



ROSATOM

Rosatom SMR technology for the market

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ROSATOM key facts & figures



ROSATOM - unique experience and capabilities in the global energy market



35 NPP UNITS in overseas portfolio

255 000 EMPLOYEES

>300 ENTERPRISES AND ORGANIZATIONS

>50 COUNTRIES of business around the globe

ROSATOM and development of small reactors



- **1945** – “birth” of Russian nuclear industry
- **Since 1954**, OKBM Afrikantov (ROSATOM) has been designing marine reactors (<60 MWe)
- **Over twenty small reactors** for civil marine applications have been manufactured and operated so far
- **Total experience** of operation of small reactors for icebreaker fleet – about **400 reactor-years**

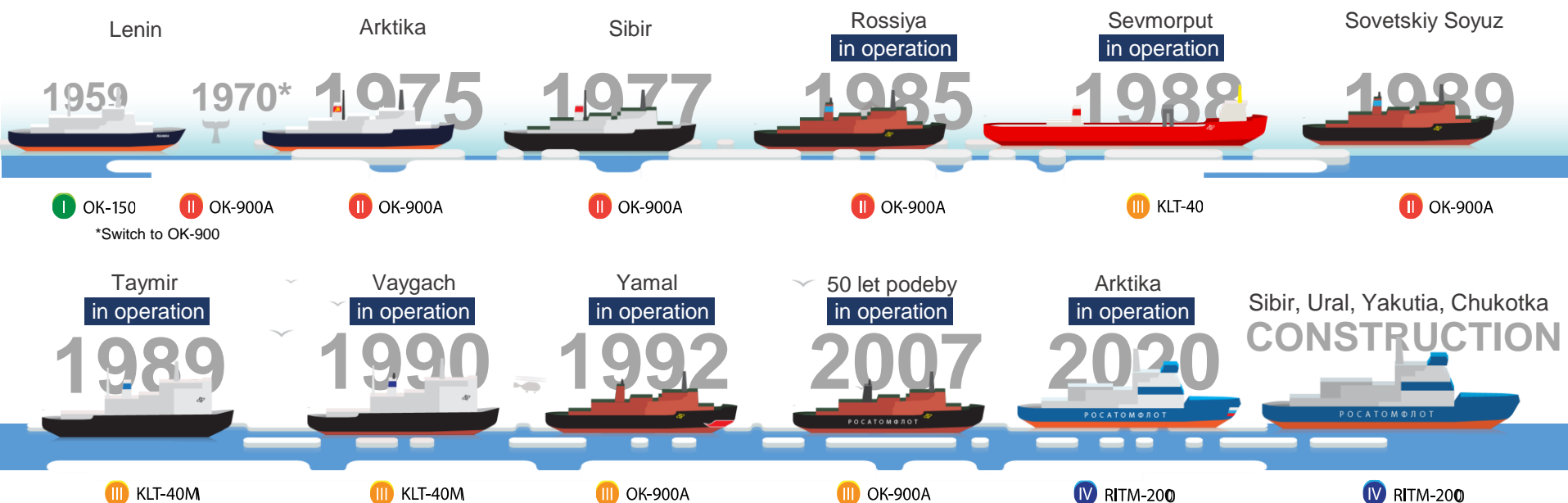
Russia is the only operator of nuclear icebreaker fleet in the world

11 nuclear icebreakers constructed

4 icebreakers under construction

THE WORLD'S FIRST
nuclear-powered surface ship
– **LENIN** icebreaker

6 nuclear icebreakers & **1** lash carrier in operation



Why does Russia need floating nuclear power plant?



- Northern and remote regions occupy **more than 50%** of the Russian territory
- **~20 mn** people live there
- **Richest reserves** of minerals have been discovered and developed here
- **Unified energy system** of Russia covers only **~15%** of the country's territory
- **Northern regions** of Russia are located in **decentralized** energy supply **zone**
- **Low powered thermal energy** sources prevail there
- FNPP provides **reliable and clean heat and power supply** to the population and **ensures potential** for further industrial consumers of Chukotka
- In the future FNPP **will replace** ageing Bilibino NPP and Chaunsk coal fired thermal power plant



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World's first floating nuclear power plant Akademik Lomonosov commissioned



2 x KLT-40S



Displacement	21 000 t
Length	140 m
Beam	30 m
Draught	5.6 m
Fuel cycle	3 years
Design life	40 years
Time to maintenance	12 years
Staff	299*

