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ГОСУДАРСТВЕННАЯ КОРПОРАЦИЯ ПО АТОМНОЙ ЭНЕРГИИ «РОСАТОМ»

Fast reactor development program in Russia

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Outline

1. Nuclear power in Russia.
2. Requirements to large scale NP.
3. Federal Program “Nuclear Power Technologies of the New Generation..”

Nuclear power. Status and prospects.

Present-day NP in Russia is based on use of thermal reactors (VVER/RBMK) and open nuclear fuel cycle technologies.

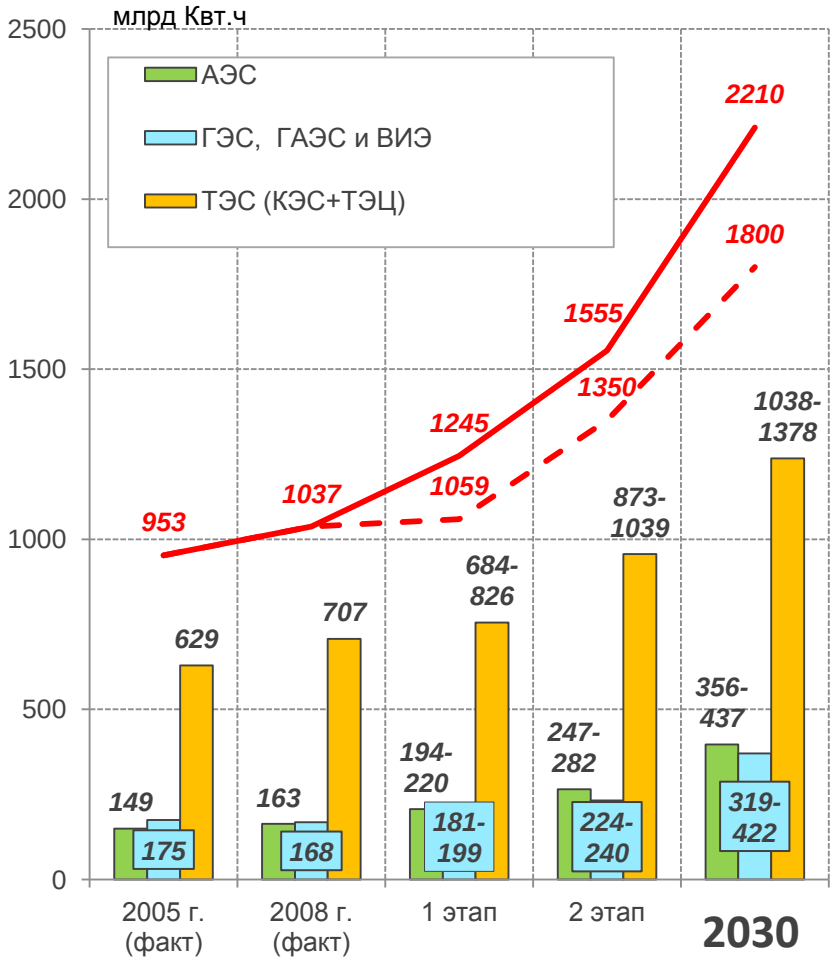
NPPs with total capacity of around 24 GWe generate about 17% of electricity in the country, and 42 % in the Northwest part of Russia.

“Energy Strategy of Russia” forecasts NP capacity increase to **52-62 GW(e) by 2030.**

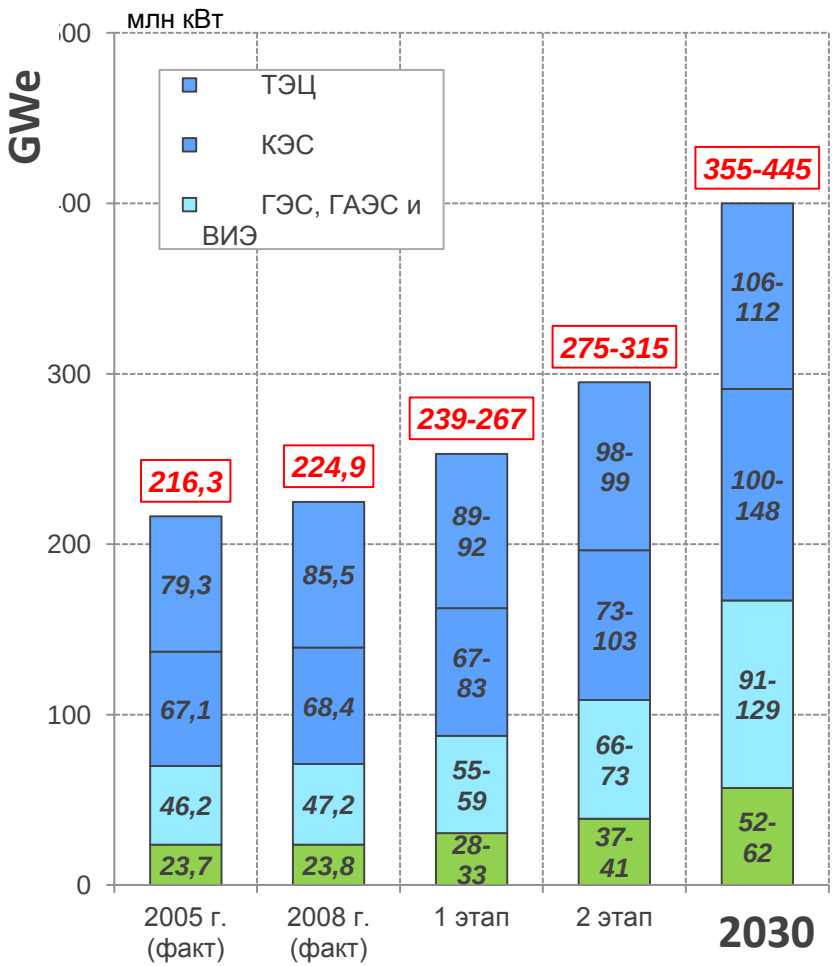
The Institute for Energy Research consider an increase of NP **to 100 -140 GW(e) by 2050** to assure sustainability of energy supply for Russian economy.

