



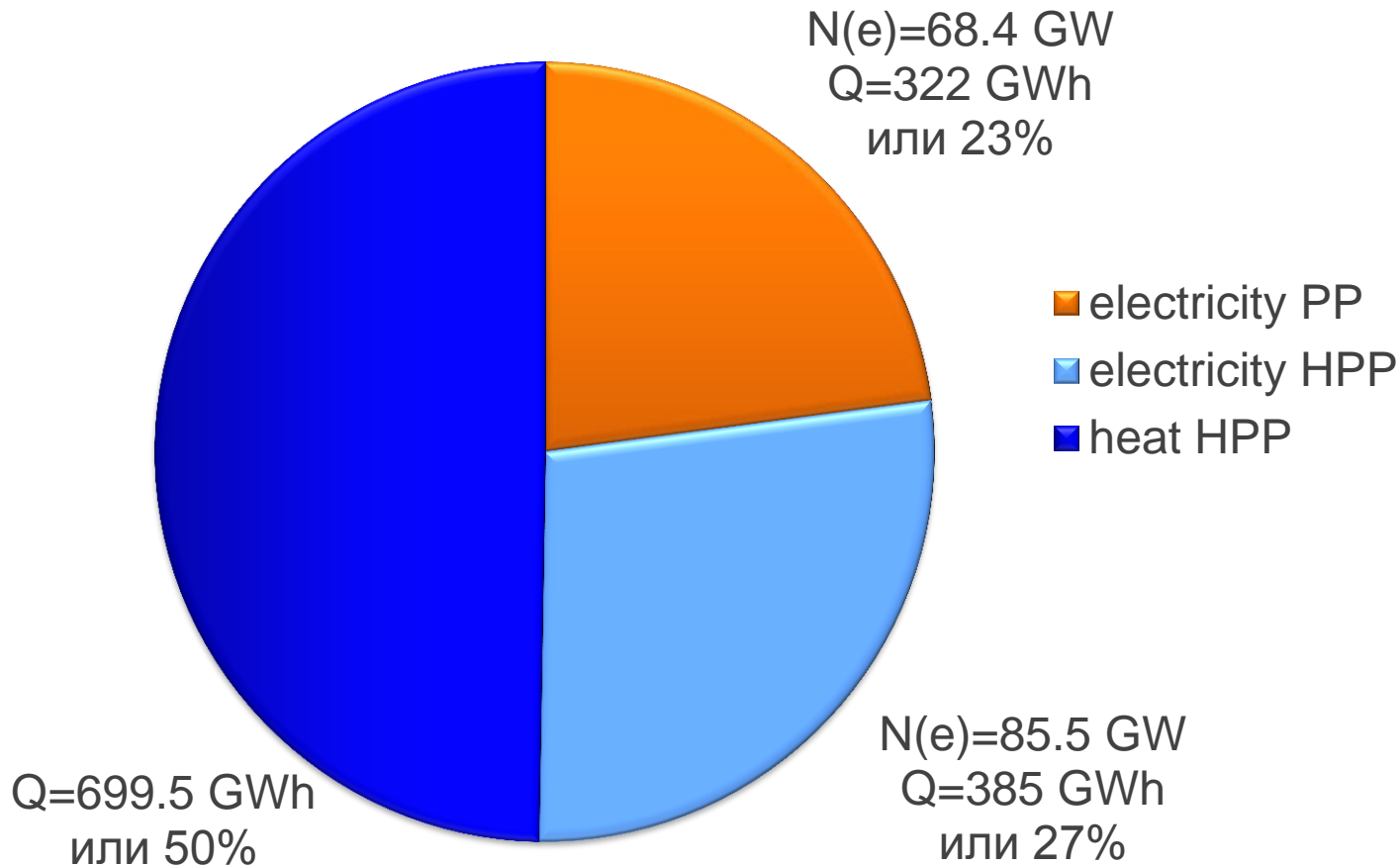
РОСАТОМ

ГОСУДАРСТВЕННАЯ КОРПОРАЦИЯ ПО АТОМНОЙ ЭНЕРГИИ «РОСАТОМ»

NUCLEAR COGENERATION POWER PLANTS IN SOLUTION OF ENERGY, ECOLOGICAL AND SOCIAL PROBLEMS IN RUSSIA'S REGIONS

Yu.N. Kuznetsov. Dr. Sc., Eng., Prof.
A.P. Vasiliev, Cand. Sc., Phys. & Math.
ICES, JSC NIKIET

