ROSATOM

SMR

Solutions RITM series

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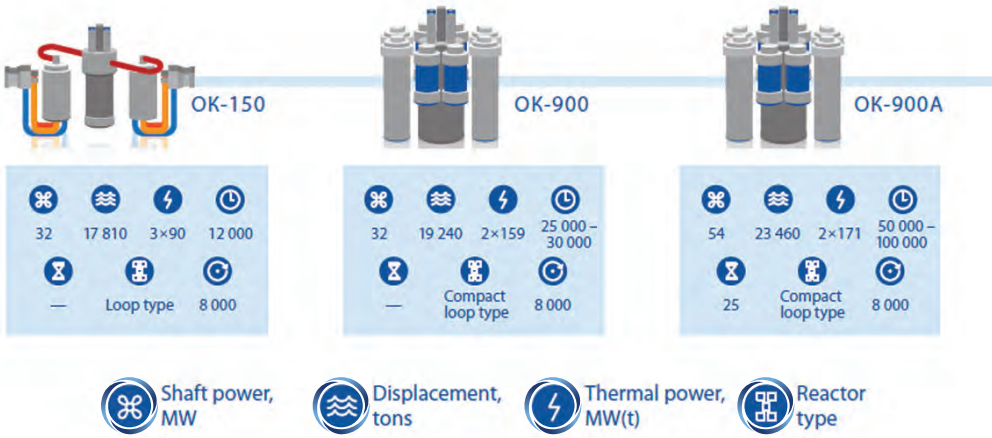
CONTENTS

ROSATOM's EXPERI

In addition to the vast experience in design, manufacturing, construction and operation of large-scale NPPs, ROSATOM also holds an impressive record of reactor technology development for nuclear icebreakers

ABOUT **400** REACTOR-YEARS! OF SAFE OPEARATION

EVOLUTION OF REACTORS FOR NUCLEAR ICEBREAKERS



ENCE in SMR

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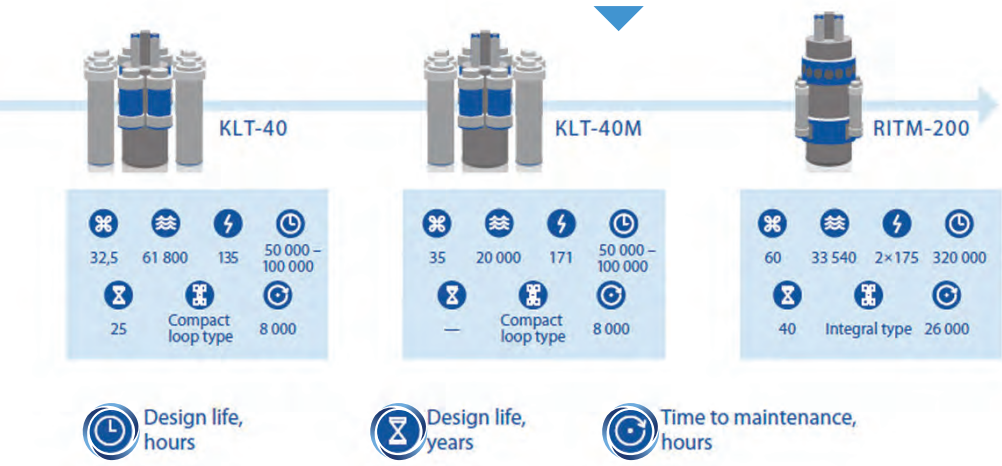
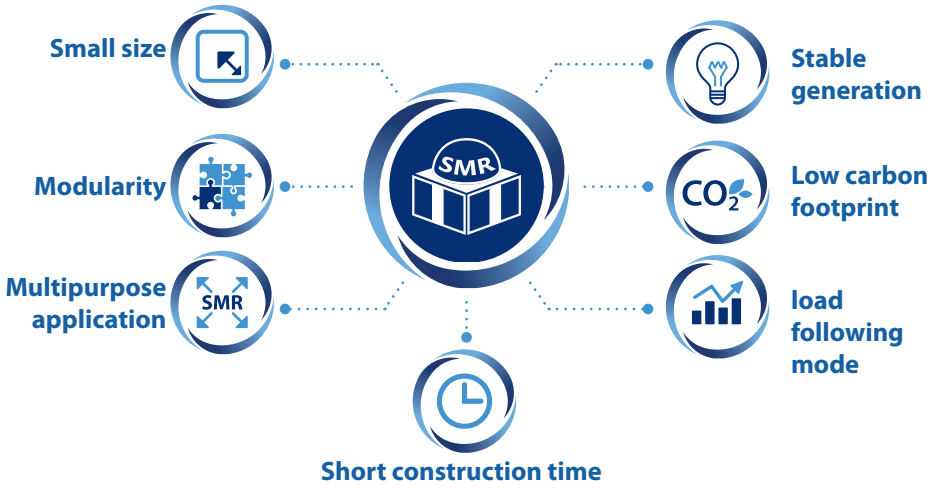
SIX RITM-200 REACTORS ALREADY OPERATE AT NEW-GENERATION ICEBREAKERS. IN NOVEMBER 2022 THE THIRD ICEBREAKER WITH TWO RITM-200 REACTORS ENTERED INTO SERVICE