Energy strategy of Russia till 2030.

Electricity generation



Electricity capacity



Nuclear is green

Present-day nuclear power. Challenges.

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Development of NP till 2030 can be realized on VVERs, while to assure large-scale NP development we have to address several challenges:

- **A serious loss of public confidence in nuclear safety after severe accidents;**
- **Significant amounts of spent nuclear fuel accumulated in the world;**
- **Risk of proliferation of uranium enrichment and reprocessing technologies;**
- **Inefficient use of natural uranium.**

The new GEA project concluded: "Nuclear energy is a choice, not a requirement".

There is a possibility of a significant increase of NP role in sustainable energy supply if the new generation of nuclear power technologies is developed.

Russian strategy of the large-scale NP development.

"The Strategy of Nuclear Power Development in Russia in the first half of the 21st century" defines the pathways for the development of large-scale nuclear power meeting "natural safety" criteria:

- Exclusion of the accidents which require evacuation or relocation of local population;
- Efficient use of natural U energy potential;
- Multirecycling of nuclear materials in a way preserving the natural radiation balance;
- Technological reinforcement of the non-proliferation regime;
- Competitiveness of nuclear power.

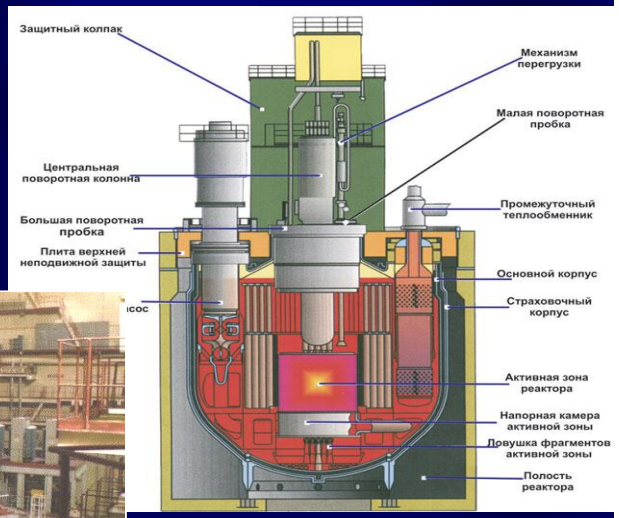
Technical requirements to the new generation of nuclear technologies:

- Ensuring the minimal reactivity margin in the reactor core, by achieving the core BR =1.05;
- Denial of direct disposal of irradiated fuel;
- Minimization of high-level wastes through multirecycling of MA with U - Pu mix;
- Minimization of the risk of nuclear materials proliferation, through elimination of the Pu breeding zones and of Pu separation.

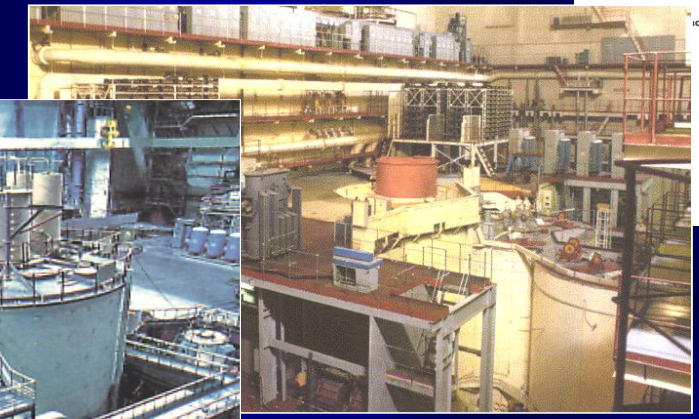
The above requirements as a whole can be met only as a result of FR and CNFC technologies development.