SCALE OF REGIONAL COGENERATION SECTOR



REGIONAL COGENERATION SECTOR of UPS



- *largest and highly socially and environmentally significant growing sector of Russian Unified Power System (UPS);*
- *formed by cogeneration units (HPP) of up to 250 MWe;*
- *pressing problem – the HPP operating life expired down to 75-87%;*
- *further evolution requires an innovative approach based on high-efficiency and environmentally friendly non-carbon technologies, including nuclear cogeneration units (NCGP) (Presidium of the State Council, ES-2035);*
- *global desalination market.*

PRECONDITIONS FOR THE USE OF NHPP



- ❖ *Substitution of decommissioned fossil fuel HPP;*
- ❖ *Reduced consumption of fossil fuel;*
- ❖ *Greatly improved urban ecology;*
- ❖ *Reliable long-term supply of heat and electricity to consumers;*
- ❖ *Stabilization of heat and electricity rates;*
- ❖ *Increased share of nuclear plants in the base load schedule.*

- *Developed to the industry order (involving over 30 organizations of Rosatom, power industry and the Russian Academy of Sciences) for large-scale use in the regional cogeneration power sector of Russia's unified energy system;*
- *For the required safety, cost effectiveness and competitiveness, the base NHPP with the VK-300 reactor facility relies on highly simple and fully passive operation and safety and use of proven NPP components;*
- *Developed:*
 - *detailed design of the VK-300 reactor facility;*
 - *NHPP design for Siberian Chemical Combine;*
 - *fundamentals of the NHPP standard design;*
 - *comprehensive feasibility study “NHPPs in Regional Power”;*
 - *investment feasibility study for the Arkhangelsk NHPP (for a more specific conditions)*

▪ Performance:

- *number of units – 2*
- *rated power – 2x250 MWe*
- *rated heat generation – 2x400 GCal/h*
- *expected annual output*
 - *electricity* - *3000 mln kWh/year*
 - *heat* - *3800 thous. Gcal/year*

▪ Economics:

- *payback period from the start of operation, years - 8 (NPP-20)*
- *internal rate of return, % -11.6 (NPP-4.3)*

▪ Competitiveness (center, 2020-2030, 5% discount):

- *more effective than HPP SGTP – rate of return 1.6 times as high;*
- *as compared to separated generation (NPP+boiler), the total revenue (including discount) is 2 to 3.7 times as high.*



❖ Increased safety through:

- *passive initiation and operation of safety systems;*
- *no need for operator actions and offsite electricity and water supplies;*
- *two containments.*

❖ Safety parameters:

- *total probability of a severe core damage 3 orders of magnitude as low as the standard level;*
- *all accident consequences confined within the NHPP site boundaries.*



Feasibility study for the Arkhangelsk NHPP (for a more specific content) conclusions:

- *base factor – substitution of HPPs having a significant adverse effect on urban ecology;*
- *minor radiological impacts on population, ecosystems, and surface and subsurface water;*
- *chemical and physical impacts on the environment are acceptable even within the NHPP buffer area;*
- *practically no damage to land and water ecosystems;*
- *people support – more than 50%.*

SUBSTITUTION OF HPPs EXPLORATORY ANALYSIS



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Ivanovo (2), **Ulyanovsk (3)**, Yaroslavl (3), Kurgan (2),
Arkhangelsk (4), Vyatka (2), Komsomolsk-on-Amur (3),
Murmansk (2), **Tver (2)**, Kazan (3), Ufa (4), Izhevsk (2),
Khabarovsk (4); **Perm (2)**

Finding

The capacity of the reviewed market is enough for 38 base
nuclear cogeneration units ($N_e \sim 10 \text{ GW}(e)$).

- ❖ *Large-scale introduction of NHPs in the Russia's unified power system:*
 - *is a great politically and socially important infrastructure innovation project;*
 - *will contribute to a dramatically extended application of nuclear power plants and their greatly increased economic and commercial effectiveness;*
 - *will provide for reliable heat and electricity supply, an improved urban ecology, and large-scale substitution of fossil fuel.*
- ❖ *The required initial step is to develop a branch program and implement a pilot NCHPP.*

A support from Rosatom State Corporation's Public Council will be helpful.

AHEAD OF NHPP



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