

**75 YEARS
OF NUCLEAR
INDUSTRY**

AHEAD
OF THE TIMES



**STATE ATOMIC ENERGY
CORPORATION ROSATOM.
PERFORMANCE IN 2019**



ROSATOM

**PERFORMANCE OF STATE ATOMIC
ENERGY CORPORATION ROSATOM
IN 2019**

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REPORT PROFILE

The Public Annual Report 'Performance of State Atomic Energy Corporation Rosatom' (hereinafter referred to as the Corporation or ROSATOM) for 2019 (the Report) has been prepared on a voluntary basis and is intended for a broad range of stakeholders.

STANDARDS AND REGULATORY REQUIREMENTS

The Report has been prepared in accordance with the following documents:

- The Public Reporting Policy and the Public Reporting Standard of ROSATOM and its organizations;
- The International Integrated Reporting Framework (International <IR> Framework);
- The Global Reporting Initiative Sustainability Reporting Standards (GRI SRS, Core option);

The Report focuses on the history, achievements and long-term development priorities of the Russian nuclear industry; this topic has been prioritized by the top management and representatives of key stakeholders.

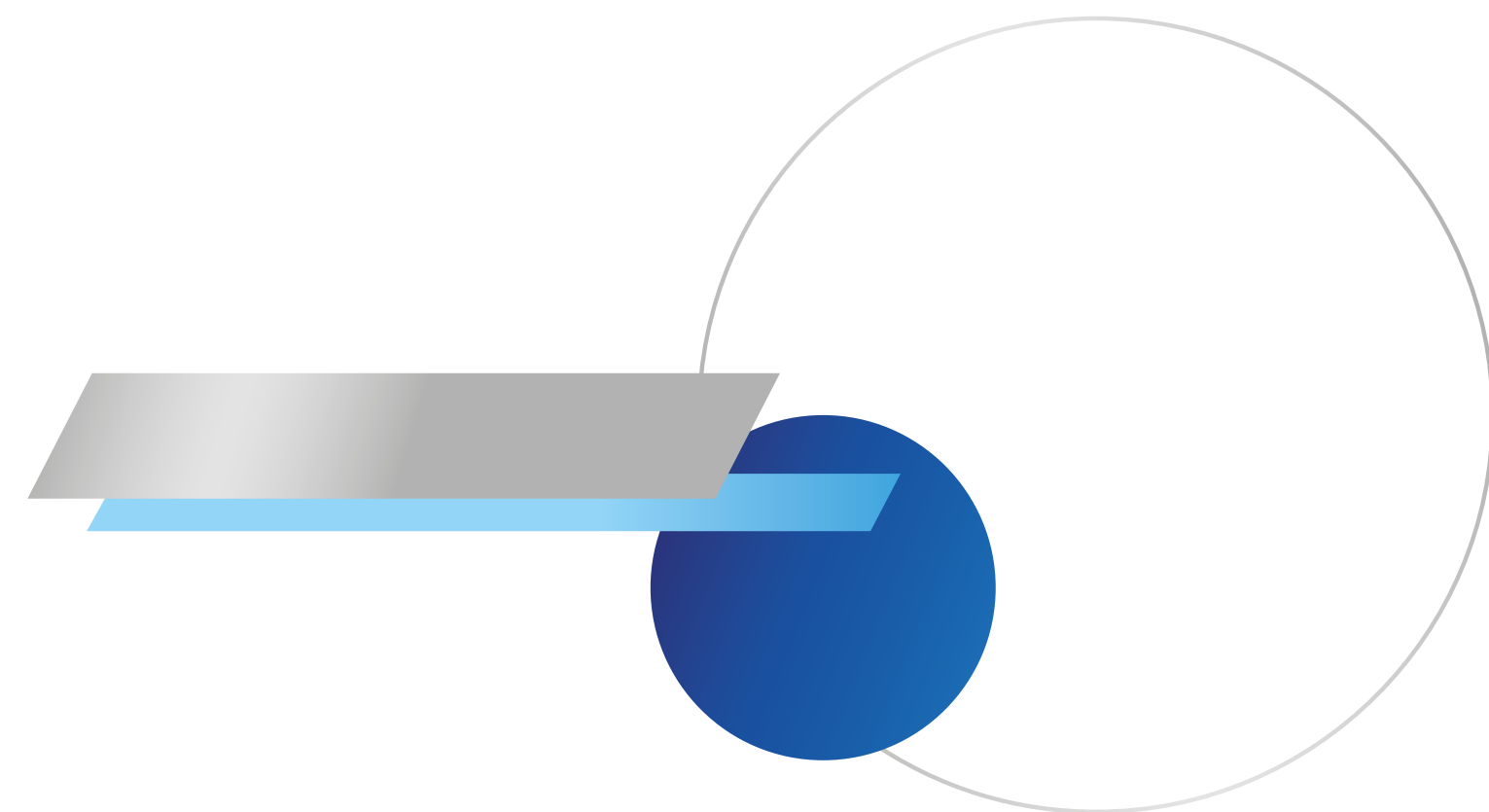
- The AccountAbility AA1000 Series of Standards (AA 1000 AP 2018, AA1000 SES 2015);
- The Conceptual Framework for the Development of Public Non-Financial Reporting in Russia;
- The Recommendations of the Russian Union of Industrialists and Entrepreneurs (RSPP) for Use in Governance Practice and Corporate Non-Financial Reporting (basic performance indicators).

STAKEHOLDER ENGAGEMENT

To improve transparency and accountability and to determine the materiality of information to be disclosed, the Report was prepared in cooperation with stakeholders in accordance with international standards (AA1000SES, the GRI Standards, the International <IR> Framework). To identify material topics to be disclosed in the Report, ROSATOM conducted an opinion poll and held dialogues with stakeholders (in a remote format).

The Report incorporates key recommendations and requests voiced by stakeholder representatives.

For details on the Report and the process of determining its content, see Appendix 1.