SMR ADVA

SMR KEY ADVANTAGES

SMR SMALL SIZE OPENS UP NUMEROUS OPPORTUNITIES FOR ITS DEPLOYMENT IN REMOTE AREAS AND LIMITED SITE CONDITIONS



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WHAT ARE THE **KEY ADVANTAGES** OF SMR TECHNOLOGIES FOR THE COUNTRIES THAT DECIDE TO IMPLEMENT THEM?

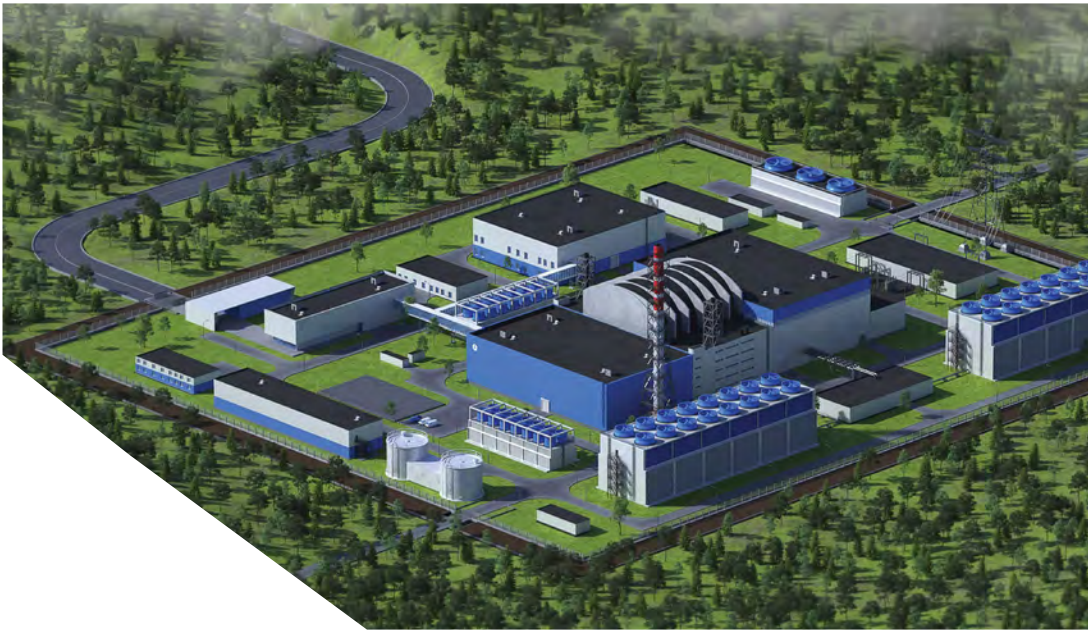
- SMRs can be considered for a wide range of potential sites, including those situated in **EXTREME CLIMATE ZONES** or **LACKING ACCESS TO GRID INFRASTRUCTURE**.
- In addition to land-based solutions, **FLOATING SMR POWER PLANTS** provide ultimate flexibility in terms of supplying power to offshore or coastal sites.
- SMR units can provide synergy with a renewable-based energy system, due to their ability to operate in a **LOAD FOLLOWING MODE**.
- **MODULARITY** is what makes SMR-based energy solutions so attractive for remote areas. It allows to **ADJUST PLANT CAPACITY** to power demand by adding **NEW MODULES**.
- All **MODULES** are prefabricated, which significantly **REDUCES THE COST AND CONSTRUCTION TIME**.
- **MULTI-PURPOSE APPLICATION:** electrical power generation, district heating and water desalination, low-carbon hydrogen production.

