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BUSINESS DEVELOPMENT REPORT



ROSATOM

RUB 697.5
BILLION

REVENUE FROM NEW
PRODUCTS

STATEMENT BY THE FIRST DEPUTY DIRECTOR
GENERAL FOR DEVELOPMENT AND
INTERNATIONAL BUSINESS

Dear colleagues and partners,

You are reading the business development report of State Atomic Energy Corporation Rosatom for 2022. We remain committed to the principle of openness and continue to operate on a global scale and comply with international quality and transparency standards.

During the past year, we had to adapt quickly to a new environment. Despite external pressure, we continue to fulfil all our contractual commitments. We are convinced that nuclear power should not be politicised; accordingly, we adhere to a business-focused approach in order to maintain our foothold on the international market.

In the context of our business, the reporting year can be described as successful: we achieved a significant increase in foreign revenue compared to 2021, which exceeded the target and totalled more than USD 11 billion.

The Corporation is actively developing its traditional business and continues to implement overseas nuclear power projects, with 23 power units currently under construction. In 2022, ROSATOM started the construction of eight NPP power units worldwide, including five Russian-design power units.

Speaking of overseas projects, I would like to highlight the Akkuyu NPP site in Turkey: this is currently the largest nuclear construction project in the world, with four power units simultaneously under construction. In 2022, two official ceremonies were held to mark the start of concreting at the El Dabaa NPP site in Egypt with an interval of four months, which is a record for the global nuclear industry. In addition, the Corporation has obtained licences for the construction of the fifth

and sixth power units equipped with VVER-1200 reactors at Paks NPP in Hungary; this is the first licence for the construction of reactors of this type in the European Union.

We see growing global demand for small NPPs. The Corporation has extensive expertise and capabilities in this area supported by a long track record of successfully operating the nuclear-powered icebreaker fleet and the first floating NPP, *Akademik Lomonosov*, which has been supplying electricity and heat to Chukotka for almost three years. In addition, we are currently implementing a large-scale project to provide power supply for the Baimskoye gold and copper deposit in Chukotka, which involves building four floating power units. We are also implementing the first onshore small NPP project in Russia, which will be situated in Yakutia. Reference projects implemented domestically enable us to maintain an active dialogue with our foreign customers. During the past year, we signed bilateral agreements and documented intentions with partners from the Kyrgyz Republic, the Republic of the Union of Myanmar, etc.

We also see the potential in other countries. Foreign partners are considering cooperation with ROSATOM, as we not only offer the best technologies but also support the overall development of individual sectors, including science, the development of the relevant legal framework, local content and personnel training. This comprehensive approach contributes to energy self-sufficiency and technological sovereignty of our partners, which is probably the key task for every country in the current environment.

In the sphere of the NFC, despite external factors, ROSATOM has fulfilled all its contractual obligations related to the export of uranium products and nuclear fuel, including supplies to customers in the US and Europe. JSC TENEX has entered a new market in Brazil with a long-term arrangement for the provision of uranium enrichment services. In 2022, ROSATOM's share on the global markets for natural uranium mining, uranium enrichment services and nuclear fuel fabrication stood at 14%, 35% and 17% respectively.

I would like to point out that technological solutions offered by ROSATOM in the sphere of environmental protection are also in demand. For instance, a contract has been signed for the rehabilitation of the Taboshar industrial site in Tajikistan, including uranium dumps and tailings storage facilities.

ROSATOM continues to develop high-technology solutions for non-energy applications. Nuclear medicine is an important focus area. The Corporation already offers integrated solutions covering various aspects, from medical isotopes to own healthcare centres. In 2022, ROSATOM started to supply Brachium gamma radiation therapy facilities designed for comprehensive cancer treatment using the brachytherapy method. The pro-

cedures have demonstrated that this equipment enables highly effective treatment, which has attracted the interest of foreign customers. Simultaneously, we are expanding the sales geography of Tianox devices for inhaled nitric oxide therapy, which have also proved to be efficient.

In addition, in 2022, stage 1 and 2 facilities of the world's highest-altitude Nuclear Research and Technology Centre in Bolivia, namely the Cyclotron Radiopharmacy Preclinical Complex (CRPC) and the Multipurpose Irradiation Centre (MIC), started pilot operation. Radiopharmaceuticals produced by the CRPC will make it possible to carry out clinical examinations for more than 5,000 patients per year, while the MIC will process agricultural produce and food products to ensure their safety and extend their shelf life; it will also use irradiation technology for the sterilisation of medical products

In 2022, ROSATOM also achieved record results in terms of new business development. Revenue from new products reached a record high of RUB 697.5 billion, which is twice as high as the target.

ROSATOM is making steady progress in developing international partnerships in the sphere of electric transport: in 2022, the Corporation start-



ROSATOM'S SHARE
ON THE GLOBAL MARKETS
FOR NATURAL
URANIUM MINING

ed to supply lithium-ion batteries to a leading Belarusian producer of electric vehicles for urban transport. Lithium-ion batteries have a high energy density and capacity; they are sustainable and make urban life more comfortable.

In the motor transport segment, we are building up our capabilities related to the manufacture of high-pressure cylinders of various classes. Cylinders supplied by ROSATOM are used on public transport and trucks, enabling a significant reduction in vehicle weight and size.

We have already acquired local expertise in the sphere of wind power generation. Seven wind power plants are in operation, and another two are under construction. In the future, we plan to launch our product on the global wind turbine market. In 2022, JSC NovaWind and representatives of a Vietnamese company An Xuan Energy JSC signed a cooperation agreement on a project to build a wind farm.

In addition, hydropower projects are underway; these are focused primarily on small hydropower plants. ROSATOM has adopted a holistic approach to this area: the project implementation process starts with a pre-feasibility study and involves performing the full range of work, up to and including the commissioning of the facility in question.

Special mention should be made of the development of the Northern Sea Route (NSR). The Corporation has set itself an ambitious task of enabling year-round navigation by 2030 in order to provide flexible logistics arrangements for its partners. We see that the transit capabilities of the NSR have attracted the interest of international businesses, primarily Asian and Middle Eastern companies, for which it will serve as an additional environmentally sustainable and stable route.

Looking back on 2022, I would like to emphasise that the year was full of business activity, and we intend to keep up the pace in the future and offer our partners high-technology solutions that help to improve people's lives.



Kirill Komarov

First Deputy Director General for Development and International Business



GRI 2-6 GRI 3-3 2.1. BUSINESS DIVERSIFICATION

One of ROSATOM's strategic goals is to develop new products. The relevant operations provide new opportunities for developing healthcare and municipal infrastructure, improving environmental safety and making progress in other key areas relevant to sustainable development.

New business areas have been formed taking into account the maximum number of overlaps with existing technical, technological and research competences, including the research and production capabilities of ROSATOM's organisations. Responsibility for new business development has been assigned to the Development and International Business Unit of ROSATOM.

Key results in 2022:

- Revenue from the sales of new products outside the scope of the nuclear industry totalled RUB 697.5 billion, up by 111.9% compared to 2021.
- The 10-year portfolio of orders for new products outside the scope of the nuclear industry reached RUB 2,250 billion, up by 13.9% compared to 2021.

2.1.1. Management system

The system for managing new businesses at the level of the Corporation is focused on the development of strategic programmes (Wind Power, Products and Services for the Oil and Gas Industry, Industrial and Consumer Waste Management, Development of the Nuclear Medicine and Technology Product Line, Energy Storage Systems Based on Electrochemical Cells, Additive Manufacturing, Digital Products, the Smart City, an International Logistics Operator, APCS and Electrical Engineering, Development of the Lithium Business, Renewable Energy (Foreign Markets), Hydrogen Energy, Gold Mining, etc.).

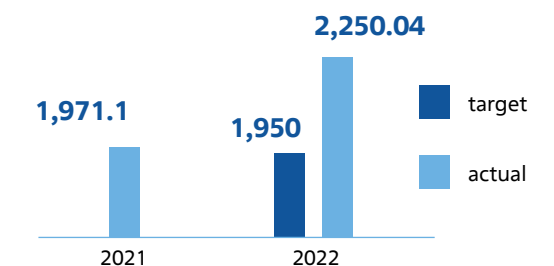
At the same time, the Corporation is actively searching for areas that may become strategically important in the near future.