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1 OUR ACHIEVEMENTS



HISTORY OF THE RUSSIAN NUCLEAR INDUSTRY

To learn more about the history of the nuclear industry, visit the website at <http://www.biblioatom.ru>

Research in the field of nuclear physics in the USSR dates back to the first half of the 20th century. In 1921, the Radium Laboratory (now the Khlopin Radium Institute) was established under the Academy of Sciences. In 1933, the 1st Nationwide Conference on Nuclear Physics was held in Leningrad. In 1939, Yakov Zeldovich, Yuliy Khariton and Alexander Leypunsky proved that a nuclear fission chain reaction in uranium was possible. In 1940, Konstantin Petrzhak and Georgiy Flyorov, researchers at the Radium Institute, discovered spontaneous fission of heavy nuclei (without neutron bombardment), as exemplified by uranium.

In the 1940s, the military 'nuclear project' gave powerful impetus to the development of the industry. On September 28, 1942, the State Defence Committee adopted a classified decree No. 2352ss on the Organization of Work on Uranium. In 1943, Laboratory of Measuring Instruments No. 2 of the USSR Academy of Sciences (now the National Research Centre Kurchatov Institute) was established; Igor Kurchatov was appointed its director. On August 20,

1945, a decree was signed on establishing a governing body responsible for managing the work on uranium: the Special Committee under the State Defence Committee of the USSR. It is considered that this date marked the emergence of the nuclear industry.

In 1946, a self-sustained nuclear chain reaction in uranium was achieved in the F-1 reactor in Laboratory No. 2. F-1 was the first nuclear reactor in the USSR and in Europe. In 1949, the USSR conducted its first successful nuclear weapon test, followed by the test of the first Soviet thermonuclear bomb in 1953. In 1958, the first Soviet nuclear submarine, Leninsky Komsomol, was built. The country's 'nuclear shield' helped accomplish a global objective: historians believe that the nuclear parity between the USSR and the US helped to avoid the third world war, while nuclear weapons became a means of peaceful containment.

Apart from the defence capability, another focus area was the use of nuclear energy in the civilian sector of the Soviet economy. In

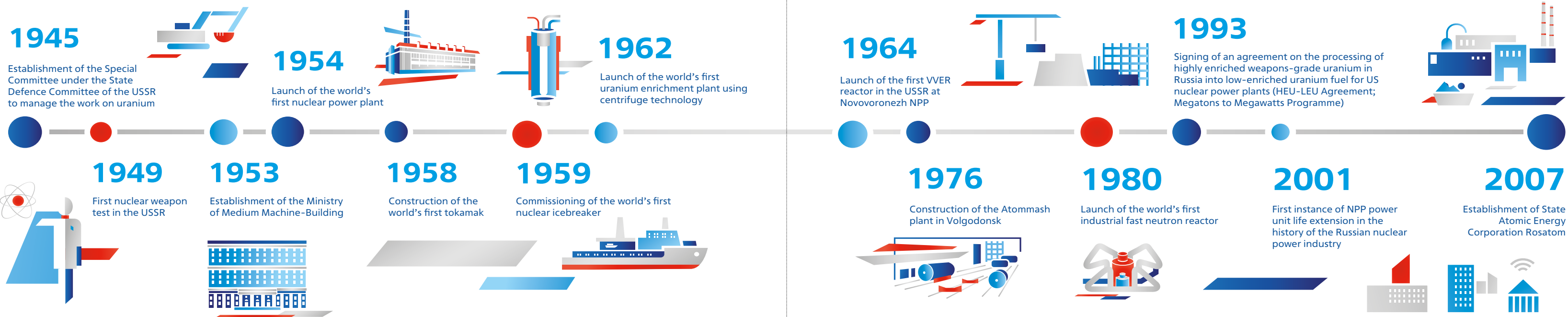
1953, the Ministry of Medium Machine-Building was established. In 1957, the Ministry was headed by Efim Slavsky, the famous 'nuclear minister', who held this position until 1986. Academicians Igor Kurchatov and Anatoly Alexandrov led the development of a programme to develop the nuclear power industry in the USSR, which involved a wide use of nuclear energy in power generation, transportation and other areas of the national economy.

In 1954, the world's first nuclear power plant, Obninsk NPP, was put into operation. In 1959, the world's first nuclear icebreaker, Lenin, was put into operation. In 1964, the first VVER reactor with a capacity of 210 MW was put into operation at Novovoronezh NPP. In 1974, the first RBMK reactor with a capacity of 1,000 MW was put into operation at Leningrad NPP. By the end of the 1980s, the total NPP capacity in the USSR reached 37 GW. Soviet atomic scientists laid the groundwork for the future: they built incredibly powerful particle accelerators, nuclear fusion facilities for research on plasma compression and numerous other facilities.

The Chernobyl nuclear disaster in 1986 hindered the development of the nuclear power industry. But at the same time, this tragic accident encouraged a fundamental review of approaches to safety, including the development of a safety culture. The

1990s, which were a challenging period for Russia, also marked a period of stagnation in the industry. But the nuclear industry survived and retained its unique research and production capabilities and, most importantly, its human resources. In the 2000s, the commissioning of new NPP power units was resumed, with power unit No. 1 of Rostov NPP and power unit No. 3 of Kalinin NPP put into operation in 2001 and 2004 respectively.

2007 saw the establishment of State Atomic Energy Corporation Rosatom. The Corporation was assigned the powers of the now defunct Federal Agency on Atomic Energy (the successor to the Soviet Ministry of Medium Machine-Building). ROSATOM started to work painstakingly to consolidate disparate nuclear enterprises and industry institutes into an integrated and efficient mechanism. The establishment of the Corporation opened up new opportunities for the development of nuclear power and science and for a considerable expansion of its overseas footprint. Today, ROSATOM is a diversified corporation, one of Russia's largest companies and a global leader in the sphere of nuclear technology. For more information on ROSATOM's performance and achievements, see the public annual reports for the period from 2009 through 2018¹.



¹ <https://rosatom.ru/about/publicnaya-otchetnost/>.

ROSATOM TODAY

ROSATOM² is a diversified corporation owning assets and possessing competences at all stages of the nuclear production chain: uranium exploration and mining, uranium conversion and enrichment, nuclear fuel fabrication, mechanical engineering, NPP design and construction, power generation, decommissioning of nuclear facilities, spent nuclear fuel and radioactive waste management.

The Corporation comprises over 300 enterprises and organizations, including research institutes, the nuclear weapons division and the world's only nuclear-powered icebreaker fleet.

