



**ROSATOM**

VIII International Forum **ATOMEXPO**

**STATE ATOMIC ENERGY CORPORATION "ROSATOM"**

# **Nuclear Desalination**

***Session***

***«Non-energy use of nuclear technologies»***

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**Moscow**

**30/05/2016**



Atomenergomash (AEM) is a leading power equipment company in Russia, supplying comprehensive solutions for nuclear, thermal power, gas and petrochemical industries

- ▶ **20%** of Russian power generation equipment (PGE) industry
- ▶ Comprising more than **30** manufacturing, engineering and R&D facilities in Russia, Ukraine, Czech Republic, Hungary
- ▶ Employing about **20 thousand** skilled and professional employees
- ▶ Order backlog exceeds **280 bln. RUR**

*AEM's equipment is installed at more than 13% of NPPs and at about 2% of TPPs worldwide, including 40% of power plants in Russia and CIS*



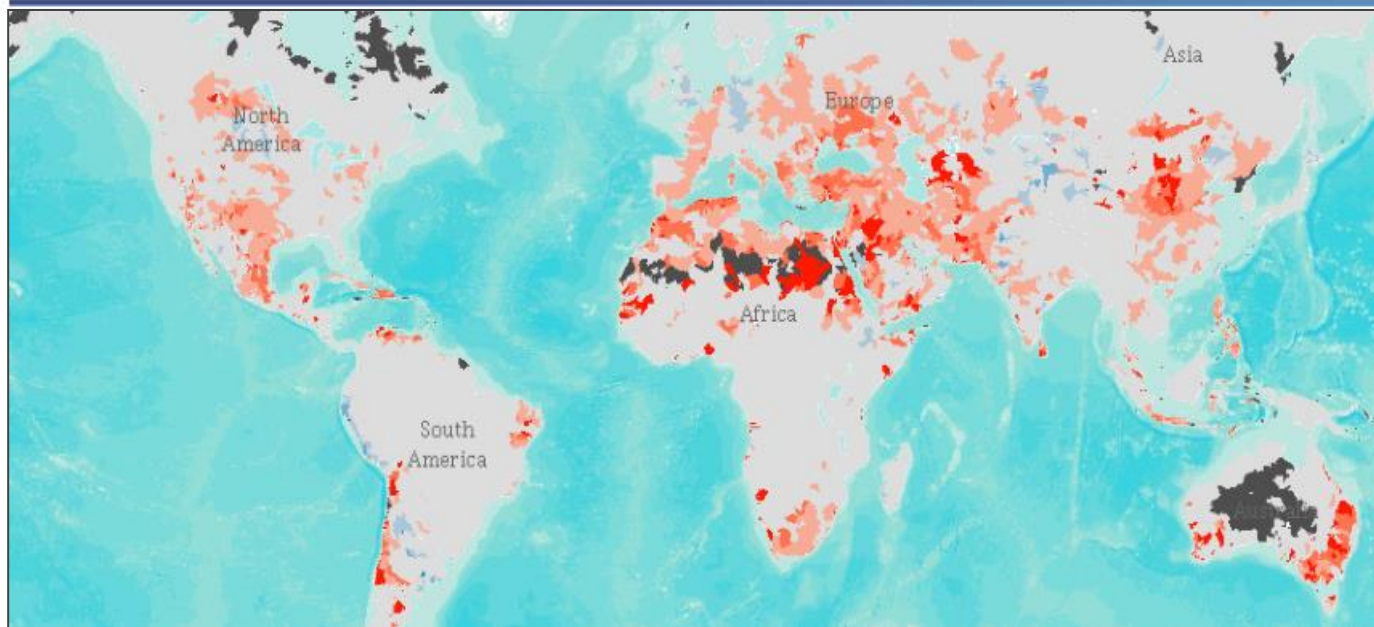
## ATOMENERGOMASH JSC

was founded in 2006 within the State Atomic Energy Corporation Rosatom. The Group of Companies is the core of the machine building unit within the State Corporation and ranks second on the Russian power engineering market.