2.1.2. Results in 2022

Last year, revenue from the sales of new products of ROSATOM's organisations to counterparties outside the industry totalled RUB 697.5 billion, which is 108.2% higher than the target set for 2022 (RUB 335 billion) and 111.9% higher than the figure for 2021 (RUB 329.1 billion).

The target and historical figures were exceeded in 2022 mainly due to an increase in volume in the following business areas: transportation and logistics services, electricity sales, special steel, digital products, reprocessed products, solutions for the urban environment, shipbuilding, and SNF management.

ROSATOM's 10-year portfolio of orders for new products (outside the scope of the Corporation), RUB billion



Process control systems and electrical engineering

In order to replace imported radio and electronic equipment used in automated process control systems and manufacturing execution systems (APCS and MES), as part of R&D activities conducted in 2022, the Corporation developed engineering designs and produced mock-ups of industrial network switches using domestically produced basic electronic components.

To meet the needs of the nuclear industry, prototypes of 6 (10) kV cubicle switchgear were produced based on components supplied by Russian manufacturers, and research focused on generator switches and on the search for technical solutions for sealed cable penetrations was completed. As part of efforts to improve information security and cybersecurity at nuclear facilities, a software and hardware system was developed to ensure information security of APCSs at NPPs; a pilot APCS test site was established to test software and hardware and software systems.

For non-nuclear markets, a SCADA system was developed in-house, and mock-ups of switches for industrial data networks were developed and produced.

Plans for 2023 include the following:

- Expanding the footprint on external automation markets; to do so, the Corporation will obtain licences for a new controller and an engineering centre;
- Completing the development of a number of digital products and solutions in the sphere of information security in order to expand the range of trusted digital platforms offered by the Corporation;
- Starting the commercialisation of the SCADA system developed by the Corporation, including certification by the FSTEC of Russia and validation by key customers, as well as developing software for a digital industrial platform and testing it to assess its compliance with information security requirements.

Wind power

Following competitive selection as part of the DPM RES and DPM RES 2 government programmes aimed at promoting the development of renewable energy generation in the Unified Power System of Russia, ROSATOM has formed a portfolio of projects with a total capacity of 1.7 GW.

On 19 December 2022, ROSATOM’s seventh wind farm, the 60 MW Berestovskaya WPP, was put into operation. Thus, by year-end 2022, seven wind farms with a total capacity of 780 MW were in operation.

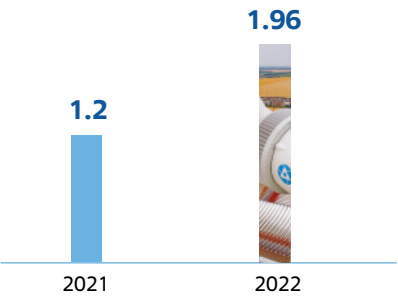
The WPPs generated 1.96 billion kWh of electricity in 2022.

In 2022, investments exceeded RUB 27 billion (including VAT).

ROSATOM produces 2.5 MW wind turbines in-house. At year-end 2022, local content in equipment produced by the Corporation stood at 68%.

In 2023, ROSATOM plans to commission the 160 MW Kuzminskaya WPP and the 95 MW Trunovskaya WPP. As a result, the number of wind farms managed by JSC NovaWind will reach nine wind power plants, while their total installed capacity will exceed 1 GW.

Electricity output from WPPs in 2021 and 2022, billion kWh



Plans for 2023 also include the first project acquisitions outside Russia. In accordance with ROSATOM’s international business strategy, the target for the total installed capacity of overseas wind farms to be owned by the Corporation by 2030 has been set at 5 GW.

Hydrogen energy

An integrated road map for the development of the Hydrogen Energy high-technology area until 2030 has been approved. On 16 January 2023, the Government of the Russian Federation and ROSATOM signed an Agreement on Cooperation in the Development of Hydrogen Energy drafted in 2022.

Under the agreement, by 2030, ROSATOM will implement a programme focused on domestically developed technologies for the production and handling of hydrogen and will start mass production of Russian electrolysis units of various capacity. The Corporation will also work on a project to build a nuclear power plant for hydrogen production comprising high-temperature gas-cooled reactors and chemical processing facilities.

On 16 February 2022, the Corporation participated in the establishment of the National Hydrogen Energy Development Union (the National Hydrogen Union). The Union aims to promote cooperation between businesses and research institutes in order to develop hydrogen energy in Russia, coordinate the efforts of market players, support the implementation of the National Hydrogen Programme, and formulate proposals for regulations on support to be provided to the sector jointly with government agencies. It is expected that the Union’s members will include companies, consumers, financial institutions and research organisations.

A number of agreements have been signed with Russian and foreign partners in order to develop cooperation and unlock opportunities for joint implementation of pilot hydrogen projects. As a follow-up to an R&D cooperation agreement with Moscow Institute of Physics and Technology (MIPT), a contract has been signed for the delivery of a pilot hydrogen production module.



TARGET FOR THE TOTAL
INSTALLED CAPACITY
OF OVERSEAS WIND FARMS
TO BE OWNED BY THE
CORPORATION BY 2030

Logistics services

The number of shiploads transported in 2022 increased by 10 compared to 2021 and totalled 19; 75,000 freight tonnes of cargo were transported (up by 50,000 freight tonnes compared to 2021).

The order portfolio totalled RUB 3.5 billion, up by RUB 1.7 billion compared to 2021. Cargo deliveries were made for Rooppur NPP (Bangladesh), Akkuyu NPP (Turkey) and Kudankulam NPP (India). In addition, cargo deliveries from Russia, India, China and other countries were arranged. Customs clearance of 20 million tonnes of coal to be transported to China was arranged.

In 2022, test cargoes were transported along the North – South and Silk Road International Transport Corridors.

Amid restrictions imposed by the EU on Russia and Russian hauliers, cargoes critical for NPP equipment manufacture were delivered to Russia. Oversized cargo with a volume of about 1,500 m³ was shipped to Rooppur NPP, setting a record in the history of LLC Rusatom Cargo.

To support the implementation of the Eurasian Container Transit project, in 2022, contracts were signed for the design of Arctic container ships and the Western Transport and Logistics Hub (WTLH); a conceptual design of the container ship was developed, and the relevant tests were conducted. As part of the development of the WTLH, a lease agreement was concluded for a land plot in the Murmansk Region in order to carry out surveys. Engineering surveys were mostly completed in the reporting year. In 2022, a concept for the digitisation of the Eurasian Container Transit project was developed and approved; these developments underpin the design of the WTLH and the commercial fleet.

In 2023, the Corporation plans to take steps to improve the efficiency of logistics arrangements in the industry and to develop commercial logistics.

Gas and petrochemical industry

In March 2022, the first tests were completed on a new test bench for medium- and large-capacity equipment for LNG projects built by JSC Atomenergomash at the site of JSC Efremov Institute of Electrophysical Apparatus (NIIIEFA) in Saint Petersburg; the test bench is unique in Europe. The first item of equipment to be tested on the test bench was the ENK 2000/241 large-capacity cryogenic LNG pump designed to load liquefied gas from storage tanks into the tanks of an LNG carrier. It currently has the highest performance among LNG pumps manufactured in Russia. The successful tests confirmed the reliability and operability of equipment made in Russia and validated the capabilities of ROSATOM's Mechanical Engineering Division in the sphere of development of new high-technology products for the gas industry.

The development of a fundamentally new LNG storage and transportation technology involving the use of independent tanks made of carbon-fibre-reinforced plastic has been initiated. Research focused on the development of a cargo containment system, including the design of a Project 10070 gas tanker, has been completed, and positive feedback has been obtained both from the Maritime Register and from Russian shipowners that are potential customers for this product. The project has been included in the Northern Sea Route development plan until 2035 and supported by the interdepartmental Commission on Promoting National Interests in the Arctic under the Security Council.

ROSATOM has initiated the production of a pilot prototype of the first Russian working fluid turboexpander with the fullest possible use of domestically produced components and the first Russian LNG loading arm, with tests scheduled for 2023.

Shipbuilding

Enterprises in the Mechanical Engineering Division have shipped a total of eight RITM-200 reactors for four icebreakers.

Power ships based on MFPUs

As part of the development of new nuclear power technologies, the Mechanical Engineering Division is building follow-on floating power units (FPUs), the Corporation's new promising product designed to provide power supply to remote areas and new industrial clusters and production facilities.