ROSATOM is tasked with implementing a uniform government policy on nuclear power and fulfilling Russia's international commitments related to the peaceful use of nuclear energy and maintaining the non-proliferation regime.

ROSATOM is Russia's largest power generation company and a leading player on global markets for nuclear technologies (NPP construction, uranium enrichment services, nuclear fuel fabrication, decommissioning, etc.). ROSATOM carries out numerous large-scale international projects and generates substantial overseas revenue.

ROSATOM is also developing new businesses outside its core production and process chain (electricity generation at large NPPs): wind power, nuclear medicine, advanced materials and technologies, digital products, infrastructure solutions, additive manufacturing and energy storage systems, process control systems and electrical engineering, environmental solutions, etc.

The Corporation's research activities are aimed at developing new solutions for the power industry and innovative technologies that will improve the quality of people's lives. ROSATOM's

key project in the sphere of nuclear power is the Proryv (Breakthrough) project, which is aimed at demonstrating the possibility of closing the nuclear fuel cycle using fast neutron reactors and developing the relevant technologies. A closed nuclear fuel cycle will significantly improve the efficiency of usage of natural uranium and will help solve the problem of nuclear waste accumulation and provide humankind with a reliable long-term source of clean energy.

No. 1
in the world

in terms of the number of NPP power units in the portfolio of foreign projects (36 power units)

No. 1
in the world

in terms of uranium enrichment (38% of the global market)

No. 2
in the world

in terms of uranium resources (512,700 tonnes in Russia and 192,000 tonnes abroad) and production (7,528 tonnes)

No. 3
in the world

in terms of nuclear fuel fabrication (16% of the global market)

RUB 9.8 billion

expenditure on corporate social programmes for employees in 2019

19%

share of power generation in the Russian Federation

RUB 23.55 billion

expenditure on environmental protection in 2019

266,400

employees

333³

organizations and enterprises within the Corporation

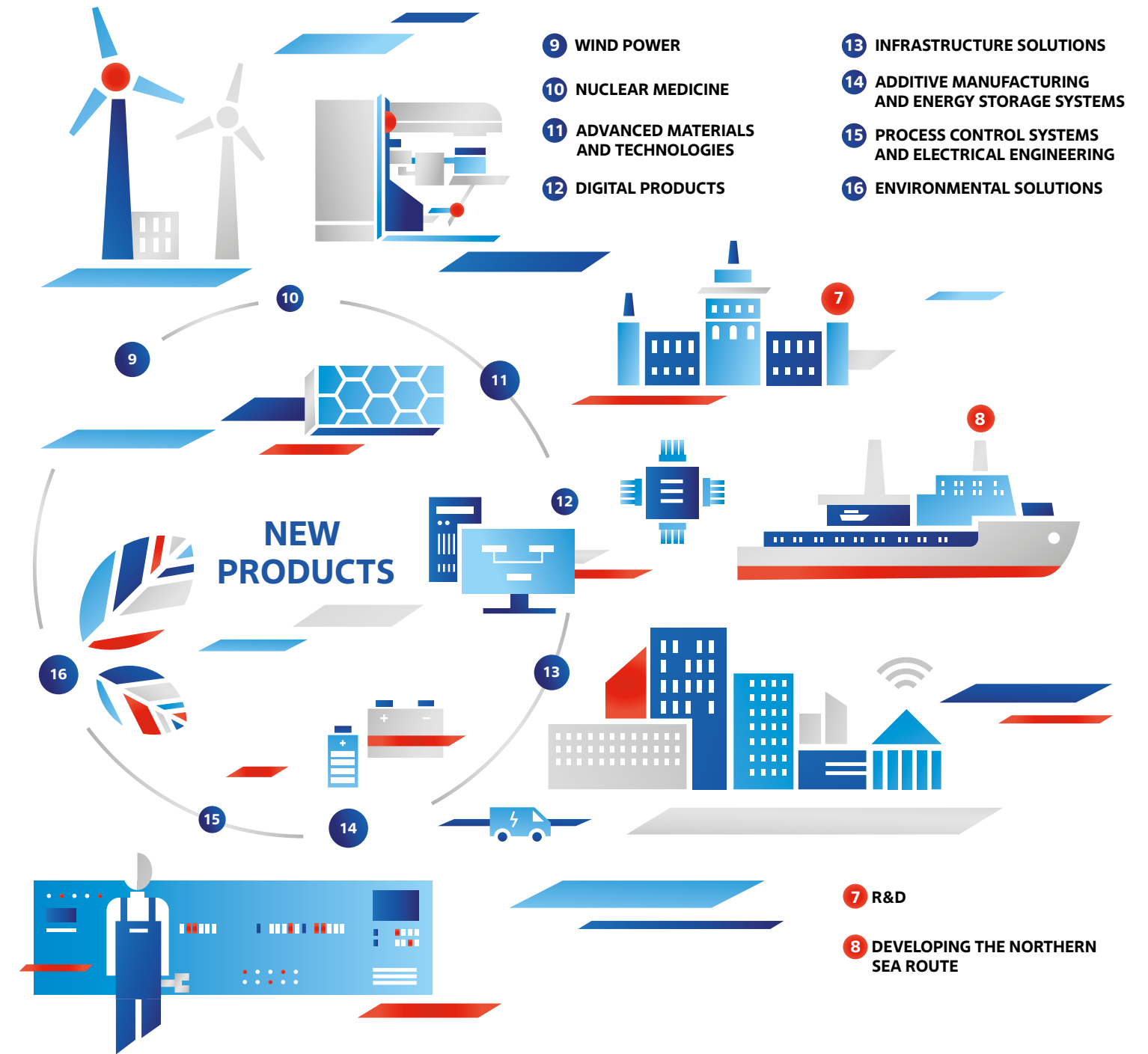
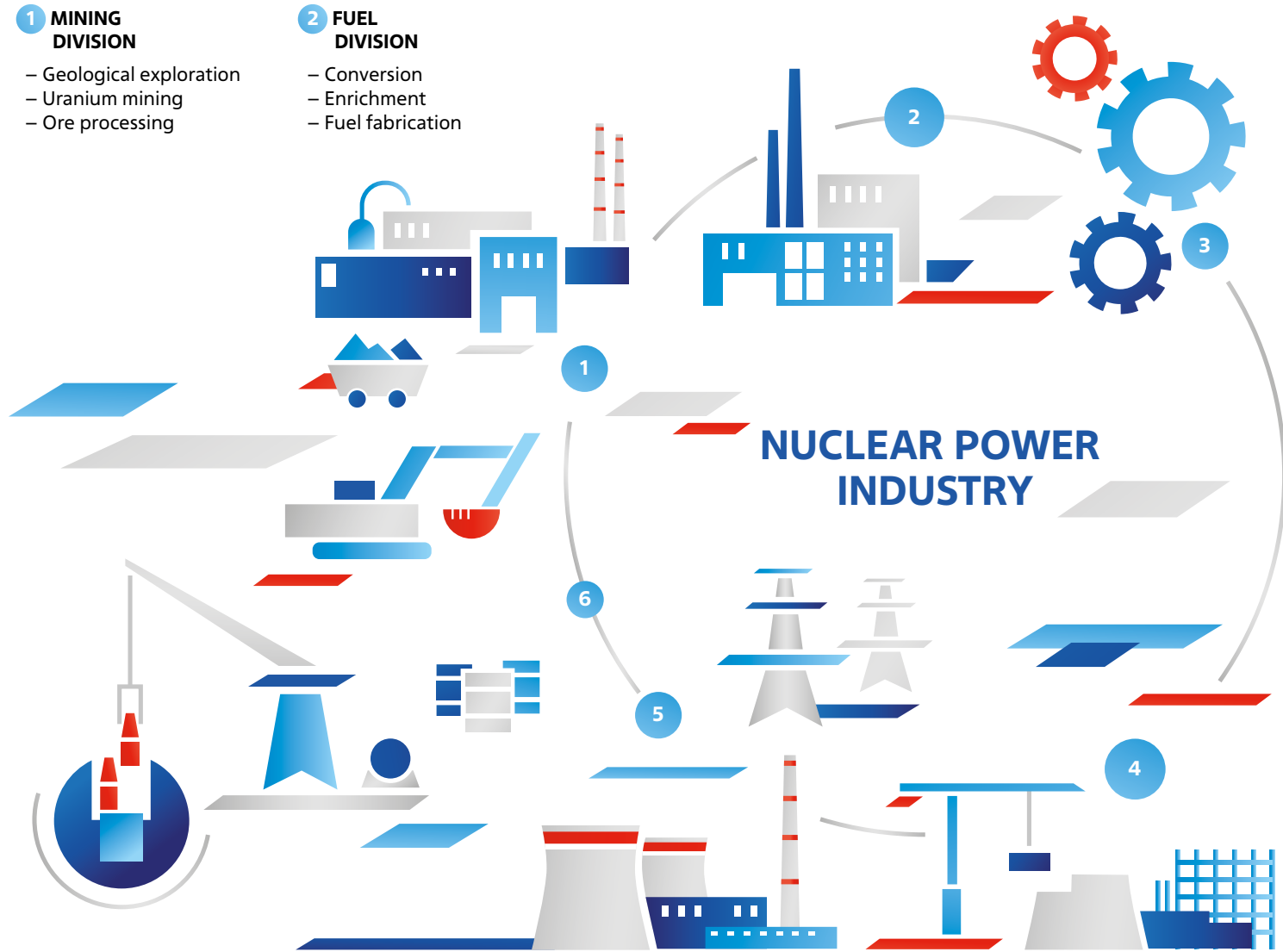
The world's
ONLY
nuclear-powered icebreaker fleet