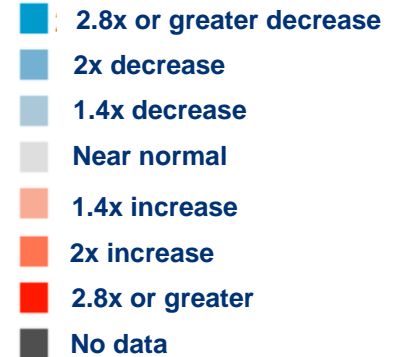


Unique production capacity, strong research base and wide-ranging expertise are the basis for successful and sustainable development of AEM

# Projected change in water stress



Projected change in water stress (Change from baseline to 2030)



Source: [www.wri.org](http://www.wri.org)

- UNESCO is forecasting that a deficit of fresh water will reach more than 2 000 bcm/year by 2025;
- 2,3 billion people are living in scarcity of water resources, 1,7 billion people of them have access to the of less than 1000 cubic meter/year of fresh water according to IAEA estimates.

**The most widespread solution of this problem is to desalinate sea water. Presently, volume of desalinated water is 30 km<sup>3</sup> per year. It is expected to grow up to 110 km<sup>3</sup> per year.**

# Why Rosatom?

## We do:



- Experience in NPP construction - 34 units in operation in Russia and 18 units under construction overseas,
- Experience in utilization of thermal energy for the needs of district heating nuclear facilities,
- The level of radiation safety of nuclear power plants complies with the most stringent international standards.

## We propose:

- A unique experience of creating desalination systems based on nuclear power plants,
- Technological solutions in terms of world-class desalination systems,
- Effective commercially integrated solution NPP + desalination complex.