LAND-B

ROSATOM is ready to offer a flexible, tailor-made SMR solution, which is designed to address most peculiar customer demands. **TWO SMR DEPLOYMENT OPTIONS** – **FLOATING AND LAND-BASED** – were developed to address all climate, regional and geographic specifics.

SUITABLE FOR SUPPLYING ELECTRICITY, HEAT AND DESALINATED WATER TO:

- LOCAL MUNICIPALITIES
- INDUSTRIAL SITES
- ISOLATED AREAS



ASED

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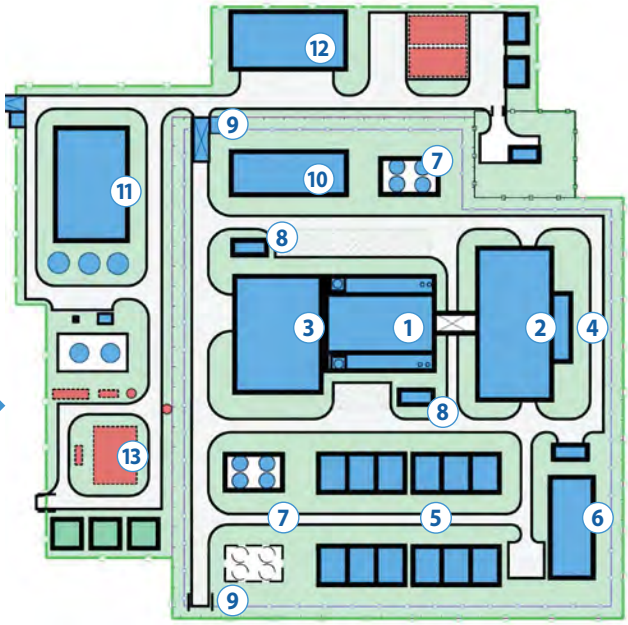
TOTAL AREA:

15 ACRES

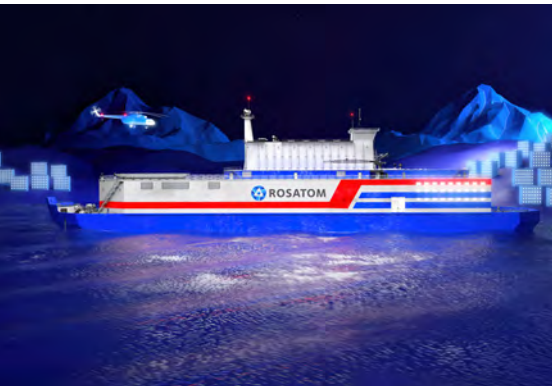
(0,06 km2)



MAIN BUILDING

1. Reactor building
2. Turbine building
3. Radwaste building
4. Indoor switchgear
5. Cooling towers
6. Cooling water pumps
7. Safety cooling towers
8. Backup generators
9. Security gates
10. Administration building
11. Water treatment building
12. Fire station
13. Sewage works

FLOAT



SUITABLE FOR SUPPLYING ELECTRICITY, HEAT AND DESALINATED WATER TO:

- COASTAL AREAS
- OFFSHORE FACILITIES
- ISLANDS AND ARCHIPELAGOES

1 2 FNPP construction and first fueling in the country of origin *

3 4 Transportation to operation site through the territorial sea of transit countries