Thermal capacity

300 MW

Electrical capacity

Up to 77 MW

COGENERATION MODE

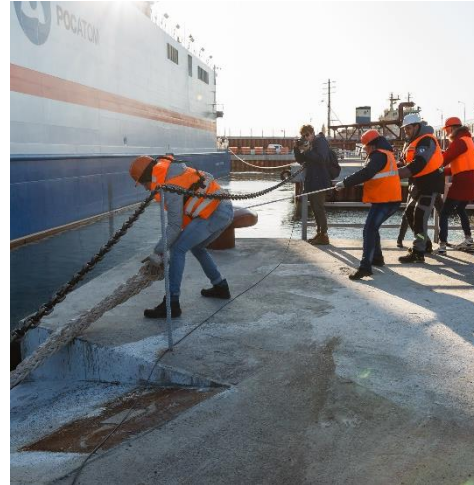
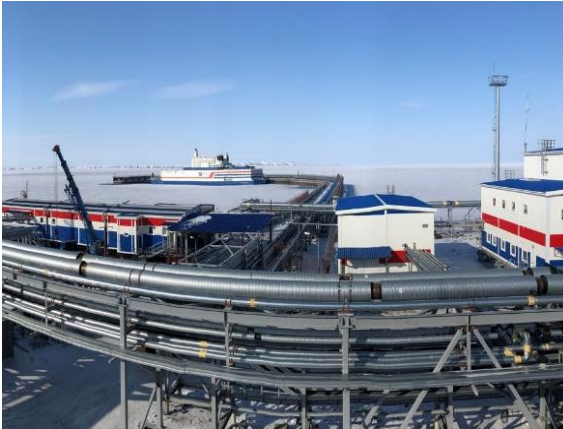
Thermal power
considering the electric power
reduced to 45 MW

146 Gcal/h

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**including operational and support staff*

Commissioning at Pevek



- **December 2019** – FNPP was connected to the grid and started supplying first electricity to Chukotka grid
- **May 2020** – FNPP was fully commissioned
- It became the 11th NPP in Russia and the **northernmost one in the world**
- **June 2020** – FNPP supplied first heat to Pevek city
- The US POWER magazine named this event as **one of the six key** global nuclear energy industry **events** of 2019

FNPP brings socio-economic effects to the region



IMPROVING THE QUALITY OF LIFE

- Heating network reconstruction. The transition from an open heat supply scheme to a closed one completed
- Overhaul of the Pevek airport runway – direct flights from Moscow will be possible
- New qualified jobs created

REDUCING CO₂ EMISSIONS AND ENSURING RELIABLE ENERGY SUPPLY

- Elimination of harmful emissions in the Arctic by replacing Chaunsk coal-fired power plant
- Guarantees region's energy security

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ROSATOM SMR evolution: from KLT-40S to RITM-200



Time proven PWR technology

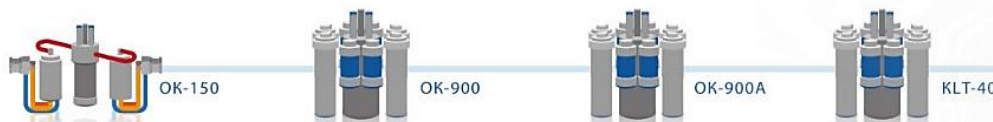
Integral configuration

3+ generation

45% less in the dimensions, 35% less in mass*

more 400


Reactor-years of
successful operation of
small reactors on
icebreakers



** Compared to KLT-40S*

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New Arktika icebreaker commissioned



21 OCTOBER 2020 ARKTIKA
ICEBREAKER OFFICIALLY ENTERED
SERVICE WITH THE RUSSIAN NUCLEAR
ICEBREAKER FLEET

Equipped with **two RITM-200 reactors**

Able to break through ice up to
3 meters

Sibir, Ural, Yakutia, Chukotka
icebreakers to enter operation in
2021, 2022, 2025, 2026

Source of the picture: United shipbuilding corporation

Versatile applications of RITM series SMRs

RITM-200



Thermal capacity, MW

175

Steam generating capacity, t/h

261

Design lifetime, years

40

Fuel cycle, years

4-7

Reactor containment dimensions

6 x 6 x 15.5

Status of the development

In operation

Year of commissioning

2019

RITM-200N



Thermal capacity, MW

190

Steam generating capacity, t/h

305

Design lifetime, years

60

Fuel cycle, years

5-6

Reactor containment dimensions

6 x 6 x 15.5

Status of the development

Land-based NPP under development

Year of commissioning

2027

RITM-200M



Thermal capacity, MW

175

Steam generating capacity, t/h

280

Design lifetime, years

60

Fuel cycle, years

10

Reactor containment dimensions

6.8 x 6.8 x 16

Status of the development

Conceptual design completed

Year of commissioning

2027/2028

RITM-400



Thermal capacity, MW

315

Steam generating capacity, t/h

450

Design lifetime, years

40

Fuel cycle, years

5

Reactor containment dimensions

9 x 8.2 x 17.5

Status of the development

Start of construction works

Year of commissioning

2027

Two options of ROSATOM small NPPs based on RITM series SMRs

FLOATING NPP EQUIPPED
WITH RITM SERIES SMR



LAND-BASED NPP EQUIPPED
WITH RITM SERIES SMR



Two options of ROSATOM small NPPs based on RITM series SMRs

FLOATING NPP EQUIPPED
WITH RITM SERIES SMR



LAND-BASED NPP EQUIPPED
WITH RITM SERIES SMR



FNPP: optimized solution for coastal areas power supply



CURRENT STATUS OF OPTIMIZED FNPP

- ✓ **August 2020** – conceptual design completed
- ✓ **IV quarter 2020** – start of technical design stage