² ROSATOM's status, the goals of its establishment and operations, its functions and powers are stipulated in Federal Law No. 317-FZ of December 1, 2007 on State Atomic Energy Corporation Rosatom.

³ Within the scope of consolidation of ROSATOM in Q4 2019 (not including State Atomic Energy Corporation Rosatom).

ROSATOM'S BUSINESS AREAS



KEY RESULTS IN 2019

Indicator	2017	2018	2019	2019/2018
KEY PERFORMANCE INDICATORS SET BY THE SUPERVISORY BOARD				
Adjusted free cash flow of ROSATOM ⁴ , RUB billion	308.7	321.5	328.7	+2.2%
Consolidated labour productivity, RUB million per person	5.8	6.2	6.7	+8.1%
Unit semi-fixed costs (as a percentage of revenue), %	24.9	24.6	25.3	▲
Power generation, billion kWh	202.9	204.3	208.8	+2.2%
Performance against the targets of JSC Rosenergoatom's investment programme, %	98.7	101.5	104.3	▲
10-year portfolio of overseas orders, USD billion	133.5	133.2	140.1	+5.2%
10-year portfolio of orders for new products (outside the scope of the Corporation), RUB billion	814.1	1,082.6	1,169.1	+8%
Revenue from new products (outside the scope of the Corporation), RUB billion	170.9	196.7	227.9	+15.9%
Integrated innovation KPI ⁵ , %	106.6	114.4	114.4	■
Fulfilment of government orders, %	100	100	100	■
Number of events rated at level 2 or higher on the INES scale	0	0	0	■

KEY EVENTS IN 2019

- Power unit No. 2 of Novovoronezh NPP-2 started commercial operation ahead of schedule.
- The floating thermal nuclear power plant in Pevek (Chukotka Autonomous District) was connected to the power system.
- Electricity output at 36 power units of 10 operating NPPs totalled 208.8 billion kWh, with the share of NPPs in Russia's energy mix totalling 19%.
- Industrial production of MOX fuel for fast neutron reactors was set up for the first time in Russia, and the first batch of this fuel was loaded into the core of the BN-800 reactor at Beloyarsk NPP.
- 7 intergovernmental agreements and 23 major interdepartmental agreements were concluded.
- The Corporation signed general contracts for the construction of power units No. 7 and 8 of Tianwan NPP and power units No. 3 and 4 of Xudabao NPP in China.
- Targets for the Northern Sea Route federal project were achieved, with cargo traffic totalling 31.5 million tonnes.
- The Ural icebreaker was launched; sea trials of the Arktika icebreaker were commenced.
- A federal law came into force whereby ROSATOM was authorized to create a comprehensive system for the management of hazard class 1 and 2 waste in Russia.
- The Corporation launched a large-scale project to create a Russian-designed 100-qubit quantum computer.
- By the end of the year, five digital products came on the market: modules forming part of the Logos software suite (Logos Aero-Hydro and Logos Thermo), the Volna ('Wave') programming and computing system, the Kalininsky Data Centre and the Technical Documentation E-Shop.
- A new version of the Innovative Development and Technological Modernization Programme was drafted.
- The Corporation started pilot operation of the first Russian-made multi-powder 3D printer with two laser sources.
- The team of the Russian nuclear industry won the WorldSkills Hi-Tech National Competition for the fifth time.
- No events rated at level 1 or higher on the international INES scale were detected at nuclear facilities (deviations (rated at level 0) do not pose a risk to employees operating the facilities, local residents or the environment).