5 Power and heat production at operation site in host country (up to 10 years before refueling)

6 Return to the country of origin for maintenance and refueling

7 Maintenance and refueling in the country of origin*

8 Radwaste management in the country of origin

9 Return to operation site

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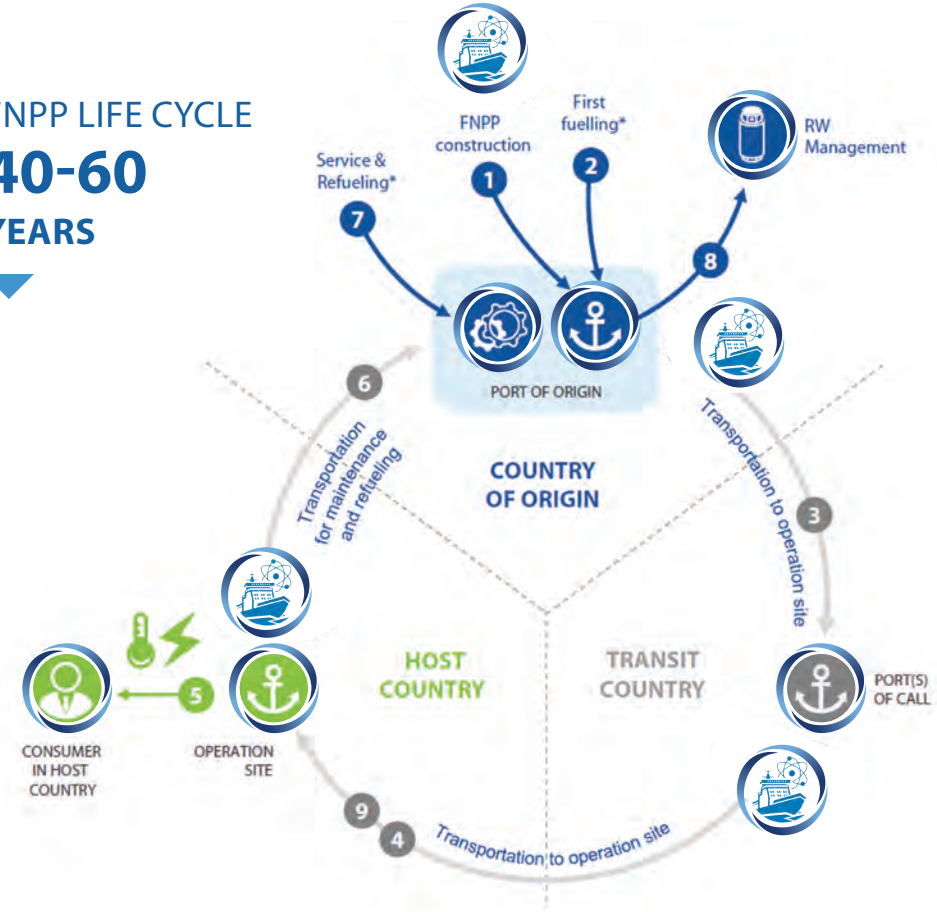
FNPP LIFE CYCLE

40-60

YEARS



** An option. Other customized options are available upon each Project conditions.*

RITM SOLUTI

RITM SERIES – is the **LATEST DEVELOPMENT** in Rosatom's new generation SMR line and has incorporated all the best features from its predecessors.

Initially **RITM** series was developed for nuclear icebreaker ships powered by two reactors.

Later it was adapted for **NUCLEAR POWER PLANT** design. Now RITM series is the flagship Rosatom SMR solution for land-based and floating small power plants.

ROSATOM RITM SERIES IS AN INTEGRAL PRESSURIZED WATER REACTOR (PWR) WITH THE CAPACITY OF >55 MW(e)

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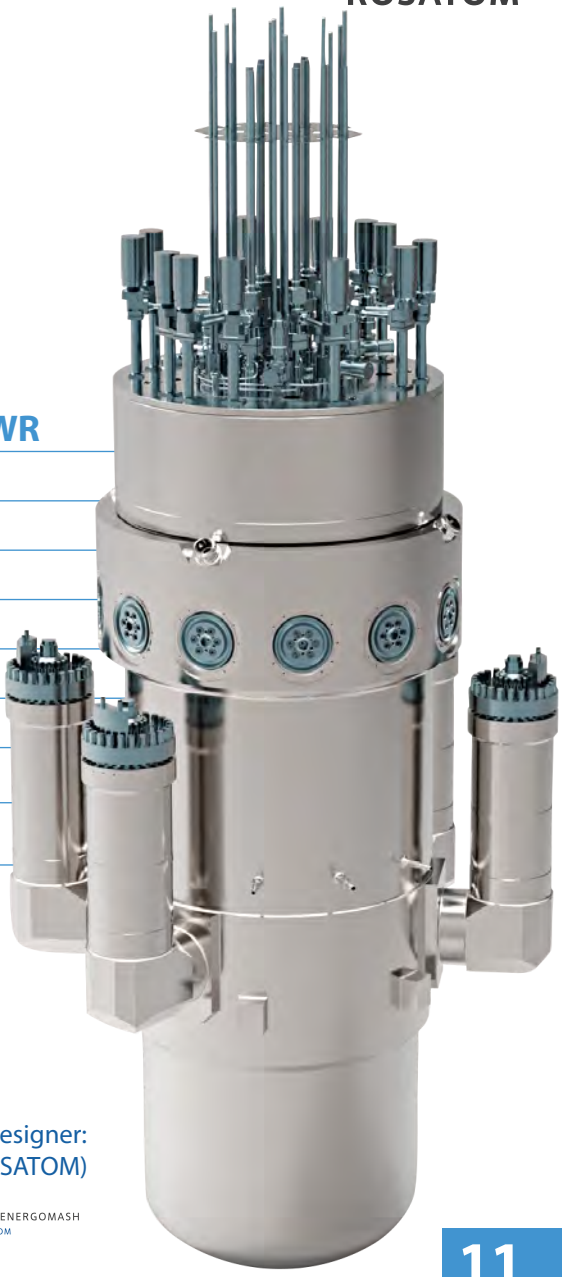
ON