In 2022, the Division started to manufacture RITM-200S reactor units for the FPUs that will provide power supply for the Baimskaya Ore Zone, and the hulls of the first two FPUs were laid down.

A total of four FPUs with installed power generation capacity of up to 110 MW each (three main FPUs and one standby FPU) will be produced. The project to provide power supply for the Baimskaya Ore Zone has given impetus for the development of an entire family of FPUs differing in terms of their capacity and applications (designed for use in the Arctic and in tropical regions), providing ample opportunities for the implementation of large-scale industrial projects and exports from the Russian Federation.

Environmental protection

As part of the Infrastructure for the Management of Hazard Class 1 and 2 Waste Federal Project, in 2022:

- Preparatory, construction and installation work was carried out in the Saratov and Kurgan Regions (the Gorny and Schuchye facilities); main steel structures were assembled; the construction of new buildings and deliveries of process equipment were initiated. In addition, construction was started in the Kirov Region and the Udmurt Republic (the Maradykovsky and Kambarka facilities); preparatory work was carried out;
- Positive opinions following state expert reviews and construction permits were obtained for greenfield industrial facilities to be built in the Irkutsk and Tomsk Regions (the Vostok and Western Siberia facilities); construction contracts were concluded, and preparatory work was started. A contract was concluded for the development of design documentation and the construction of the RG Centre industrial facility in the Nizhny Novgorod Region;
- In the sphere of hazard class 1 and 2 waste management, FSUE FEO (an organisation within ROSATOM's scope of consolidation), which is the federal operator responsible for hazard class 1 and 2 waste management, started to operate on 1 March 2022. A digital platform, FGIS OPVK, has been introduced; it is designed for waste tracking and the monitoring of its management, and for managing the operations of market players. At year-end 2022, 34,400 waste-generating organisations, as well as operators providing hazardous waste transportation and processing services were operating in the digital environment.

As part of the Clean Country and Preservation of Lake Baikal Federal Projects, the Corporation continued the remediation of particularly challenging legacy sites causing environmental damage.

Work was started as part of the project to repair historical environmental damage at the Krasny Bor toxic industrial waste landfill. Construction of a multilayer cut-off wall surrounding the landfill site was underway; it is designed for groundwater diversion and prevents the seepage of contaminants to adjacent areas. The structure will be equipped with an automated control system. In addition, the construction of infrastructure for wastewater treatment and for the processing of liquid and paste-like waste stored in open landfill cells was started.

Government contracts were concluded as part of the project to repair historical environmental damage in the Usolye-Sibirskoye municipality (Irkutsk Region). The dismantling of superstructures of 204 buildings and structures was completed ahead of schedule.

As part of the project to repair historical environmental damage from the operations of OJSC Baykalsk Pulp and Paper Mill (BPPM), measures were implemented to lower the water level above the sludge layer in landfill cells at the Babkhinsky and Solzansky landfills. This helped to prevent the contamination of Lake Baikal with waste generated by the enterprise. About 70,000 m³ of sludge water was treated and transferred to municipal sewage treatment facilities in Baykalsk.

Design work was completed as part of measures to repair historical environmental damage at the site of sewage treatment facilities, including industrial spaces where black liquor is stored (the central wastewater treatment facilities), and at the Babkhinsky landfill site; positive opinions were obtained following state expert reviews.

In 2023, the Corporation will continue to build infrastructure to enable the safe management of hazard class 1 and 2 waste, with the Gorny and Schuchye sites to be commissioned in December 2023.

In 2023, the Corporation will continue to take steps to repair environmental damage caused by legacy sites. Measures to repair historical environmental damage at the Krasny Bor landfill site are scheduled to be completed in 2025, while work in the Usolye-Sibirskoye municipality and at the site of OJSC BPPM (the Babkhinsky landfill and the site of the central wastewater treatment facilities) is scheduled for completion in 2026.

Energy storage systems

In October 2022, the construction of Russia’s first ‘gigafactory’ started in the Kaliningrad Region; the factory will produce lithium-ion batteries (cells) and assemble battery modules. The factory will meet the demand of Russian electric vehicle producers for lithium-ion traction batteries; it will also produce stationary energy storage systems for the power grid and for industrial enterprises.

The factory will become a fully integrated lithium-ion battery production facility, with its operations covering all stages from the mixing of cathode and anode mass components to the outgoing inspection of finished products.

The first batteries will come off the production line in 2025. The first stage of the ‘gigafactory’ will have a capacity of 4 GWh per year, supplying lithium-ion batteries for up to 50,000 EVs. If demand for the products is confirmed, the second and third stages of the factory may be commissioned.

Battery assembly capacity in Russia has been increased from 15 MWh per year to 150 MWh per year; a universal battery module based on a new type of lithium-ion cells has been developed.

Nuclear medicine

Despite restrictions, in 2022, ROSATOM managed to increase its overseas revenue from isotope products.

Imports of life-saving drugs were replaced. More specifically, deliveries of radioimmunoassay (RIA) kits produced in Belarus were started in order to replace brands that had left Russia, and the supply of samarium-153 oxabifor for the treatment of bone metastases was increased by 53%.

As part of the promotion of BRACHIUM gamma radiation therapy facilities, the Tula Regional Cancer Centre was the first in Russia to receive a BRACHIUM machine and carried out the first radiation therapy procedures.

A registration certificate was obtained from the Federal Service for Surveillance in Healthcare (Roszdravnadzor) for the ONYX radiation therapy facility.

The pilot operation of a manufacturing site was started as part of the project to localise the manufacture of diagnostic equipment.

The project to develop a competitive domestically produced 1.5 T MRI scanner received government support from the Ministry of Industry and Trade. On 15 December 2022, an agreement was signed on the provision of subsidies from the state budget. JSC Rusatom Healthcare and JSC NIITFA concluded a contract for the development of the MRI scanner.

As part of the initiative to establish a multipurpose irradiation centre in the Republic of Tatarstan, the production of main process equipment and the construction of a shielding room for an accelerator were started.

The development of a pilot ONYX remote radiation therapy facility (KLT-6) by JSC NIITFA is nearing completion. The project will help to promote the widespread use of new medical techniques and domestically produced equipment in clinical practice, guarantee a higher quality of treatment for cancer patients and reduce dependence on expensive imported equipment.

Additive manufacturing

In the reporting year, the first commercial delivery of an industrial 3D printer using the selective laser melting technology developed in-house was made.

A pilot sample of a DMD printer based on two industrial robots and a positioner was put into operation; the relevant technology was developed, and a fragment of a partition for an in-vessel device of a VVER-TOI reactor with an optimised design was produced from 08H18N10T stainless steel.

Batch production of stainless steel powders was launched, and an additive manufacturing centre was opened in Novouralsk (Sverdlovsk Region).

Two 3D printers using the selective laser sintering and direct laser growth techniques were put into operation at the site in Nizhny Novgorod in order to introduce additive manufacturing technologies into the production cycle of the enterprise and print parts for the nuclear industry.

The pre-commissioning of a pilot sample of 3D equipment for wire-based electron-beam additive manufacturing (EBAM) was completed; a technology was developed for the manufacture of a blank for the outlet of a magnetohydrodynamic pump for an analogue of the BREST-OD-300 reactor.



TOTAL INSTALLED
POWER GENERATION CAPACITY
OF ROSATOM’S THERMAL
POWER PLANTS

An integrated process chain for the printing of parts involving heat treatment in the commissioned vacuum kiln, post-processing and 3D scanning was set up at the additive manufacturing centre in Moscow; parts for the aircraft industry were printed from superalloys.

A new product was developed, namely the MARPAK mobile automated additive manufacturing facility for repairs and production; field tests of the first pilot sample are underway.

The development strategy for this business area involves launching mass-produced 3D printers using metal powder compositions and wire materials on the market, launching batch production of stainless steel powders, superalloys and titanium alloys, and further expanding the network of additive manufacturing centres.

Small nuclear power plants

An agreement has been signed to supply power from a small nuclear power plant for the development of the Kyuchus deposit in the Ust-Yansky and Verkhoyansky Districts in the Sakha Republic (Yakutia).

Under the agreement, an onshore small NPP with a RITM-200N reactor unit will supply electricity for 40 years starting from 2028. A positive opinion has been obtained from the State Environmental Expert Review Board for supporting materials for the licence for the placement of the NPP.