⁴ Calculated as net cash flow from day-to-day operations adjusted for proceeds from the disposal of non-core assets, dividends and interest, before lease payments and reserve funds.

⁵ The calculation includes the number of foreign patents, revenue from sales of innovative products and the results of implementation of ROSATOM's new innovative development programme. The target for the reporting period was set at 100%.

ADDRESS BY THE CHAIRMAN OF THE SUPERVISORY BOARD



SERGEY KIRIENKO
Chairman of the Supervisory
Board of ROSATOM

Dear colleagues,

We are presenting to you the report for 2019, which was a special year for ROSATOM. We launched the world's first floating thermal nuclear power plant, Akademik Lomonosov; electricity output at our NPPs in Russia reached a new all-time high; we commissioned yet another reactor at Novovoronezh NPP and saw cargo traffic along the Northern Sea Route reach a record high, with ROSATOM appointed as infrastructure operator of the NSR. The Corporation remained the largest power generation company in Russia and a global leader in the construction of safe nuclear power plants.

At the same time, the Russian nuclear industry remains a laboratory generating new knowledge and developing new technologies that are successfully applied in various industries. We are developing nuclear medicine, materials science and engineering, mechanical engineering and digital products. The lean manufacturing system introduced and improved by ROSATOM is successfully used not only in industry, but also in the social sphere in Russia. ROSATOM's know-how in a wide range of areas, including science, technology and management, is already helping us to respond to the tough challenges that we are facing in 2020.

I am convinced that we will continue to work in a focused, consistent and responsible manner to develop new technologies for the benefit of humankind.

I would like to express my profound gratitude to all employees in the Russian nuclear industry for doing their difficult and important jobs and contributing to the achievement of our shared goals!

ADDRESS BY THE DIRECTOR GENERAL



ALEXEY LIKHACHEV
Director General
of ROSATOM

Dear colleagues,

2020 marks the 75th anniversary of the Russian nuclear industry. As we celebrate this date and commemorate the founding fathers of the industry, we can be proud of our past. The groundwork laid by our great predecessors underpins today's victories and achievements and gives us confidence that science and technology of the future will bring about an improvement in people's lives, which is the most important thing.

The world is rapidly changing, and our business is rapidly growing. Over the past decade, ROSATOM has outgrown the local market, and now we operate in dozens of countries on all continents. Nuclear power remains a mainstay for ROSATOM, but in recent years, the Corporation has diversified far beyond this business area and is no longer just an energy company. The list of technologies that we are actively working on has been expanded considerably. These include lasers, quantum computers, new materials and numerous other technological solutions.

No-one can tell what the future holds, but there is no doubt that only by developing new technologies will we be able to respond to global challenges and shape a bright future.

We are working to create decent and comfortable living conditions. This means clean energy fully meeting all the fundamental needs of humankind, a healthy planet with enough clean air and water for everyone, a cure for diseases which used to be incurable, and outer space exploration. We have lots of ambitious tasks ahead of us. The nuclear industry is celebrating its 75th anniversary, but it is just the beginning.

Results achieved in 2019 and presented in this report are yet another step forward. It has been made possible by concerted efforts and efficient work of employees of ROSATOM's organizations and enterprises. I would like to express my sincere thanks to you for your work. I would also like to thank all our partners in Russia and abroad for constructive and fruitful cooperation.

ADDRESS BY A STAKEHOLDER REPRESENTATIVE



VLADIMIR OGNEV
Chairman of the Interregional
Social Movement of Veterans
of Nuclear Power and Industry

Dear colleagues,

The history of the Russian nuclear industry is a history of success, heroic work and accomplishment of tasks that previously seemed impossible.

The industry emerged in the post-war period full of enormous challenges, when the country needed to implement the first national programme – the ‘atomic project’ – as quickly as possible. This top-priority task was assigned to the country’s best and most responsible specialists. The spirit of victory in the Great Patriotic War, combined with a high level of professionalism and dedication, helped them to accomplish this monumental task. Thus, the generation of victors became a generation of creators. Appreciation for their efforts is reflected in the recognition that they received from the government. Nine three-time Heroes of Socialist Labour (out of 16 in total in the history of the USSR) were atomic scientists; eight representatives of our industry were awarded the title of Hero of Socialist Labour twice; 264 people were awarded this title once, and another 14 were awarded the title of Hero of the Soviet Union.

The era of the peaceful atom began in 1954, when the world’s first nuclear power plant was built in Obninsk under the supervision of the Ministry of Medium Machine-Building of the USSR. Our country produced the first nuclear icebreaker. We gave the world tokamaks; we were the first to adopt centrifuge technology for uranium enrichment and to commission an industrial fast neutron reactor. Nuclear technology has enabled us to create a large fleet of nuclear submarines and launch a successful space exploration programme.

The nuclear industry is an undisputed leader in the use of nuclear energy; it creates world-class scientific and technical know-how, not only for its own needs but also for related industries. At the same time, it should be remembered that every techno-

logical solution and every innovative breakthrough are the result of work done by people. The achievements that our country can be rightly proud of have been made possible by perseverance, innovative thinking, expertise, hard work and the highest level of responsibility demonstrated by our researchers, designers, engineers, builders and workers – in short, by everyone involved in the nuclear industry.