Reactor RITM-200N

Reactor type	Integral PWR
Electrical capacity	>55 MW
Thermal capacity	190 MW
Steam capacity	305 t/h
Steam temperature	295 °C
Steam pressure	3.82 MPa
Design life	60 years
Refueling cycle	up to 5-6 years
Capacity factor	90%
Fuel enrichment	> 20%



Chief designer:
OKBM Afrikantov (ROSATOM)

OKBM AFRIKANTOV ROSATOM

ATOMENERGOMASH ROSATOM

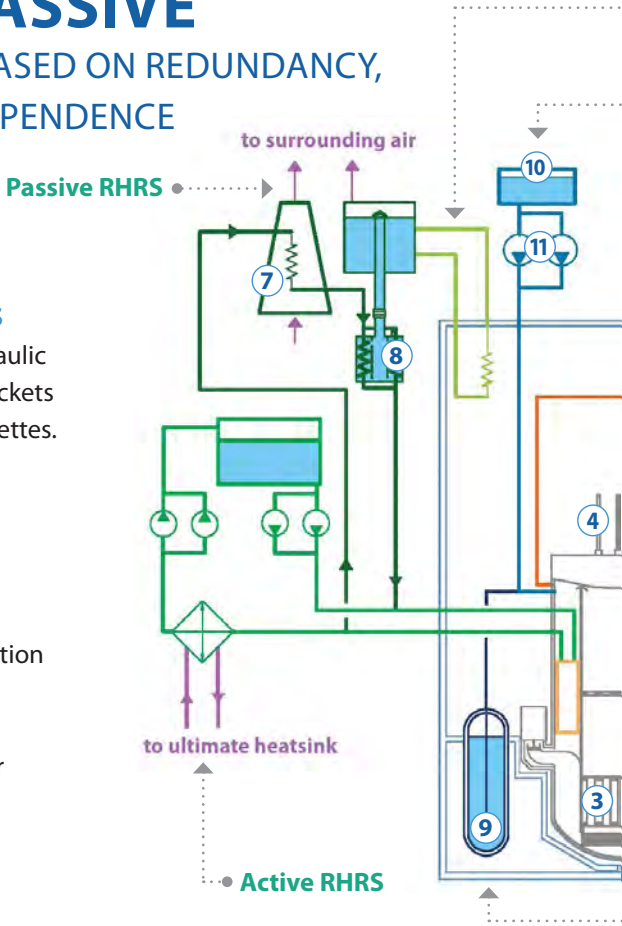
- DEFENCE IN DEPTH PRINCIPLE
- INHERENT SAFETY FEATURES
- **ACTIVE & PASSIVE**

SAFETY SYSTEMS BASED ON REDUNDANCY, DIVERSITY AND INDEPENDENCE

The reactor is designed as an integral vessel with the ① **MAIN CIRCULATION PUMPS** located in separate external hydraulic chambers with side horizontal sockets for ② **STEAM GENERATOR** cassettes.

RITM-200 adopts a referenced ③ **LOW ENRICHED URANIUM CORE** that ensures long time operation without refuelling and meets international non-proliferation requirements.

④ **CONTROL ROD DRIVE MECHANISM (CRDM)** is used for reactivity control.