ROSATOM has signed a Cooperation Agreement with the Ministry for the Development of the Russian Far East and Arctic to build a small NPP with a RITM-200N reactor in the Sakha Republic (Yakutia) as part of the Far Eastern Concession Programme.

The engineering design has been developed for the RITM-200N reactor unit; it has enhanced characteristics compared to the RITM-200 marine reactor unit and has been adapted for onshore use.

The Corporation has continued to cooperate with potential foreign customers for small NPPs; a number of documents have been signed as part of exploration of opportunities for cooperation in the construction of new Russian-design nuclear power units, including in Kyrgyzstan, Myanmar and other countries.

Non-energy nuclear projects (NRTCs)

In 2022, ROSATOM continued to implement one of its key major projects in Latin America, namely the construction of a Nuclear Research and Technology Centre in Bolivia. In 2022, stage 1 and 2 facilities, namely the Cyclotron Radiopharmacy Preclinical Complex (CRPC) and the Multipurpose Irradiation Centre, started pilot operation, and the necessary permits were obtained from the Bolivian healthcare regulator for the medical use of radiopharmaceuticals produced at the CRPC.

For details, see the section ‘New Products for International Markets’.

Smart City

ROSATOM has completed the acquisition of PJSC Quadra – Power Generation. As a result, in 2022, installed power generation capacity of ROSATOM’s thermal power plants totalled 4 GW, while their installed heat generation capacity exceeded 19,000 Gcal/h. The Corporation has also completed the acquisition of GORTEKH Group of Companies.

The development of the Digital Heat Supply and Infrastructure IoT Platform products has been completed, and they have been launched on the market.

In 2022, the Smart City solutions covered 12 regional projects, 18 nuclear towns and cities and 84 non-nuclear towns and cities.

16 towns and cities where the Smart City projects were being implemented by ROSATOM ranked high in the Urban IQ Index ranking compiled by the Russian Ministry of Construction, Housing and Utilities for 2022.

A greenhouse gas emission reporting verification and validation body has been established and accredited to operate.

Six concession agreements aimed at managing and upgrading resource supply systems in Lesnoy, Glazov, Kursk, Voronezh and Yuzhno-Sakhalinsk are being implemented.

GRI 2-6 2.2. INTERNATIONAL BUSINESS DEVELOPMENT

Key results in 2022

- The 10-year portfolio of overseas orders totalled USD 135.9 billion.
- The portfolio of overseas orders covering the entire life cycle totalled USD 200.8 billion.
- Foreign revenue reached USD 11.76 billion (USD 8.98 billion in 2021).
- The overseas NPP construction project portfolio comprised 34 power units in 11 countries around the world.
- Projects were underway in more than 50 countries worldwide.

2.2.1. Promoting ROSATOM’s technologies on foreign markets

Despite the deteriorating global political environment, in 2022, ROSATOM remained a leader in key segments of the global nuclear energy market.

The main focus of ROSATOM’s international business is the construction of Russian-design nuclear power plants abroad. The Corporation promotes an integrated offer covering a wide range of areas, from uranium supply and NPP construction to assistance in project financing and personnel training. This approach is unique on the global market, which enables the Corporation to remain the only player in the world capable of establishing a comprehensive technological partnership in the nuclear power industry.

ROSATOM is actively promoting Russian nuclear technologies and solutions for energy and non-energy applications both in countries that are beginning to develop nuclear power and in countries with a well-developed national nuclear power industry (including based on Russian technology).

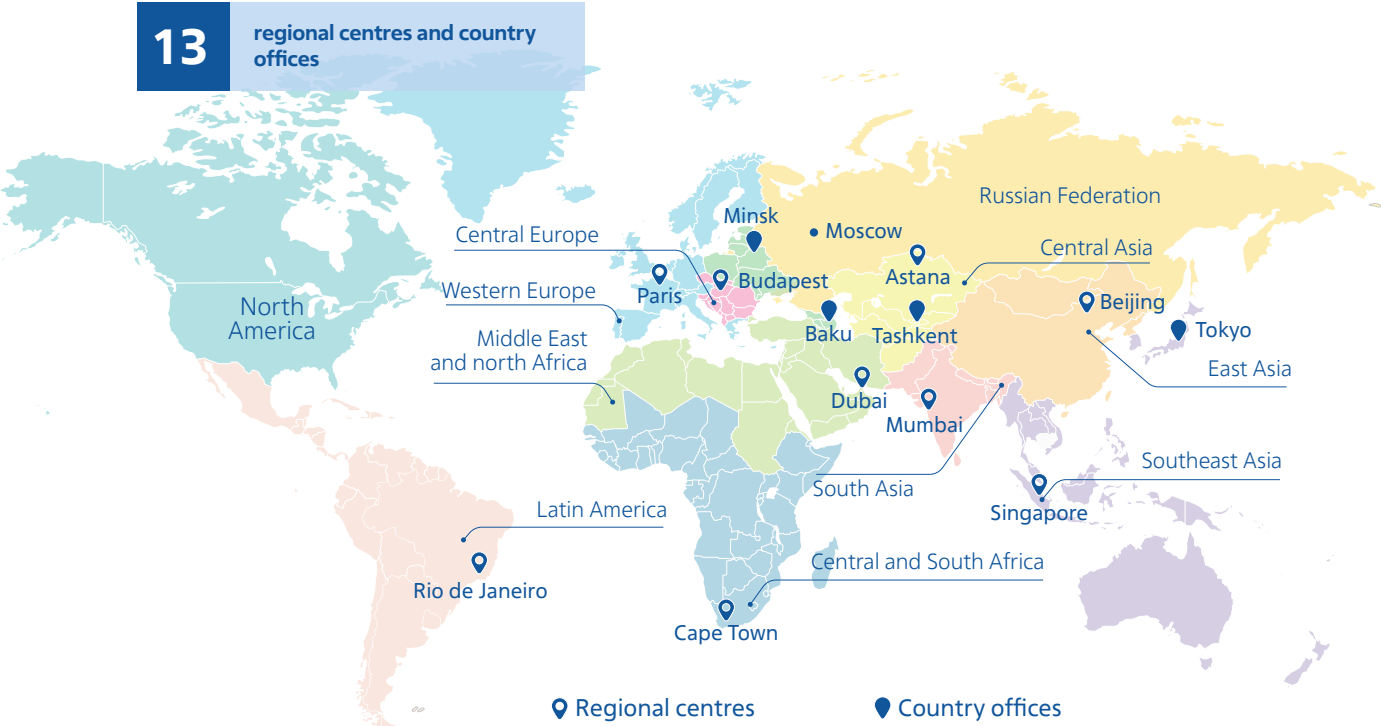
In addition, ROSATOM provides support throughout the life cycle of nuclear facilities (including both energy and non-energy facilities) by supplying the global market with the full range of products and services in the front-end and back-end stages of the nuclear fuel cycle (NFC), as well as providing services related to the maintenance and modernisation of such facilities. In 2022, ROSATOM maintained its foothold on the nuclear fuel cycle product market.

GRI 2-1 Despite all challenges that faced it in 2022, including growing sanctions pressure, ROSATOM maintained and even expanded its overseas footprint. ROSATOM implements its projects in more than 50 countries worldwide.

As at 31 December 2022, 158 overseas divisions of ROSATOM and its organisations operated in 43 foreign countries. Among them, a special role is played by 13 regional centres and country offices of ROSATOM. They are managed by Rusatom International Network, a private institution that performs international business development, marketing and PR functions in the industry.

Furthermore, ROSATOM not only builds nuclear power plants under existing contracts but also continues to make steady progress in terms of arrangements for the construction of new NPPs.

ROSATOM’s country offices and regional centres



ROSATOM takes systematic steps to promote small nuclear power plants; given heightened interest from customers in the energy market, this is a crucial focus area for the Corporation. ROSATOM’s capabilities and the successful implementation of the project to build the FTNPP, which simultaneously supplies both heat and power to the town of Pevek in Chukotka, enable the Corporation to engage in a meaningful dialogue with overseas partners. For instance, in November, documents were signed on a joint pre-feasibility study for small NPP construction projects in Myanmar and Kyrgyzstan.

GRI 2-28 ROSATOM attaches special importance to cooperation with foreign organisations (non-profit organisations, including associations, initiatives, councils, etc.). In 2022, ROSATOM had business relationships with more than 30 foreign organisations in 16 countries worldwide. The World Nuclear Association (WNA) remains a key partner of the Corporation. As part of the Corporation’s membership in the WNA, representatives of ROSATOM and its organisations took part in the key WNA events, as well as its working groups and research initiatives.