# Rosatom experience in integrated solutions based on high capacity nuclear power plant

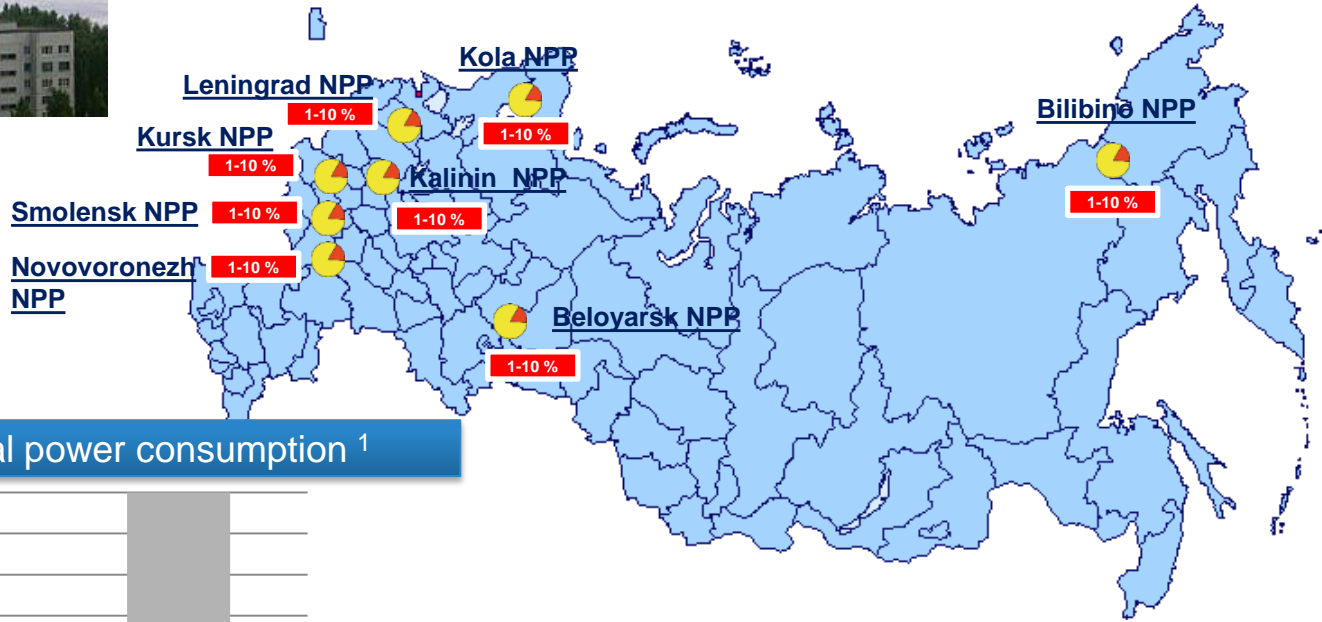


## Cogeneration plants based on NPPs, Russia

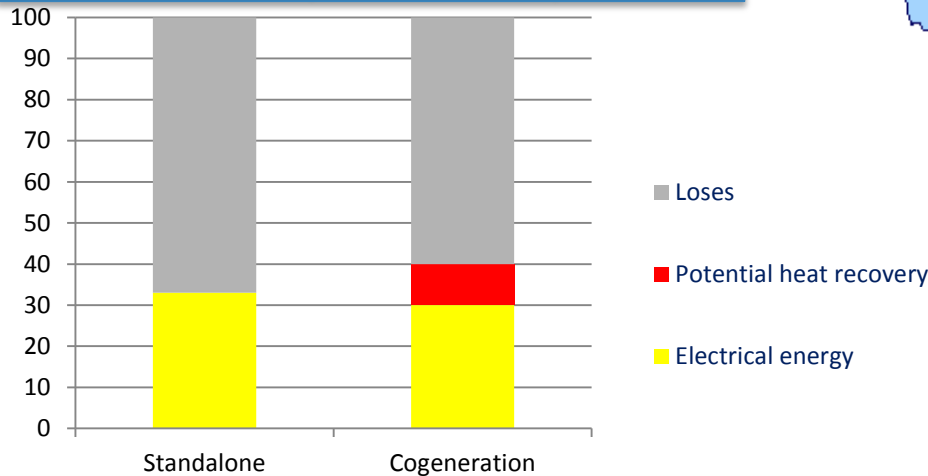
- Plants provide heat to nearby towns;
- Steam source – low-grade heat from the NPP turbine plant



Offtake of NPP thermal power, %



## NPP thermal power consumption <sup>1</sup>



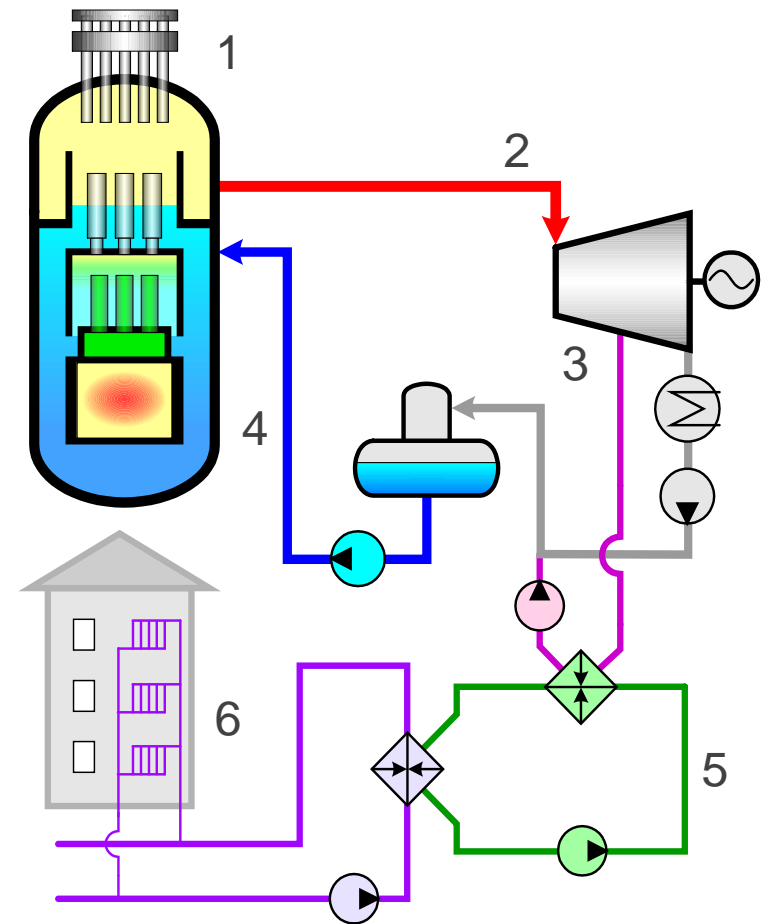
Many years of experience in operating district heat plants for heating nearby cities is a great example of effectiveness of integrated solutions as part of NPP.