Development of sodium cooled fast reactor technologies in Russia

Total reactor-years is ~ 140

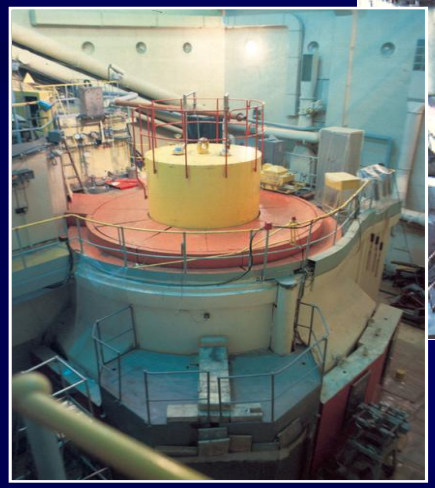


BN-800 (planned for 2014)



BN-600 (1980)

BN-350 (1973)

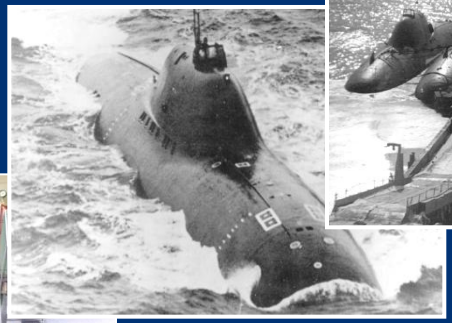


BR-5/10 (1959)

The stages of heavy metal coolant technology development

Pb-Bi

Test facility
(1951)

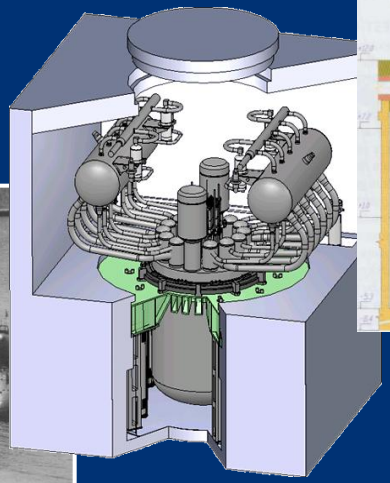


Pb-Bi

APL-705
experimental
(1971)

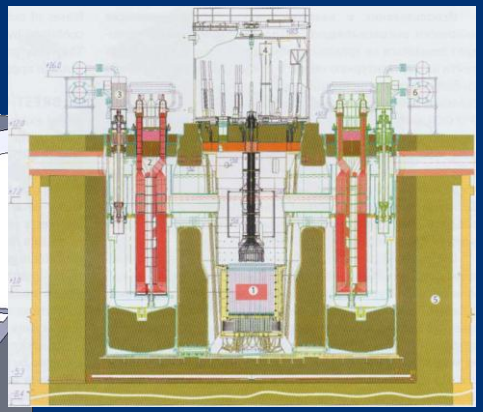
Pb-Bi

APL-705 serial
(1976-1996)



Pb-Bi

SVBR-100
(plan - 2017)



Pb

BREST-300
(plan - 2020)

Status of CNFC technologies development in Russia.

- PUREX technology for reprocessing of spent UOX fuel from VVER-440 and BN-600 (RT-1 plant);
- MOX fuel testing (of about 50 assemblies with pellet fuel, and about 30 vibro-compacted fuel assemblies) in BN-350 and BN-600 reactors;
- Experimental technology of nitride uranium fuel;
- Technology of pyrochemical processing of irradiated nuclear fuel at laboratory level.

Assessment of various FR and CNFC technologies

The BREST system has the highest potential.

The main challenge - none of the technologies involved in the BREST system has been demonstrated.

Federal Target Program "Nuclear Power Technologies of a New Generation".

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The following major facilities are planned to be developed and commission by 2020:

- **Multi-purpose fast research reactor – MBIR;**
- **Prototype power unit with lead-cooled fast reactor - BREST-300;**
- **Commercial prototype power unit with a lead-bismuth fast reactor - CVBR-100;**

Total amount of funds allocated to the implementation of the Program is about 100 billion rubles or 2.5 billion Euro.

Federal Target Program “Nuclear Power Technologies of a New Generation”.

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Projects in compliance with the “natural safety” criteria:

- industrial line for production of mixed nitride U-Pu fuel (MNIT);
- R&D, design and construction of BREST-OD-300;
- R&D, design and construction of on-site closed fuel cycle facilities for BREST-OD-300;
- R&D and design of the sodium cooled fast reactor BN-1200;

The goal is to select the best technological solutions for the design of the first-of a kind power module with 2 fast reactors of 1200 MW(e) capacity each and on-site closed fuel cycle facilities associated with these two reactors.

Conclusions

The large-scale NP can be developed on the basis of new generation of CNFC and FR technologies being in compliance with "natural safety" criteria;

Within the FTP we are planning to develop alternative technologies with the goal to select by 2020 the best technological option for the large-scale nuclear power development in Russia in 21 century.

Thank you