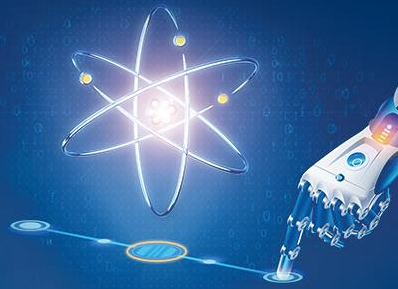
SCIENTIFIC FORUM
NUCLEAR ENERGY FOR CLIMATE



Floating nuclear power units for Net Zero industry clusters development in remote regions

Salnikova N.A.
Afrikantov OKBM JSC

2023

The role of nuclear technologies in decarbonization

ROSATOM IS A NATIONAL LEADER IN ELECTRICITY GENERATION (ABOUT 20% OF TOTAL OUTPUT)**, THE 1ST LARGEST PORTFOLIO OF ORDERS FOR THE CONSTRUCTION OF NUCLEAR POWER PLANTS IN THE WORLD**

ROSATOM'S STRATEGY IS AIMED AT DEVELOPING LOW-CARBON GENERATION AND REDUCING CO2 EMISSIONS

TRENDS AFFECTING THE DEVELOPMENT OF ENERGY SYSTEMS:

- **globalization** international cooperation and widespread use of unique technical solutions;
- **localization** is creation of sustainable regional systems that are aimed at reducing the burden on the environment when operating;
- **acceleration of development** is a request for flexible and fast solutions;
- **adaptability** is an ability to conform to changing reality and resistance to the appearance of "black swans".

Innovative nuclear solutions that meet modern requirements

Nuclear floating power units of low power are a reliable and flexible solution for the needs of local consumers

TECHNICAL SOLUTIONS FOR THE RITM SERIES REACTOR UNITS ARE APPROVED BY THE EXPERIENCE OF DESIGN, MANUFACTURE AND OPERATION:

- ✓ **6** RITM-200 reactor units are operated on **3** nuclear icebreakers;
- ✓ **2** nuclear icebreakers under construction

Based on operational experience, a line of nuclear floating power units with RITM series reactors was created

ADVANTAGES OF NUCLEAR FLOATING POWER UNITS:

- continuous energy production for a period of 5-10 years
- maneuverability (rapid change in the power of the energy source)
- reducing CO2 emissions
- factory construction of a fully operational facility
- changing the capacity at the customer's request by changing the number of power units on the operation site
- serial construction, technical solutions do not depend on the operation site
- “green lawn” after completion of operation
- competitiveness in comparison with gas sources

The Russian Arctic: the development of a high-potential region in the conditions of the Far North

- **low population density** – 0.1-0.2 people per 1 m^2;
- small and **isolated** settlements;
- **harsh climatic conditions**: permafrost, low sub-zero temperatures all year round, high wind strength, heavy precipitation, polar day/night;
- **vulnerable natural environment** and slow recovery rate of disturbed natural objects;
- **the developing port and transport infrastructure** of the Northern Sea Route - cargo traffic increased from 4 million tons in 2014 to 34 million tons in 2022;
- the high cost and **complexity of the construction**;
- **significant natural resources**;
- the need to use **special equipment for cargo delivery**;
- complex logistics;
- the need to use **maneuverable power plants**.

Arctic Reference Project – FPU Akademik Lomonosov

IN MAY 2020: FPU *AFADEMIK LOMONOSOV* WAS PUT INTO COMMERCIAL OPERATION

The emissions of carbon dioxide equivalent **of OVER 300000 TONS** into the atmosphere have been prevented

ELECTRICITY AND HEAT SUPPLY to residential consumers in the Chukotka Autonomous District

MORE THAN 491 million kWh of electricity has been generated

OVER 402000 GCAL of thermal energy has been generated

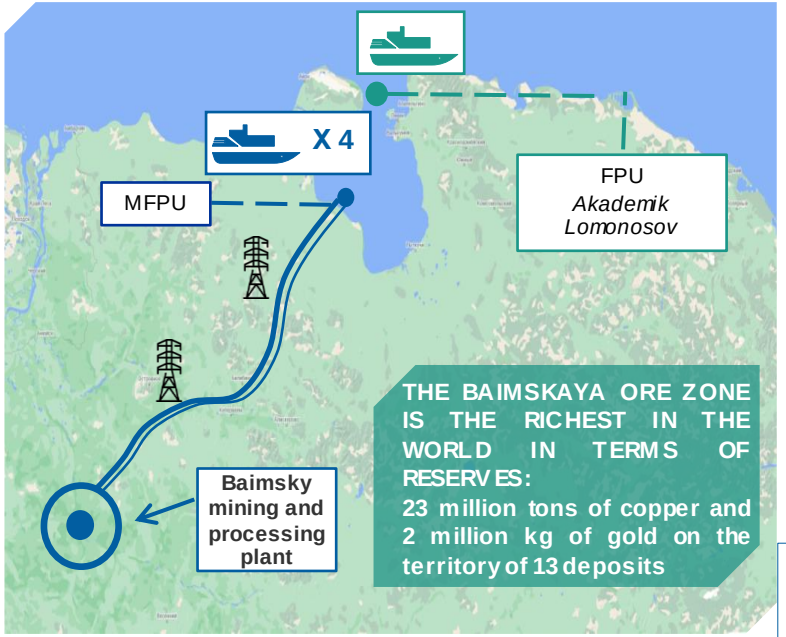
Conditions for **ACCELERATED SOCIO-ECONOMIC DEVELOPMENT** of the Arctic and the Northern Sea Route are created