<sup>1</sup> Source: Expert assessment of the IAEA

**Extensive experience** based on Bilibino NPP (world's closest to North Pole NPP)

**Manoeuvrability** between heat generation and electricity production

**Economic efficiency** improvement due to product production



1 – Nuclear reactor  
2 – Steam to the turbine  
3 – Turbogenerator

4 – Feedwater supply to the reactor  
5 – Heat generation unit  
6 – Heat consumer

# Rosatom experience in the field of desalination

Rosatom has 45 years of experience in the construction of desalination complexes on the basis of evaporation technology.

**The number of completed projects is more than 40.** The largest of them are:

## **Aktau (earlier Shevchenko) water production facility in operation since 1967 to 1999**

- The first desalination complex in the world with capacity of 120 000 m<sup>3</sup>/day consists of 13 evaporation desalination plants of various types, performance and service life. Providing distillate supply to three large thermal power plants and nuclear power unit, public water supply to the city (population of 150 000) and supply of industrial distillate to several plants.
- Steam source – low-grade steam from the turbine plant of the nuclear power plant based on BN-350 type of reactor (140 C).
- Evaporation desalination technology (incl. MED).



## **System for water demineralization based on Rostov NPP, launched in 2010**

- The facility produces demineralized water to feed NPP power units 1, 2, 3 and 4 (8 demineralization units, total capacity of 9,600 m<sup>3</sup>/day).
- Steam source – low-grade heat from turbine plant of the nuclear power plant based on VVER-1000.
- MED demineralization technology.



Rosatom continuously puts into operation new desalination capacity on the basis of NPP

# Desalination Complex for own needs of NPP

<b>Power resource:</b>	VVER-1200 (3200 MW (τ))
<b>Technology:</b>	MED/RO
<b>Placement:</b>	Near NPP Unit
<b>Capacity:</b>	Up to 13 000 cubic meter/day (depending on the arrangement of NPP)
<b>Desalinated water quality:</b>	TDS < 10 ppm
<b>Readiness of the solution:</b>	Possibility to realize during the time of NPP construction



## ADVANTAGES OF THE SOLUTION

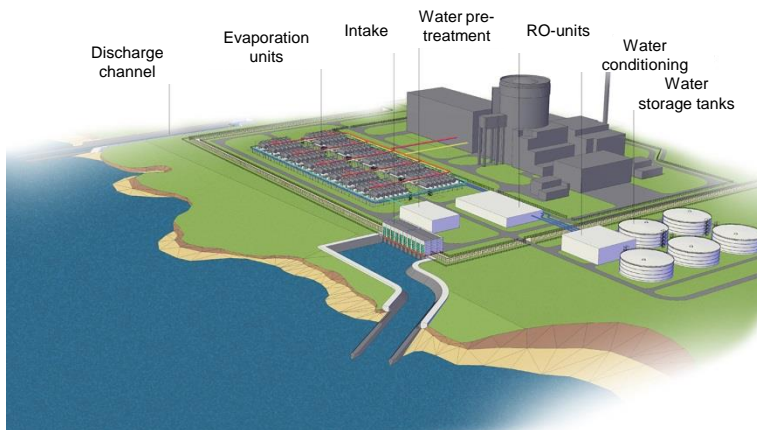
- Providing improved security and independent operation of NPP
- Desalination unit and NPP puts into operation at the same time
- Safety aspect: vapor is extracted within the permissible limits of security settings for NPP
- Does not require significant changes in NPP standard project
- Production of high quality distillate for own needs of NPP (including makeup water treatment)



# Product description

## PRODUCT

Drinking water capacity through 7100 m<sup>3</sup>/h (170 000 m<sup>3</sup>/day.) for external sales, which produced by hybrid technology (MED + RO) desalination complex integrated with high capacity NPP. \*



## KEY CLIENT

- ✓ Ministry and Agency of client country.
- ✓ Regional municipality, which have a lack of potable water, big industrial consumers.