State Atomic Energy Corporation Rosatom has become a worthy successor to the Soviet Ministry of Medium Machine-Building in the 21st century. The Corporation has expanded into new fully-fledged segments of the industry which had previously been outside its scope, namely the nuclear-powered icebreaker fleet and nuclear mechanical engineering. In addition, ROSATOM has integrated new research institutes that have extensive research and technical capabilities and highly skilled specialists. ROSATOM upholds the time-honoured traditions and values of the legendary Ministry of Medium Machine-Building.

I am gratified to know that our industry still remains the backbone of our nation. ROSATOM is Russia’s largest power generation company and a leader in NPP construction overseas: it has documented commitments to build 36 power units. ROSATOM’s 10-year portfolio of overseas orders exceeds USD 140 billion. ROSATOM holds 38% of the global uranium enrichment market, 16% of the nuclear fuel market and 14% of the uranium mining market.

I am proud that once again, we are entrusted with the most challenging tasks in today’s Russia. ROSATOM has become the infrastructure operator of the Northern Sea Route and contributes to the implementation of strategically important projects in the Russian Arctic. ROSATOM is upgrading its nuclear-powered icebreaker fleet; it plans to build fundamentally new Lider-class icebreakers that will enable year-round navigation along the Northern Sea Route. ROSATOM has been tasked with creating

a comprehensive system for the management of hazard class 1 and 2 waste in Russia. We will need to create a new business in the sphere of hazardous industrial and consumer waste management from scratch; at the same time, the list of our regions of operation will be expanded to include new towns and cities where we will build environmental technology parks for waste management.

ROSATOM is a socially responsible company and partner. It is actively involved in the development of its regions of operation and takes a responsible approach to the environment. ROSATOM’s Uniform Industry-Wide Social Policy provides reliable support to the Corporation’s employees. I would like to express my special and sincere thanks to the management of ROSATOM for caring for our veterans.

Veterans appreciate trust in ROSATOM, which has been entrusted with an important task of supporting submariners in the Northern Fleet and missile personnel in the Strategic Missile Forces of Russia. We support the crews of the world’s largest nuclear submarine, Dmitry Donskoy, the world’s largest diesel-electric submarine, Sarov, and the 11th Nuclear Submarine Division, as well as the personnel of the State Central Marine Test Site, where state-of-the-art weapons are tested. We also support the 42nd Division of the Strategic Missile Forces based in Nizhny Tagil.

I would like to express my deep respect for veterans that were pioneers of the nuclear industry.

I would like to congratulate veterans, all employees in the industry and the residents of our ‘nuclear’ towns and cities on the upcoming 75th anniversary of our industry. I wish you all good health, prosperity, well-being for your families and new professional achievements for the benefit of ROSATOM and our country!

FINANCIAL AND ECONOMIC RESULTS⁶

Indicator	2017	2018	2019	2019/2018
KEY FINANCIAL RESULTS, RUB BILLION				
Revenue	967.8	1,033.9	1,151.9	+11.4%
Assets	3,437.7	3,802.2	4,292.6	+12.9%
Intangible assets	103.5	194	170.9	-11.9%

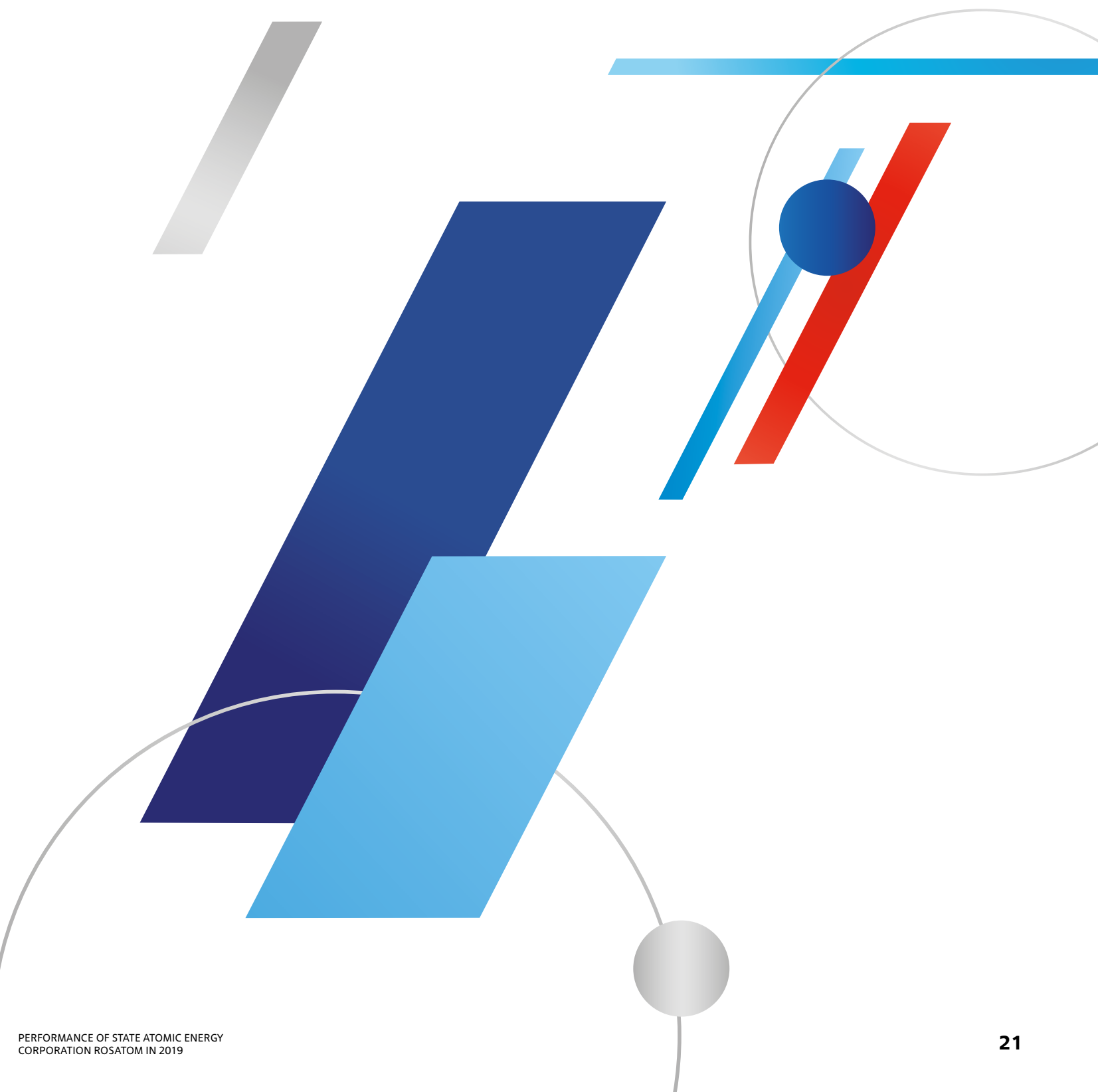
An 11.4% increase in revenue compared to 2018 was driven mainly by:

- An increase in revenue from electricity and heat generation and capacity (including power generation by new power units at Rostov and Leningrad NPPs);
- An increase in revenue from NPP construction projects.