2.2.2. Changes in foreign revenue and the portfolio of overseas orders

In the reporting year, ROSATOM’s 10-year portfolio of overseas orders reached USD 135.9 billion.

Changes in the portfolio of overseas orders, USD billion

Indicator	2020	2021	2022
10-year portfolio of overseas orders, including:	138.3	139.9	135.9
– NPP construction abroad	89.1	84.1	78.0
– NFC (including the back end)	30.9	34.0	33.5
– Other activities	18.3	21.2	24.4

Changes in foreign revenue, USD million

Indicator	2020	2021	2022 ¹
Foreign revenue, including:	7,475	8,979	11,764
– NPP construction abroad	4,098	4,896	5,612
– NFC (including the back end)	2,899	3,336	4,098
– Other activities	479	748	2,051

2.2.3. NPP construction abroad

At year-end 2022, ROSATOM’s portfolio of overseas NPP construction projects included 34 power units in 11 countries worldwide, with 23 power units in eight countries at the construction stage. All overseas NPP construction projects are on track; the only exception is the Hanhikivi 1 NPP project in Finland, which has been unilaterally terminated by the Finnish customer for political reasons. No other overseas construction project has been suspended. Russian-design nuclear reactors that are currently under construction fully meet international safety requirements.

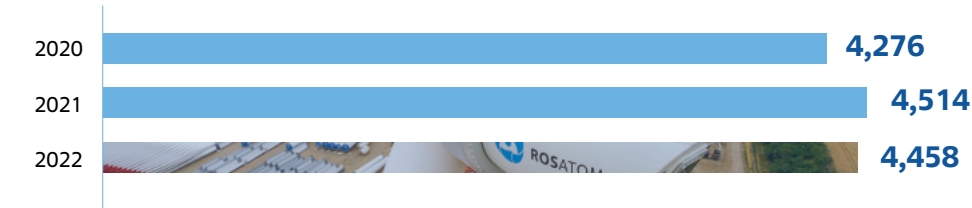
1. Foreign revenue for 2022 includes MC Delo.

NPP, country	Results
Asia	
Rooppur NPP, Bangladesh	The welding of the main coolant line has been completed at power unit No. 1 The installation of the inner containment dome has been completed at power unit No. 1 The reactor vessel has been moved into final position at power unit No. 2
Kudankulam NPP, India	The reactor vessel has been installed at power unit No. 3 The installation of reactor unit equipment has been completed at power unit No. 3 The dome of the reactor building of power unit No. 3 has been moved into final position
Tianwan NPP, China	The core catcher vessel has been installed at power unit No. 7 Concreting of the foundation slab of the reactor building has been started at power unit No. 8 The core catcher vessel for power unit No. 8 has been shipped
Xudabao NPP, China	The core catcher vessel has been installed at power unit No. 3 Concreting of the foundation slab of the reactor building has been started at power unit No. 4
Europe	
Paks II NPP, Hungary	A licence has been obtained for the implementation of the Paks II NPP project
Belarusian NPP, Belarus	Preparations for the commissioning of power unit No. 2 are underway
Middle East and North Africa	
El Dabaa NPP, Egypt	Concreting of the foundation slabs of the reactor buildings has been started at power units No. 1 and 2
Akkuyu NPP, Turkey	The production of fresh nuclear fuel for power unit No. 1 has been launched Concreting of the foundation slab of the reactor building has been started at power unit No. 4

2.2.4. NPP servicing abroad

ROSATOM provides maintenance services for 48 Russian-design power units abroad that are currently in operation or at the design/construction stage. Its product portfolio targeted at international markets includes a wide range of work and services covering the entire NPP life cycle.

Uranium mining by Uranium One enterprises, tonnes



In 2022, the Corporation provided support for scheduled preventive maintenance at Kudankulam NPP (India), Tianwan NPP (China), Kozloduy NPP (Bulgaria) and the Armenian NPP. The first scheduled repairs were successfully carried out at power unit No. 1 of the Belarusian NPP.

Over 900 members of operating and maintenance personnel at foreign NPPs underwent training as part of long-term and short-term programmes in 2022, including at Rooppur NPP (Bangladesh), Akkuyu NPP (Turkey), El Dabaa NPP (Egypt) and Paks II NPP (Hungary).

The Corporation provided assistance to foreign customers in building and improving nuclear infrastructure in Egypt, Bolivia, Bangladesh and Namibia.

Reactor control systems were upgraded at power unit No. 6 of Kozloduy NPP (Bulgaria). The relevant equipment was put into operation.

A long-term contract was signed for the supply of spare parts and equipment for the reactor coolant pump to Tianwan NPP (China).

Full-scale and analytical simulators for the training centres at Akkuyu NPP (Turkey) and Rooppur NPP (Bangladesh) were delivered and put into operation.

2.2.5. Export of uranium products and natural uranium enrichment services

In 2022, ROSATOM remained one of the world’s leading suppliers of nuclear fuel cycle front-end products.

All obligations under existing contracts in the reporting year were fulfilled in full, with uranium products supplied to 43 customers in 15 countries. Feedback received as part of customer satisfaction surveys and the findings of supplier audits conducted by customers indicate that on the whole, product quality, communications and supply chain resilience meet customer expectations. The customer-centric approach adopted by the Corporation and the importance that it attaches to its partners’ offers provide a foundation for constructive long-term cooperation. The 10-year portfolio of orders for uranium products remained roughly at the same level as in previous years.

In the reporting year, 15 new contracts for the supply of uranium products were concluded with 11 customers from eight countries, including addenda to existing contracts.

Uranium mining abroad

In 2022, ROSATOM’s overseas uranium mining enterprises produced about 4,500 tonnes of uranium; along with the operation of its mining enterprises in Russia, this enabled ROSATOM to remain the world’s second largest producer of this naturally occurring metal.

The Corporation plans to develop its mineral resource base and continuously improve the economics of its natural uranium mining projects.

2.2.6. Nuclear fuel export

In 2022, the Corporation continued to fulfil its existing contractual obligations related to nuclear fuel supply, despite the transportation and logistics challenges facing it.

In 2022, ROSATOM’s share on the global nuclear fuel fabrication market totalled 17%.

In the reporting year, Russian nuclear fuel fully met the demand of Russia, as well as a number of partner countries, including Armenia and Belarus, for reactor fuel. Nuclear fuel produced by ROSATOM is also used in reactors at NPPs in India, China and a number of other countries.

Despite existing external factors, all deliveries of nuclear products were made in full and on time. In addition, contract documents were signed with the Indian party, and the first batch of a new type of fuel, TVS-2M, was supplied to power unit No. 1 of Kudankulam NPP. Fuel for start-up core loading and for the first reloading of the CFR-600 high-power fast neutron reactor, which is currently under construction in China, was manufactured and shipped to the customer.

The reactor core mock-up was delivered to Akkuyu NPP in Turkey using new document preparation and customs clearance mechanisms.

A contract was signed with the Uzbek customer for the supply of a pilot batch of advanced fuel. It will be used to conduct reactor tests in a research reactor in Uzbekistan, to be followed by the delivery of a commercial batch.

NFC products were supplied and contracts were concluded for additional volumes and an expanded product range, including uranium components, as well as aluminium alloy and aluminium powder products, as a follow-up to the long-term framework contract for the supply of nuclear fuel components for the ETRR-2 research reactor to Egypt, which was concluded in 2020 with the Egyptian Atomic Energy Authority (EAEA).



As part of the Balanced NFC product line, the Corporation developed the design of the fifth-generation fuel bundle, TVS-5, for VVER reactors, which underwent a full range of pre-irradiation tests. These confirmed the reliability of the design and the possibility of its use in VVER-1000 and VVER-1200 reactors. The special features of the TVS-5 design will help to completely eliminate manual labour in nuclear fuel production.

The programme of reactor tests for new materials for accident tolerant fuel was expanded. The technology for the production of fuel pellets from uranium disilicide was developed. Reactor tests of new VVER- and PWR-sized fuel elements with uranium silicide fuel were started in the MIR research reactor.

2.2.7. New products for international markets

Construction of Nuclear Research and Technology Centres

ROSATOM also continues active work on non-energy applications of nuclear technology.