## TARGET PRODUCT

Desalinated water, which produced by desalination complex integrated with high capacity NPP

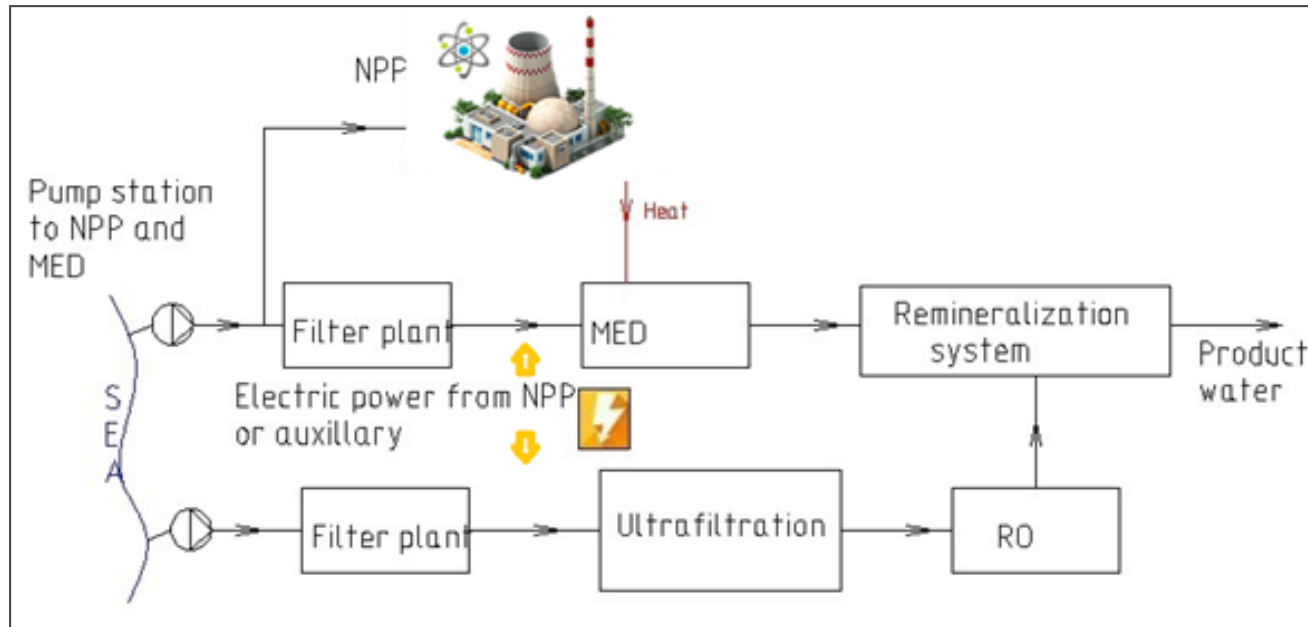
## REASONS OF PROJECT

- ✓ Integration of desalination complex and NPP allows us to receive cost-effective technology decision, because of allowable energy resources and infrastructure united use (water inlet and etc.)
- ✓ CAPEX and OPEX optimisation
- ✓ Possibility to produce up to 170 000 m<sup>3</sup>/day of desalinated water
- ✓ Simplicity of constructive solution: typical power plant project + module desalination units
- ✓ Does not require significant changes in PP design



# Technical concept of Water desalination plant (WDP)

## Schematic diagram of the integration between NPP&WDP



### Hybrid MED-RO technology advantages:

- ✓ Possibility of high volume desalination water treatment without principal NPP design changing and low potential steam usage.
- ✓ Moderate operational expenses to produce high quality desalinated water
- ✓ Improved water quality compare with reverse osmosis
- ✓ Maneuver and reliable desalination complex.
- ✓ Desalination complex working possibility in case of heat source absence and membrane replacement.



POCATOM

# Thank You for Attention!

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