Indicator	2017	2018	2019
PROFITABILITY RATIOS, %			
Return on sales (ROS)	10.81	20.34	11.3
Return on assets (ROA)	3.04	5.53	3.03
Return on equity (ROE)	4.59	8.45	4.99

Profitability ratios decreased in 2019, primarily due to a year-on-year decrease in profit.

⁶ Data has been provided on the part of the scope of IFRS consolidation of ROSATOM for which information is publicly available. Data for 2018 has been recalculated in order to reflect the effect of fair value measurement of assets and liabilities recognized as at the date of acquisition of control over JSC CONCERN TITAN-2.



2 STRATEGY FOR A SUSTAINABLE FUTURE



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2.1. BUSINESS STRATEGY UNTIL 2030



IGOR ERMAKOV
Director of the Strategic
Management Department



— In 2019, ROSATOM updated its strategy. What necessitated this update? What were the main changes made to the strategy?

— ROSATOM's business strategy approved by the Supervisory Board in 2014 was formulated taking into account macroeconomic, geopolitical and technological trends that were relevant to the Corporation at the time. Adjustments were necessitated by changes in the economic and political situation that had been impossible to predict back then. Technological challenges are another aspect making the most significant impact on ROSATOM's global operations. New technologies are developing increasingly fast, and trends that only started to emerge in 2014 now have a decisive influence on global markets.

We continue to focus on the key areas outlined in the 2014 Strategy as we are working to accomplish our objectives and expanding their list. In the new version of the Strategy, we have supplemented ROSATOM's three strategic goals (increasing the international market share, reducing production costs and the lead time and developing new products) with a fourth goal: achieving global leadership in state-of-the-art technology. It should be emphasized that we do not confine ourselves to nuclear technology, and this is what enables us to define the Corporation's development trajectory more clearly, with a focus on progressing from global leadership in the nuclear industry to global technological leadership.

Nuclear power and the full range of services in the nuclear fuel cycle will remain our mainstay for years to come. Under any scenarios, both optimistic and pessimistic, until 2030 the global nu-

clear power industry will continue to play an important role in the global energy mix. This means that we still have a 'window of opportunity' for promoting our NPPs on foreign markets.

But at the same time, we need to develop new production operations. We will focus on offering state-of-the-art technological solutions that are not only unique but also, and most importantly, in demand. By doing so, we will be able to become a major player on today's markets.

Another important new feature is the fact that we have added contribution to the achievement of the UN Sustainable Development Goals to the list of requirements for our business. Traditionally, our Strategy gives priority to safety as a mandatory requirement for our operations. The fact we have established another important criterion in addition to safety reflects our commitment to developing our regions of operation and shapes our social agenda. In addition, this is crucial in terms of expanding ROSATOM's presence on international markets.

— What will ROSATOM be like in 2030?

— The Corporation's target vision for 2030 includes three sets of goals.

The first one comprises economic goals. By 2030, we intend to increase revenue to RUB 4 trillion, with more than half of this revenue coming from overseas orders. We intend that, in addition to our core business, namely nuclear power generation, other sources of revenue will include an increase in the output of new

products, which should account for at least 40% of the total revenue. It should be pointed out that we have set ourselves the goal of effectively expanding the scope of our business, which is reflected in a multiple increase in EBITDA.

The second set of goals is related to technological leadership. We intend that the entire industry will focus on developing state-of-the-art high technology, and we are setting very ambitious goals for each of the business areas that we have prioritized, such as wind power, additive manufacturing, nuclear medicine, development of the Northern Sea Route, environmental protection, hydrogen energy, composite materials and development of digital products. I would like to emphasize that this list of strategically important business areas is open-ended and does not limit the Corporation's operations in any way: we will regularly monitor global technological trends, search for and select new business areas and integrate them into the industry's product offer.

The third set of goals is related to governance and corporate culture. We need to create a governance system aligned with international standards and easily adaptable to a new environment, which is changing incredibly rapidly at the moment. ROSATOM needs to become a single organism, including by developing efficient project management and teamwork. We need to build an integrated ecosystem involving our Russian and foreign partners. We intend to adopt a more customer-centric approach, which means proactively identifying customer needs and offering products and services that are most in-demand. And, finally, we have already started to take steps to fully unlock the potential of our employees. This includes creating a continuous education environment, developing programmes to attract the best talent and removing obstacles to working in the industry, including for expatriates.

2.1.1. BUSINESS CONTEXT

Trends in the development of the nuclear industry

The nuclear industry is influenced by a number of factors, including⁷:

- Global population growth from 7.8 billion people in 2019 to 10 billion people in 2050 and an increase in the share of urban population from 55–56% to 68% by 2050;
- Global GDP growth by an average of 2.4% per year until 2050;
- Growth of global electricity consumption. Global electricity consumption is expected to increase by 26% compared to 2019 and reach 34.1 TWh as early as in 2030. Asian countries will lead the growth, with electricity consumption in the region increasing by a factor of 1.4 (from 13 TWh to 18 TWh). In Russia, electricity consumption is expected to grow by 0.9% per year until 2030;
- Accelerating greenhouse gas accumulation. Global carbon dioxide emissions total about 33 billion tonnes per year and continue to grow. By 2030, carbon dioxide emissions are projected to exceed 34 billion tonnes per year. This drives the active development of low-carbon power generation, which includes nuclear power.