In 2022, ROSATOM continued to implement one of its key projects focused on new products, namely the construction of the Nuclear Research and Technology Centre in Bolivia, the world's highest-altitude nuclear facility. As part of the construction of the Centre, in 2022, stage 1 and 2 facilities, namely the Cyclotron Radiopharmacy Preclinical Complex (CRPC) and the Multipurpose Irradiation Centre, started pilot operation, and the necessary permits were obtained from the Bolivian healthcare regulator for the medical use of radiopharmaceuticals produced at the CRPC. In addition, in 2022, a licence was obtained for the construction of stage 4, which includes reactor and engineering facilities, and the required degree of completion of the relevant facilities was achieved.

Jointly with foreign partners, the Corporation is examining options for the establishment of production and sales hubs for the construction and subsequent operation of radiopharmaceuticals plants and nuclear medicine centres.

In addition, in 2022, ROSATOM continued to implement the intergovernmental agreement signed earlier on cooperation in the construction of an NRTC in Vietnam, with a focus on preparing for the development of a feasibility study for this project.

Promoting life cycle back-end services

The Corporation continues to promote the Balanced NFC, a product offer for the back end of the nuclear fuel cycle (NFC), on the global market. This is a solution incorporating certain elements of a closed nuclear fuel cycle and enabling effective recycling of regenerated nuclear materials and a significant decrease in the volume and radioactivity level of radioactive waste sent for near-surface or medium-depth disposal. This is achieved through SNF processing and high-level waste fractionation.

In 2022:

- Russia and Belarus concluded an intergovernmental agreement on cooperation in SNF management, which is a necessary prerequisite for concluding a contract for the management of SNF from the Belarusian NPP;
- A contract was concluded and transportation packages were delivered for the management of SNF from Kudankulam NPP;
- The pilot TUK-137T.R transportation package was manufactured; this is new-generation packaging required for the implementation of the Balanced NFC concept.

Nuclear medicine

In 2022, ROSATOM continued to develop its capabilities in the sphere of medicine, produce and supply medical isotopes and radiopharmaceuticals, and develop medical equipment for diagnostics and therapy. For instance, following a successful tender, a contract was signed with a Bengal partner to upgrade a gamma radiation facility and supply cobalt-60. Distribution contracts were concluded for the supply of Russian medical equipment to Mexico and Belarus.

Isotope products

In 2022, ROSATOM continued to operate on the global market for isotope products. It supplied products under existing contracts and concluded new contracts with foreign customers. Considerable efforts were made to redesign logistics, supply chains and payment arrangements. Preparations continued for launching Russian radiopharmaceuticals compliant with international GMP standards on the foreign market.

2.2.8. Plans for 2023

Plans for 2023 include the start of full-scale operation of power unit No. 2 of the Belarusian NPP. As part of the Akkuyu NPP construction project in Turkey and the Rooppur NPP construction project in Bangladesh, in 2023, the Corporation plans to deliver fresh nuclear fuel to the construction sites. As part of the El Dabaa NPP construction project, the Corporation expects to obtain a licence for the construction of power unit No. 3 and subsequently start the concreting of the foundation slab of the reactor building at power unit No. 3.

As part of the NRTC construction project in Bolivia, ROSATOM plans to continue construction and installation operations at stage 4 facilities, including the installation of main process equipment for Bolivia's first nuclear research reactor.

Given that the customers' interest in the energy market is shifting towards flexible solutions (in terms of both the power generation volume and the amount of funding), the most important area of focus for ROSATOM in 2023 will be the promotion of small nuclear power plants. More specifically, the Corporation plans to complete pre-feasibility studies in Myanmar and Kyrgyzstan.

ROSATOM plans to consistently diversify its product offer and launch new products on new markets. In 2023, the Corporation intends to continue to expand the footprint of its isotope business abroad. It also plans to be more active on foreign markets in the wind power segment and to leverage existing capabilities in the Russian Federation. Special emphasis will be placed on the development of projects in the field of nuclear medicine and energy storage systems, given the considerable potential of these market segments.

2.3. ENERGY EFFICIENCY

2.3.1. Energy efficiency management system. Implementation of energy efficiency management and energy management systems

Energy conservation is an important prerequisite for the efficient use of ROSATOM's energy resources, making it more competitive and reducing the negative impact on the environment. An energy conservation and energy efficiency improvement programme for the period from 2018 to 2022 is being implemented in the Russian nuclear industry.

In accordance with the government programme of the Russian Federation titled 'Development of the Nuclear Power and Industry Complex' (hereinafter referred to as the 'DNPIC programme'), between 2015 and 2022, the Corporation set and achieved the following targets for the reduction in energy consumption as a percentage of the actual consumption volume in 2015 and 2020 respectively:

Indicator	2018		2019		2020		2021		2022	
	tar- get	actu- al	tar- get	actu- al	tar- get	actu- al	tar- get	actu- al	tar- get	actu- al
Savings compared to 2015, %	5	8.9	6	9.7	7	9.84	–	–	–	–
Savings compared to 2020, %	–	–	–	–	–	–	0.5	0.99	1.0	1.50
Cumulative total savings between 2015 and 2020, RUB billion (excluding VAT)	–	2.6	–	2.9	–	2.95	–	–	–	–
Cumulative total savings in 2021 and 2022, RUB billion (excluding VAT)	–	–	–	–	–	–	–	0.35	–	0.56

2.3.2. Results in 2022¹

Energy consumption and energy cost allocation with a breakdown by Division and complex

In 2022, energy costs of ROSATOM's organisations (under comparable conditions, in 2020 prices) totalled RUB 36.85 billion (JSC Rosenergoatom: RUB 2.30 billion; JSC Atomerdmetzoloto: RUB 1.87 billion; JSC Atomenergomash: RUB 1.05 billion; the NWD: RUB 7.56 billion; other: RUB 24.07 billion), with energy costs of JSC Atomenergoprom totalling RUB 26.56 billion.

Energy consumption in the nuclear industry in physical terms (reduction against 2020 as the base year)

Division/ complex	Heat		Water		Electricity		Other (gas, fuel oil)	
	Actual consump- tion during the period under comparable con- ditions, '000 Gcal	%	Actual consump- tion during the period under comparable conditions, '000 m ³	%	Actual consump- tion during the period under comparable conditions, '000 kWh	%	Actual consumption during the period under comparable conditions, tonnes of fuel equivalent	%
JSC Atomred- metzoloto	591.33	1.23	3,668.32	2.89	468,635.49	3.02	–	–
JSC Atomener- gomash	48.23	4.52	1,385.59	37.77	159,506.79	2.16	65,510.83	3.57
JSC Rosener- goatom	410.02	2.32	1,185,983.41	0.44	984,804.95	0.97	–	–
JSC Science and Innova- tions	228.12	0.29	5,528.21	0.70	165,778.62	0.53	1,023.48	1.71
Environmental Solutions	488.65	8.48	21,232.58	17.71	328,448.50	2.75	23,240.90	0.00
NWD	2,101.24	0.72	25,731.78	2.33	866,939.75	1.56	158,408.88	1.43
Other	2,065.44	3.53	597,081.78	-4.48	3,133,882.26	0.54	2,569,886.53	1.91
Total across ROSATOM	5,933.03	2.56	1,840,611.67	-0.78	6,107,996.36	1.11	2,818,070.62	1.91

1. According to the reports of nuclear organisations in the Corporation's information system (the Automated Energy Efficiency Management System, hereinafter referred to as the AEEMS).

Energy savings as a result of energy efficiency measures and energy cost savings achieved by ROSATOM, with a breakdown by Division and complex

In accordance with the DNPIC programme, the energy conservation target for ROSATOM for 2022 has been set at 1.0% of the actual consumption volume in 2020.

According to reports by nuclear organisations, in 2022, actual energy savings against 2020 as the base year totalled 1.50%, or RUB 0.56 billion (excluding VAT) in monetary terms and 2,508,652.09 GJ in physical terms, with the following breakdown by Division/complex:

Energy cost savings in 2020 (against 2015 as the base year, excluding VAT) and in 2021 and 2022 (against 2020 as the base year, excluding VAT)

Division/complex	2020		2021 ¹		2022	
	RUB million	%	RUB million	%	RUB million	%
JSC Atomredmetzoloto	227.60	12.64	23.24	1.22	33.66	1.77
JSC Atomenergomash	187.35	19.65	31.11	2.86	35.28	3.25
JSC Rosenergoatom	90.40	4.86	12.74	0.55	11.06	0.48
JSC Science and Innovations	82.92	9.01	8.56	0.67	3.87	0.30
Environmental Solutions	570.99	23.97	26.24	-1.24	118.64	5.23
NWD	645.03	10.57	86.68	-1.13	107.16	1.40
Other	1,141.68	7.17	164.83	0.86	251.01	1.20
Total across ROSATOM	2,945.97	9.84	353.40	0.99	560.68	1.50

2.3.3. Implementation of new import substitution technologies that contribute to the technological sovereignty of the Russian Federation

ROSATOM's organisations work continuously to achieve the strategic goal of developing new products for the Russian and international markets, which involves increasing the share of import substitution products relevant to energy conservation.