EXPERIENCE IN OPERATING KLT-40 SERIES REACTOR PLANT:

- 2 nuclear icebreakers
- 1 nuclear LASH carrier

* FPU – Floating power unit

Development of industrial clusters in the Arctic: case of the Baimskaya ore zone



Energy Solution – a modernized floating power unit

There are **2 RITM-200S reactor units** on board

MFPU electric power – **2*53 MW**

PROJECT DEPLOYMENT SCHEDULE:

AUGUST 2022
Keel-laying of 2 hulls in China

SEPTEMBER 2021
Signing the agreement with GDK Baimskaya LLC

Q1, Q2 of 2027
Commissioning of the 1st and 2nd MFPUs

Q1, Q2 of 2027
Completion of the 1st and 2nd MFPUs construction

Q1 of 2032
Commissioning of the 4th MFPU

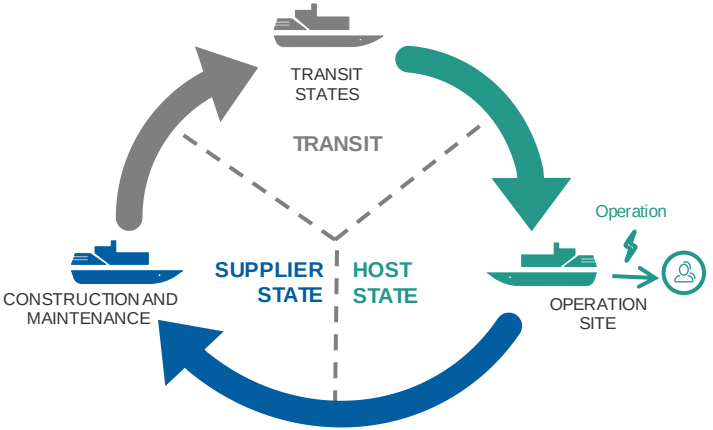
Q1 of 2028
Commissioning of the 3rd MFPU

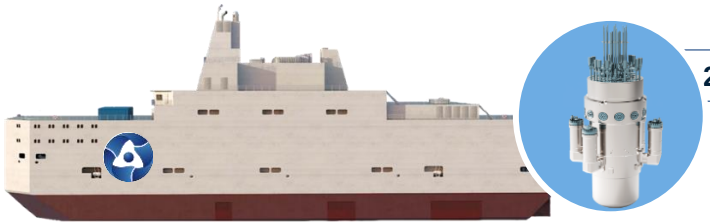
* MFPU — Modernized floating power unit

Optimized floating power unit: a complete solution for tropical regions

OPTIONS FOR THE OFPU APPLICATION IN ORDER TO MEET THE NEEDS OF TROPICAL REGIONS:

- energy supply to remote and isolated settlements and industrial facilities
- desalination of seawater
- replacement of imported energy resources, the cost of which increases due to delivery





2 RITM-200M reactor units

60 years
Service life

2*50 MW
OFPU electric power

CO2 EMISSION REDUCTION AND PROTECTION OF UNIQUE FLORA AND FAUNA IN THE REGION

- The OFPU operating organization assumes all risks associated with construction and operation of nuclear facilities
- The responsibility of the the energy consumer is minimized

significant reduction in the timing and cost of projects implementation

* OFPU – Optimized floating power unit

Challenges of deploying floating power units

01
Approval of safety for transportation between countries

02
Legal and regulatory support for projects, unique business schemes of implementation

03
The necessity of international cooperation based on transparent and non-discriminatory approaches

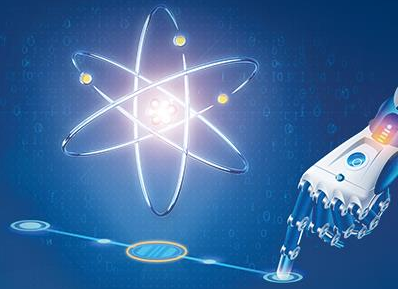
THE WAY FORWARD:

1. Cooperation between IAEA and IMO
2. Analyzing the experience of pilot projects and successful practices of international cooperation
3. Forming working groups to develop specific standards

Conclusions:

- ✓ Nuclear floating power units can become the basis for power systems development of which has been limited by isolation and/or remoteness from large power grids and infrastructure
- ✓ Nuclear floating power units are a competitive solution and can be used in hybrid power systems together with gas, wind, solar energy sources
- ✓ The widespread use of nuclear floating power units can lead to a significant reduction in CO2 emissions while accelerating regional development

SCIENTIFIC FORUM
NUCLEAR ENERGY FOR CLIMATE



Thank you for attention!

Brykalov S.M, Gorbunov P.A., Salnikova N.A.
Afrikantov OKBM JSC

2023