itself. This is a similar position to that of grain imports, where Russia has been continuously financing the development of US agriculture to provide necessary grain supplies instead of solving this problem internally.

Thus, it it not the case that Russia is receiving financial support from Western countries to increase its nuclear safety, but that Russia itself is providing financial support to develop and sustain the Western nuclear power industry. Moreover, the Western proposal does not provide for the immediate substitution of RBMKs, which will mean an inevitable gap in electricity production; Russia will thus need to find other, non-nuclear, sources.

A very tight fuel and energy balance during the transition period 1993–97 means that it is impossible to remove the nuclear capacity from the energy balance without other compensating sources. That would exert a negative influence on economic reforms in Russia. Under conditions of a continuing decline in crude oil production, there is urgent and large-scale need to enhance oil refining to provide the growing Russian economy with light petroleum products. This will diminish significantly the quantities of residual fuel oil supplied for power generation, which will also need to be compensated for somehow.

The scheme of nuclear for nuclear substitution will inevitably demand more complex decisions of a macroeconomic character and cannot be effectively solved on a purely nuclear industry level, though it seems to provide – at first glance – the quickest possible solution to the safety problem.

I will now examine what these complex solutions might be if a macroeconomic approach had been used from the very beginning of the evaluation process. The problem of providing increased safety in Russia's nuclear power stations covers a wide spectrum of Russian energy–economic development and can be treated only as a complex macroeconomic task. This means that, despite its high priority, the nuclear safety programme must be developed in parallel with other urgent and capital intensive energy activities.

To carry out these activities over the

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next decade, huge amounts of financial support will need to be concentrated in the following six areas:

(i) To speed up the programme aimed at renovating existing fossil fuel power generation by efficient gas fired units with significant environmental improvement of the newly built and reconstructed units. Intensive construction of the gas fired units with a total capacity of 35 million kW, including 20 million kW from the renovated, existing power generation plants will demand the construction of an adequate electricity grid and training for personnel.

(ii) Increased development and production of gas to provide for additional gas fired turbines and to provide compensatory capacity for the closed nuclear power stations and the diminishing supplies of residual fuel oil.

(iii) Energy saving in end-use processes in industry, transport, residential and agro-food sectors. The potential here is high. According to IMEMO research fellow Yuri Adno's calculations, if the iron and steel industries had, by the end of the 1980s, an energy intensity of the main technological processes that reached the levels of Western equipment, total energy consumption of Russian industry would have decreased by an amount equal to the annual electricity production of all nuclear stations of the former USSR.

(iv) Development of renewable energy sources, including R&D and commercial production of the equipment for installations using wind, geothermal, solar and biomass energy, as well as small hydro and fuel pumps.

(v) Development of engineering industries based on the conversion of former military enterprises to production of the gas turbines and steam gas units, its equipments and control systems.

(vi) Reconstruction of the acting nuclear power stations; take off and conservation of the energy units with RBMK and first generation of WWER; joint creation of highly safe nuclear power stations on the basis of Russian R&D.

Preliminary calculations (which will be subjected to further research) suggest that the total costs for these projects in the forthcoming 8–10 years will be around 1.4 million roubles and more than US$24 billion (see Table 1).

To implement these proposals it would be sensible to establish a special energy programme, which will unite the intellectual, financial and resource capabilities of Russia with those of developed Western nations in order to stabilize and further develop a highly efficient, environmentally clean and safe energy supply.

During the coming decade the following problems can be solved within the framework of the programme:

- safety levels of the currently operated nuclear power stations can be increased followed by the phasing out of the obsolete RBMKs and introducing the first generation of the WWER nuclear reactors;
- new generation of nuclear energy reactors can be created satisfying international safety standards and even exceeding them;
- the large-scale reconstruction of non-nuclear power generation can be achieved using modern gas fired technologies;
- a stable gas supply can be achieved with the development of the giant gas fields of the Yamal Peninsula, Barentz and Kara Seas and the utilization of hydrocarbon resources;
- large-scale conversion of former military industries for energy needs can be developed;
- radical environmental improvement can be achieved if conventional fossil fuel power generation plants were equipped with SO_x and NO_x cleaning systems;

Table 1. Estimation of costs to implement improvements of Russian nuclear power safety

	Direction of work	Cost (billion roubles)	Cost (billion US$)
1	Speeded-up construction of steam-gas units of total capacity 35 million kW, including 20 million kW under technical refurbishment and reconstruction of operating thermal power plants	394	6.1
2	Additional development of gas industry in volumes providing operation of steam gas units, substitution of residual fuel oil and nuclear power plants decommissioned	395	8.7
3	Energy conservation in industry, transport, agriculture and municipal economy	510	1.7
4	Development of non-traditional energy, including completion of working out and serial manufacturing of equipment for wind power stations, small hydro power plants, geothermal and solar plants, biomass energy units and heat pumps	43	1.3
5	Development of machine-building base of conversion enterprises for manufacture of gas turbine and steam gas units, equipment and control systems for energy sector	13	1.5
6	Reconstruction of operating nuclear power plants, decommissioning and conservation of units with RBMK and first generation WWER reactors, working out of high-reliable nuclear power plants	50	4.8
	Total	1405	24.1

- effective energy saving can be achieved in all spheres of energy production and consumption.

In all these areas of action active cooperation with the West can be achieved using direct investments, credits, and the technologies and expertise of Western countries.

This programme can be accomplished on a multilateral and/or bilateral basis under the umbrella of the European Energy Charter, with the participation of the international energy organizations, such as the World Bank and EBRD, IMF, private banking and investment capital of Russian and foreign firms.