In order to replace imports and meet the demand for lighting fittings, JSC Khiagda continued to produce high-performance lighting products (LED lamps) used in industry enterprises. More than 3,000 lamps have been sold since 2021.

ROSATOM's organisations have implemented most elements of an energy management system compliant with the ISO 50001 international standard (the organisations of JSC Rosenergoatom and JSC TVEL have obtained international certificates; organisations in other Divisions have implemented individual elements of the system).

Organisations in the industry also use the AEEMS information system (the Automated Energy Efficiency Management System of ROSATOM) for reporting on energy conservation and improvement of energy efficiency. In addition, in order to comply with the requirements of Federal Law No. 261 -FZ of 23 November

1. The decrease was due to the transition to a new base year (2020).



2009 on Energy Conservation and on Increasing Energy Efficiency and on Amending Certain Laws of the Russian Federation, in 2022, energy conservation and energy efficiency improvement programmes for the period from 2023 through 2027 were approved in ROSATOM and its organisations, and a similar programme was approved in JSC Atomenergoprom; among other things, they involve migrating the AEEMS to software that does not rely on imported solutions.

Number of ROSATOM's organisations covered by the AEEMS



2.3.4. Plans for 2023 and for the medium term

In 2022, the energy conservation target was 0.5% higher than the target set as part of the DNPIC programme; accordingly, the following differentiated energy conservation targets were set for 2023 and included in the KPI maps of executives of ROSATOM's Divisions/complexes (against 2020 as the baseline), providing for outperformance against the targets set in the DNPIC programme for the current year:

Division/complex	Energy conservation targets for 2023 (%)
JSC Atomredmetzoloto	1.70
JSC Atomenergomash	2.10
JSC Rosenergoatom	0.40
JSC Science and Innovations	0.60
JSC Rusatom Infrastructure Solutions	1.50
Environmental Solutions	1.20
NWD	2.20
Other	from 0.80 to 5.60

In the medium term, ROSATOM will also continue to take steps to meet the requirements of the DNPIC programme until 2027:

Reduction in energy consumption (under comparable conditions)	Target (%)				
	2023	2024	2025	2026	2027
against 2020	1.5	2	2.5	–	–
against 2025	–	–	–	0.5	1

In addition, between 2022 and 2027, ROSATOM plans to:

- Monitor progress on scheduled energy audits in organisations in the industry;
- Monitor updates to energy conservation programmes approved by organisations with energy costs exceeding RUB 50 million per year for the next five years following the completion of the current programmes;
- Assess the outcomes of energy conservation measures implemented by the organisations (assign industry ratings) on an annual basis;
- Maintain the energy efficiency management and energy management systems implemented in the industry and continuously improve their performance;
- Achieve additional synergy between energy conservation initiatives and the Corporation’s efforts to improve sustainability maturity in the industry;
- Migrate the AEEMS to software that does not rely on imported solutions;
- Update the Corporation’s scope of reporting;
- Continuously improve the functionality of the AEEMS.

2.4. BUSINESS EFFICIENCY

2.4.1. ROSATOM Production System

Key results in 2022

- The scope of systematic RPS development included 41 nuclear enterprises.
- Digital benchmarks were created in 14 nuclear enterprises.
- The Shop Floor Club of Construction Project Owners was established.
- More than 3,000 RPS projects with a social and economic focus were implemented in the regions.

The ROSATOM Production System (RPS) is a lean manufacturing culture and a system for continuous process improvement to provide ROSATOM with competitive advantages globally.

The RPS principles enable the Corporation to achieve one of its strategic goals: to reduce the production cost and the lead time by identifying and eliminating all types of losses in manufacturing and office processes and by improving the performance of each employee.

2.4.2. Results in 2022

Digital RPS Enterprise as a new RPS priority

Since 2015, a systematic RPS development programme is implemented in nuclear enterprises: business goals are decomposed to the level of production sites; the manufacture of an enterprise’s core products (production flows) is optimised; training in RPS techniques is provided for employees, and incentive systems are introduced to encourage continuous improvement.

Nuclear enterprises supporting the comprehensive development of the ROSATOM Production System are eligible for one of the following statuses: the RPS Reserve, an RPS Candidate, an RPS Leader or a Digital RPS Enterprise (a Lean Smart Plant). In 2022, the scope of systematic RPS development included 41 enterprises.

The Digital RPS Enterprise is a new RPS priority. This approach is focused on improving the management of manufacturing operations through the application of RPS tools, digital solutions and information technologies.

The Digital RPS Enterprise initiative involves comprehensive production development in accordance with the RPS methodology and the achievement of targets for the following indicators:

1. Digital RPS benchmarks incorporated into product flows;
2. The use of end-to-end digital technologies;
3. The use of digital twins of production facilities;
4. Digital RPS benchmarks incorporated into production support processes;
5. The use of digital modelling techniques;
6. The use of electronic information centres.

Based on development progress measured by the relevant indicators, enterprises are successively awarded the Bronze, Silver and Gold levels.

In 2022, digital benchmarks were created in 14 enterprises: JSC Afrikantov OKBM, JSC CDBMB, JSC Chepetsk Mechanical Plant, the Petrozavodskmash branch of JSC AEM-Technology, JSC Khiagda, branches of JSC Rosenergoatom (Kalinin, Kola and Balakovo NPPs), JSC MSZ Machinery Manufacturing Plant, PJSC NCCP, JSC Angarsk Electrolysis Chemical Plant, JSC PA ECP, JSC Dalur and FSUE Mining and Chemical Plant. Following a peer review of progress in RPS development carried out in early 2023 to promote RPS development, some of these enterprises became eligible for the Bronze level of the Digital RPS Enterprise status.

These enterprises were developing more than 40 digital RPS benchmarks. They are currently using a variety of digital solutions based on state-of-the-art technology, such as artificial intelligence and machine vision, digital twins and digital 3D modelling, robotics and additive manufacturing, the Industrial Internet of Things (IIoT) and predictive analytics, as well as MES, ERP, PLM, CAE, CAD, PDM and other information systems.

An RPS benchmark is a processing stage or a process in the process flow for a key product of ROSATOM’s organisation matching global best practices in production engineering.

The development and roll-out of RPS benchmarks continued in shop floor clubs established in the previous years: Mechanical Assembly Operations, Multi-Product Machining and Design Organisations.

The participants of the RPS Leaders forum held in December 2022 reviewed the best practices in the implementation of the Lean Smart Plant approach introduced in 2022 (the use of electronic checklists, bar coding capabilities, 3D modelling techniques for assemblability evaluation, a prototype digital twin of a product flow, additive manufacturing technologies) and discussed matters related to the development of a digital RPS enterprise.

RPS engineering

In 2022, ROSATOM continued to implement RPS engineering standards at construction sites of RPS enterprises in the nuclear industry.

Kursk NPP-2 has met all the necessary criteria for assigning the highest (third) level of an RPS construction benchmark. More specifically, effective cooperation between the project owner and the general contractor on the construction site has been demonstrated; joint process optimisation initiatives are being implemented at all stages of construction.

RPS construction projects have been successfully implemented at major construction sites:

- Reduction of the lead time for the decommissioning of an industrial site of the Moscow branch of FSUE Radon;
- Timely completion of key 2022 milestones in the construction of the BREST-300 reactor unit (JSC SCP);
- Reduction of the lead time for the construction of process units 4-1, 4-2, 4-3, 3-3, 3-2 targeting the Eastern ore body of the Khokhlovskoye deposit (JSC Dalur);
- Optimisation of the process for ensuring preparedness for the assembly of the 10UJA reactor vessel at power unit No. 1 of Kursk NPP-2 (JSC ASE).