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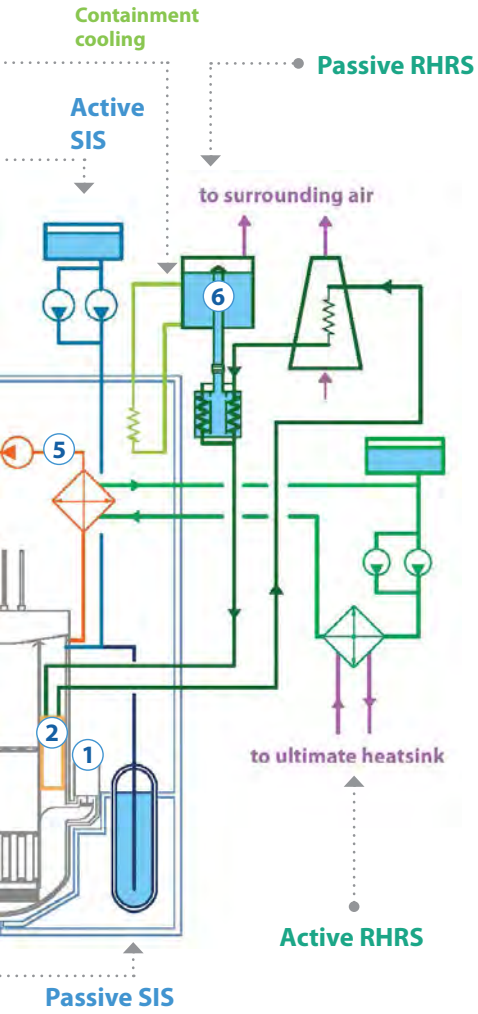

RESIDUAL HEAT REMOVAL SYSTEM (RHRS)

is designed to remove residual heat from the core after the reactor shutdown. Active trains remove heat from the core through a steam generator and the heat exchanger of primary circuit (5) **COOLANT PURIFICATION LOOP**. Two passive safety loops with natural coolant circulation from (6) **WATER TANKS** through steam generators, (7) **AIR-TO-WATER HEAT EXCHANGERS**, and (8) **WATER HEAT EXCHANGERS**.

SAFETY INJECTION SYSTEM (SIS)

is designed for water injection in primary circuit to mitigate the consequences of a loss-of-coolant accident (LOCA). The system is based on two passive pressurized (9) **HYDRAULIC ACCUMULATORS** and two active channels with (10) **WATER TANKS** and two (11) **MAKE-UP PUMPS** in each channel for redundancy.

AKADEMIK LOMONOSOV

ROSATOM is the **WORLD'S PIONEER** in developing **FLOATING NUCLEAR POWER PLANTS**.

AKADEMIK LOMONOSOV FNPP – IS THE FIRST-OF-A-KIND FLOATING NUCLEAR POWER PLANT PROJECT IN THE WORLD.

OSOV FNPP

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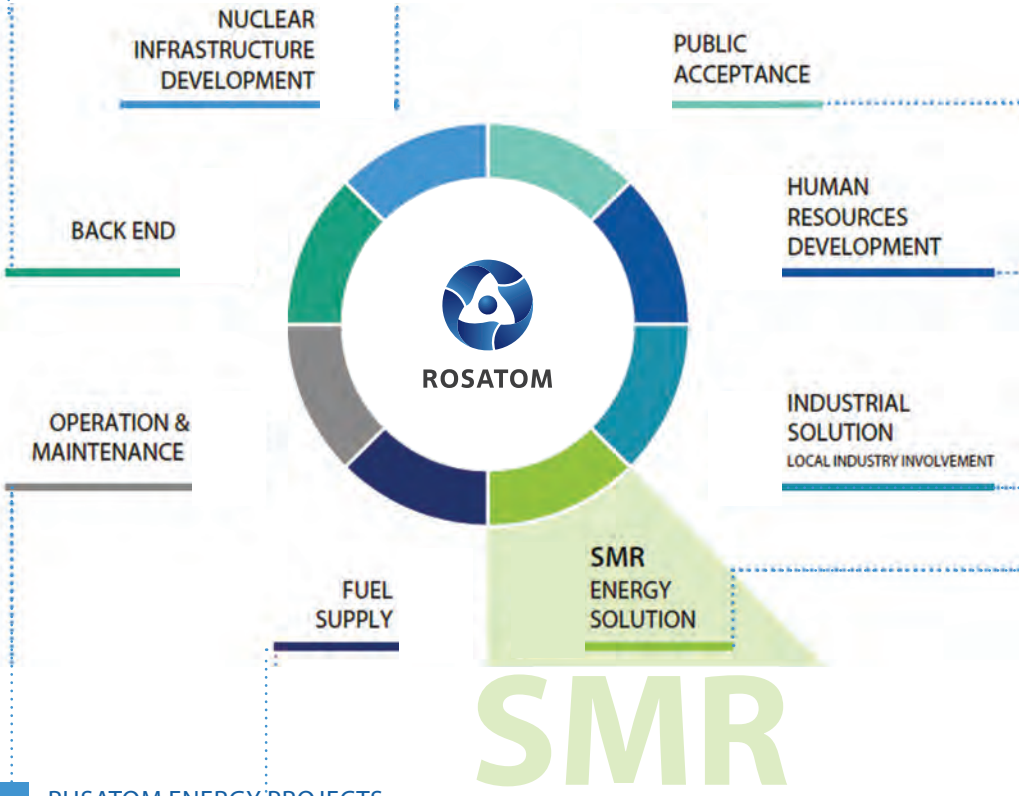
Reactor	2 × KLT-40S
Electrical capacity	> 70 MW
District heating	up to 146 Gcal/h
Thermal capacity	300 MW (2 × 150)
Length	140 m
Beam	30 m
Draught	5.6 m
Displacement	21 000 t
Refueling cycle	up to 3 years
Design life	40 years
Mobility	Towed