TECHNICAL PARAMETERS

Reactor	2 x RITM-200M
Electrical capacity	100 MW
Fuel cycle	up to 10 years
Design life	60 years
Displacement	16 680 tons
Length	112 m
Beam	30 m
Draught	5 m

OPTIMIZATION RESULTS COMPARED WITH FNPP AKADEMIK LOMONOSOV

by **28 m** – length reduction

by **4 320 t** – displacement reduction

30% – electrical capacity increase

Optimized FNPP benefits

ALL BENEFITS OF NUCLEAR POWER:



A continuous base-load power supply within a 60-year life



Synergy with the renewable energy sources



Effective cost management due to fixed total electricity cost throughout a 60-year life



Multipurpose application including water desalination, district heating



ADDITIONAL SPECIFIC ADVANTAGES OF FNPP



Short period of construction works at the site



No decommissioning at the site



Long fuel campaign (up to 10 years)

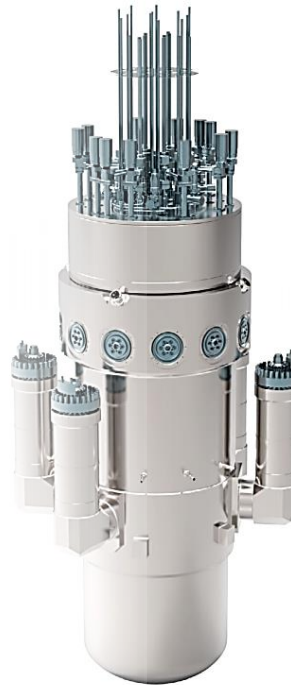


Flexible life-time period



Two options of ROSATOM small NPPs based on RITM series SMRs

FLOATING NPP EQUIPPED
WITH RITM SERIES SMR



LAND-BASED NPP EQUIPPED
WITH RITM SERIES SMR



Land-based NPP equipped with RITM series SMR



2×55 MWe – 110 MWe

2 RITM-200N reactors  **Modularity available**

TECHNICAL PARAMETERS

Electrical capacity	>110 MW (2 x 55 MW)
Thermal capacity	380 MW (2 x 190 MW)
Refueling cycle	5-6 years
Design life	60 years
Availability factor	90%
Plant area	15 acres (0.06 km ²)
Construction period	3 - 4 years



**FLEXIBLE, TAILOR-MADE SMALL NPP SOLUTION
BASED ON RITM SMR IS DESIGNED TO ADDRESS A
WIDE RANGE OF CUSTOMER DEMANDS**

ROSATOM FOAK land-based SMR project









“

*An important aspect of our foreign practices is that ROSATOM always follows the principle: **first we build in our own country and only then offer the technology to the market***

”

Alexey Likhachev

Director General of ROSATOM

-  **2018**
Conceptual design developed
-  **2019**
FOAK site selection process started
-  **2020**
FOAK site in Russia selected
-  **2023**
Site license obtained
-  **2024**
License for construction obtained, start of construction
-  **2027**
Power start-up

ROSATOM LAND-BASED SMR NPP CAN BE POTENTIALLY COMMISSIONED ABROAD STARTING FROM 2028 AND BEYOND AS NTH OF A KIND

Yakutia is selected as a site for the deployment of NPP with RITM-200N reactor

50 MW – energy demand (industry and household consumers)

- Providing the region **not only with electricity**, but also **with heat at a favorable price** compared to alternatives
- **Load-following mode** operation in an **isolated power system**. Significant **reduction** in existing economically feasible electricity tariffs (replacement of **diesel** and **coal facilities**) and **reduction of budget load**
- **SMR** is a **key track** of **Yakutia Energy Strategy 2032**
- **Two potential sites selected** after comprehensive field works
- **Letter of intent** between ROSATOM and the Government of Yakutia **signed**
- **Declaration of Intent** between ROSATOM and the Government of Yakutia **to be signed**



Key take-aways



- 1** Akademik Lomonosov FNPP, equipped with KTL-40S reactors, the world's only floating nuclear power plant, was commissioned in May 2020
- 2** RITM series SMR is ROSATOM flagship energy solution that incorporates all the best features from its predecessors – KLT-40S reactors. It features time-proven PWR technology and 400 reactor-years experience of ROSATOM in operation of small reactors for marine applications
- 3** Land-based and floating options based on RITM series SMRs are available
- 4** RITM series SMR is safe. Safety is enhanced by deliberate design choices such as combination of active and passive systems, inherent safety features, defense-in-depth principle. Resistance against various external events (including tsunamis) is guaranteed
- 5** Land-based SMR NPP project in Russia is already being implemented. 2027 – land-based SMR NPP commissioning. Conceptual design of optimized FNPP is completed

A series of thin, white, curved lines that originate from a point on the right edge and fan out towards the left, creating a sense of motion and depth against the solid blue background.

Thank you for your attention!

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Rusatom Overseas
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