In order to mobilise reserves and promote horizontal cooperation in the sphere of construction, the Shop Floor Club of Construction Project Owners was established in 2022.

Supplier development

According to the Uniform Industry-Wide Guidelines on the Development of the Production System of ROSATOM’s Suppliers, suppliers’ production systems are developed in three stages:

The first stage of development includes efforts aimed at starting the transformation and creating a pilot production site using lean manufacturing techniques and tools.

The second stage is aimed at laying the foundation for a production system underpinned by the lean manufacturing principles, further improving process flows selected earlier for optimisation, ensuring that the pilot production site reaches a benchmark level, starting to roll out best practices, planning and launching systematic initiatives across focus areas (Decomposition, Process Flows, Project Implementation, Training, Motivation).

The third (highest) stage of development (Efficiency) includes efforts aimed at creating an operational system of continuous improvement and a strategy for the development of key product flows. After reaching the third stage of development and meeting the necessary criteria, an enterprise is able to develop its own production system without regular involvement of the Customer’s RPS experts.

In 2022, industry RPS experts contributed to the systematic development of over 30 suppliers from other industries using lean manufacturing approaches and tools. The development is based on the Uniform Industry-Wide Guidelines on the Development of the Production System of Suppliers of ROSATOM and Its Organisations Using the Techniques and Tools of the ROSATOM Production System. In 2022, 14 enterprises participating in systematic development efforts demonstrated a high level of efficiency.

The Corporation constantly searches for new tools and reserves in the sphere of supplier development. For instance, in 2022, the Supplier Data Reliability Audit with a Production System Assessment Unit tool was used for the first time at the stage of announcing the outcomes of tendering. The audits were commissioned by a division of JSC ASE, for which three pilot procedures were conducted in the following enterprises: JSC Uralmashplant (Ekaterinburg); JSC Enmash (Rybinsk); LLC Smart Pipeline Systems (Nizhny Novgorod).

Introduction of lean techniques in Russia’s social sector and industry

ROSATOM voluntarily shares its best management techniques and workflow organisation methods nationwide as part of the Efficient Region project and the Labour Productivity and Employment Support National Project. Introduction of the principles and tools of the ROSATOM Production System enables a significant improvement in the efficiency of healthcare, education and utility systems and other sectors of the Russian economy.

In 2022, the Efficient Region project was underway in 35 regions, with the Republic of Tatarstan, the Kaliningrad, Vladimir, Novgorod and Omsk Regions joining the project during the year. Over 3,000 social and economic projects were implemented in the regions.

In 2022, 162 benchmark best practices in the application of lean techniques were validated in the following areas of social and economic activity in the regions: public and municipal administration, education, healthcare, housing and utilities, employment centres, multi-service centres, social security, sports and industry.

It should be noted that in 2022, all four prizes in the Lean Management Projects category of the Project Olympus competition in the sphere of professional project management in the public sector were awarded to projects implemented in the regions involved in the Efficient Region project.

2022 saw rapid development of lean communities in the form of clubs as part of the Efficient Region project; these include the Club of Directors of Lean Schools and Kindergartens, the League of Lean Colleges and the Association of Lean Universities, a community of lean local governments, as well as regional associations, which currently comprise more than 750 educational institutions in 10 regions.

In 2022, ROSATOM participated in the National Social Initiative in cooperation with the Agency for Strategic Initiatives; as a result, more than 100 interorganisational lean projects were implemented in 127 organisations to address 12 real-life situations in 10 Russian regions.

The project of the Ministry of Health of the Russian Federation titled ‘Development of Primary Care Models Underpinned by the Principles of Value-Based Healthcare’ has been implemented in seven pilot regions jointly with the Federal Research Institute for Health Organisation and Informatics of the Ministry of Health of the Russian Federation. The results of this project will be replicated in all Russian regions.

In 2022, ROSATOM, along with the Ministry of Economic Development of the Russian Federation, the Agency for Strategic Initiatives and major business associations, joined the End-to-End Investment Flow project. The project is aimed at reducing paperwork and speeding up the launch of investment projects. The optimisation of the end-to-end investment flow, or the investor journey, is supported by the tools and approaches of the ROSATOM Production System.

The project covers seven pilot regions that previously participated in the Efficient Region project run by ROSATOM (the Krasnodar Territory, the Rostov, Nizhny Novgorod, Lipetsk, Oryol and Sakhalin Regions and Kuzbass), as well as 12 observer regions. Work on the identified issues has resulted in the drafting of more than 160 proposals for amendments to federal laws and about 140 proposals for amendments to regional and municipal laws and regulations, as well as the development of about 500 measures to address organisational and technological issues. The key project parameter is the lead time. It has been used as a basis for the

calculation of the relevant targets for all algorithms. As they reach the target state, regions will be able to reduce the lead time for the end-to-end flow by a factor of 1.5–2 (by 120 to 800 days, depending on the region); furthermore, if they use the best results of the pilot regions as a benchmark, it will be possible to reduce the lead time for the end-to-end flow more than three-fold.

2.4.3. Plans for 2023

ROSATOM has prioritised the following areas for 2023:

- The Digital RPS Enterprise (Lean Smart Plant);
- RPS engineering;
- Supplier development;
- Introduction of lean techniques in Russia’s social sector and industry.

Digital RPS Enterprise (Lean Smart Plant)

Plans for 2023 include creating at least 30 new digital RPS benchmarks for product flows and production support processes in 18 nuclear enterprises. A list of key digital RPS projects scheduled for 2023 has been compiled following a review of road maps for the development of Digital RPS Enterprises in seven Divisions.

Steps will be taken to improve the digital maturity of enterprises, and an active knowledge environment will be created (this will involve demonstrating digital solutions in process flows, holding digital literacy workshops, facilitating the sharing of experience between enterprises, including those in other industries, and formulating requirements for the establishment of laboratories focused on digitisation and robotic process automation).

The development of the Digital RPS Enterprise initiative will also involve designing the format and formulating requirements for project teams developing digital RPS benchmarks (the allocation of responsibility, functional specifications, mechanisms for cooperation and communication, etc.), and establishing operations centres focused on digital competences, which will provide advisory support.

RPS engineering

The Club of Technical Coordinators of Construction Projects will function in 2023; it will be tasked with promoting horizontal cooperation among construction project participants. The Club will review typical challenges and issues facing many construction firms. This shop floor club will enable construction companies to share their experience with other participants.

Category strategies for the supply of key products involve planning measures to ensure long-term supply of key products to the Divisions in the industry.

ROSATOM will continue to implement RPS engineering standards at construction sites of RPS enterprises in the industry and to develop RPS construction benchmarks for operational construction schedule management.

Supplier development

As part of its initiatives focused on supplier development and logistics management, ROSATOM constantly searches for new tools and reserves. In 2023, the task of the RPS is to make a significant contribution to the development of the industry-wide import substitution and de-monopolisation initiative. ROSATOM plans to actively engage RPS experts in the development of category strategies for the supply of key products to the Divisions in the industry at the stage of supplier qualification. Subsequently, during the implementation of the category strategies, RPS tools will be used for the introduction of new product lines into production.

Introduction of lean techniques in Russia’s social sector and industry

As part of the Efficient Region programme, the Corporation will continue to create benchmarks in all areas of social and economic activity in the regions.

ROSATOM is developing a Regional Social Standard jointly with the Agency for Strategic Initiatives. In 2023, Standards for Friendly Social Welfare Institutions are to be piloted in the sphere of healthcare and education in five Russian regions.

The project to develop a benchmark primary care model will be implemented jointly with the Ministry of Health of the Russian Federation in pilot regions. The development of the model is scheduled to be completed by the end of 2023; it is expected to be adopted by healthcare institutions in all Russian regions by 2030.

Plans for 2023 for the End-to-End Investment Flow project include continuing the implementation of measures to address regional and local issues and a focus on operational analysis and monitoring, with the project to be supported simultaneously by investors and by regional governments and municipalities. Amendments need to be made to regional laws and regulations, and amendments to federal laws and regulations need to be discussed with industry authorities and submitted as a package. In the future, a ranking of pilot regions will be compiled based on the findings of operational analysis with assistance from the Agency for Strategic Initiatives. The second ‘cohort’ of regions is to participate in the optimisation of the end-to-end investment flow.



RPS PROJECTS WITH A SOCIAL AND ECONOMIC FOCUS IMPLEMENTED IN THE REGIONS