ROSATOM INTEGRATED OFFER



ROSATOM SUPPORTS ITS CUSTOMERS THROUGHOUT THE CIVIL NUCLEAR PROGRAM: FROM THE VERY INTRODUCTION OF A NUCLEAR OPTION INTO THE ENERGY STRATEGY TO DECOMMISSIONING OF THE LAST NUCLEAR FACILITY.

ROSATOM

BACK END
providing eco-friendly solutions for spent nuclear fuel and radwaste treatment and decommissioning nuclear facilities

NUCLEAR INFRASTRUCTURE DEVELOPMENT
preparing the customer country to host a nuclear facility in accordance with the world's best practices, as well as IAEA requirements

PUBLIC ACCEPTANCE
raising public awareness of the benefits, that nuclear energy provides and disseminating positive information about its effects among the population

HUMAN RESOURCES DEVELOPMENT
training the qualified professionals to manage a national nuclear program and to operate nuclear facilities safely and efficiently

INDUSTRIAL SOLUTION
enabling local suppliers to contribute to the national nuclear program and giving a boost to the local economy

ENERGY SOLUTION
design, construction, and commissioning of large-scale NPPs, featuring the state-of-the-art VVER-1200 and SMR technologies designed to be a reliable source of power

FUEL SUPPLY
uninterrupted fuel supply throughout the NPP operation cycle to ensure continuous power flow in the national grid

OPERATION & MAINTENANCE
managing safe operation and cost-effective power generation at NPPs

OTHER ROSATOM ENERGY SOLUTIONS

SHELF-M

Micro SMR Solution,
<10 MWe

SVBR-100

Generation IV SMR,
100 MWe

VVER-600

Medium Power
Solution,
600 MWe

BN-TYPE REACTORS

Sodium Cooled Fast Reactor

ROSATOM

ALL RUSSIAN–DESIGNED NPPS SAVE:

207 M TONES

CO_2EQ ON AVERAGE PER YEAR

SUSTAINA
DEVELOPMENT

NUCLEAR ENERGY IS THE ONLY EXISTING TYPE OF GENERATION THAT MEETS ALL THE CRITERIA OF SUSTAINABLE ENERGY SYSTEMS AT ONCE

COST PREDICTABILITY FOR POWER GENERATION

NON-INTERMITTENT POWER SUPPLY

MINIMUM GHG EMISSIONS DURING LIFECYCLE

CLIMATE CHANGE MITIGATION

ENERGY SECURITY

ACCESS TO ENERGY

STABLE POWER SUPPLY FOR 60+ YEARS

ABLE
T GOALS

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NUCLEAR POWER CONTRIBUTES TO

JOB CREATION

EACH NPP UNIT* CREATES
200,000
JOB-YEARS
OVER ITS LIFECYCLE

ECONOMIC

CLIMATE MITIGATION

GLOBALLY, NUCLEAR POWER PLANTS PRODUCE MORE THAN

ONE QUARTER (1/4) OF ALL LOW CARBON ELECTRICITY.

ENVIRONMENTAL

ACCESS TO ENERGY

ONE NPP* CAN PROVIDE ACCESS TO BASELOAD LOW-CARBON ENERGY FOR
5 **ABOUT MLN** PEOPLE

SOCIAL

THREE SUSTAINABLE DEVELOPMENT **PILLARS**

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