In recent years, environmental aspects of the electricity industry have come under closer scrutiny, which has resulted in an increase in the share of low-carbon power in the global energy mix. The levelized cost of electricity (LCOE⁸) for renewable energy sources has almost matched that of conventional power generation facilities, ranging from USD 60 to USD 90 per megawatt-hour.

These factors, as well as a reduction of fossil fuel reserves, contribute to the long-term demand for nuclear energy. Leading global think tanks predict an increase in installed capacity in the nuclear power industry by 2030. The International Energy Agency, UxC consulting company and the World Nuclear Association expect to see an increase in the capacity of operating NPPs under the base case scenario to 450-500 GW, according to different estimates.

The global nuclear power industry will remain competitive in the long run compared to other energy sources. Thermal power generation will yield to nuclear energy primarily because of CO₂

⁷ Data from the World Bank, the UN, the IEA World Energy Outlook 2018 (New Policy Scenario), EIU, the IAEA, McKinsey, the Energy Research Institute of the Russian Academy of Sciences and the General Layout Plan of Power Facilities until 2035 have been used.

⁸ The levelized cost of electricity (LCOE) is the net present value of the unit cost of electrical energy over the life cycle of an NPP.

emissions, which have a negative impact on the environment and drive up the cost of energy since many countries have imposed CO₂ emission fees. Furthermore, if CO₂ capturing devices are installed, the LCOE of thermal power plants increases by more than 50%, which makes them economically unviable. Unpredictable prices for raw hydrocarbons are yet another major disadvantage of thermal power generation.

Regarding renewable energy, even if energy generation becomes significantly cheaper, further traditional backup facilities or energy storage systems will need to be built to secure stable supplies of energy. This, in turn, will entail an increase in capital expenditure on the power grid.

ROSATOM's competitive position⁹

The competitiveness of services provided by ROSATOM is based on unique facilities, technical capabilities and human resources, as well as the experience of coordinating R&D and design organizations. The Russian nuclear industry is one of the global leaders in terms of research and development in reactor design, capabilities and technologies in the nuclear fuel cycle and in the sphere of NPP operation. Russia has the most advanced enrichment technologies in the world; nuclear power plants with water-cooled water-moderated power reactors (VVERs) have proved their reliability over one thousand reactor-years of fail-free operation. At year-end 2019, ROSATOM was the largest global market player in terms of the portfolio of NPP construction projects abroad (36 power units).

ROSATOM's competitive advantages:

- Integrated offer for the entire NPP life cycle, which guarantees a competitive cost per kilowatt-hour (LCOE);
- Use of reference technologies meeting the highest safety standards;
- Assistance in securing funding (including under the BOO scheme) and building project infrastructure (legal framework, employee training, community relations, etc.).

ROSATOM has identified two groups of factors that have the most significant impact on the Corporation's global operations:

- **The economic and geopolitical situation.** Although global economic growth outpaces that of the Russian economy, as a global company ROSATOM sets itself higher growth targets, given persisting political pressure and a general trend towards growing protectionism;
- **The technological landscape.** The Fourth Industrial Revolution that is currently underway across the world makes a significant impact on both global and local businesses. Its key elements, which ROSATOM takes into account when updating its business strategy, include:
 - Large-scale automation of production through active introduction of manufacturing solutions based on fully automated machine work;
 - Customization of production in order to fully meet the customers' individual needs;
 - Consolidation of manufacturing enterprises into integrated 'smart' networks and the development of the Internet of Things in the manufacturing industry, which involves the fullest possible digitization of information exchange;
 - Accelerated development and commercialization of technologies; a shorter life cycle of technologies and products;
 - Development of flexible project management systems.

2.1.2. LONG-TERM STRATEGIC GOALS

The development of ROSATOM is based on the long-term technological policy, which involves mastering new-generation nuclear energy technologies (including fast neutron reactors and the closed nuclear fuel cycle), as well as strengthening the export potential of Russia's nuclear technologies (construction of nuclear power plants abroad, rendering uranium enrichment services, nuclear fuel fabrication, etc.).

ROSATOM's mission reflects the development model that it has prioritized: the Corporation leverages the research, technological and manufacturing capabilities that it has developed over the years and continues to create new technologies that can help to improve the standard of living around the world.

ROSATOM's operations facilitate the implementation of the global sustainable development agenda. The Corporation contributes to the achievement of the UN Sustainable Development Goals through its product line and its efforts to ensure the sustainability of internal environmental, social and governance processes (*for details, see the section 'Sustainable Development Management'*).

The Corporation's business strategy provides general guidelines for the long term, shapes the global vision of the industry and sets a framework for development.

ROSATOM has set itself four long-term strategic goals to be achieved by 2030:

- **To increase the international market share.** To assert its leadership on the global nuclear power market, ROSATOM is currently expanding its footprint in over 50 countries around the world and the long-term portfolio of overseas orders and increasing the corresponding revenue. *For details, see the sections 'International Cooperation' and 'International Business'*;
- **To reduce production costs and the lead time.** In order to develop the most competitive products, the Corporation will take further steps to reduce the duration of NPP construction and the levelized cost of electricity (LCOE);

ROSATOM's mission is to leverage the achievements of nuclear science and modern high technology for the benefit of humanity.

- **To develop new products for the Russian and international markets.** Given the accumulated knowledge and technologies of the 'nuclear project' in civilian sectors, the Corporation plans to increase the share of new businesses in revenue significantly by 2030;
- **To achieve global leadership in state-of-the-art technology.** ROSATOM seeks to extend its global leadership beyond the nuclear industry. The Corporation intends to leverage its existing capabilities, the understanding of nuclear technologies and accumulated experience in order to diversify into new segments. In the future, ROSATOM aims to rank among international companies perceived as global technological leaders.

In order to implement the strategy, the following objectives must be met:

- Ensuring safe use of nuclear energy;
- Non-proliferation of nuclear technologies and materials;
- Preventing the negative environmental impact;
- Ensuring that the development of nuclear power is socially acceptable;
- Developing the Corporation's innovative potential;
- Shaping a corporate culture focused on results and performance improvement;
- Ensuring that the state defence order is fulfilled;
- Ensuring full compliance with Russian legislation, including the Law on State Secrets.

⁹ For information on ROSATOM's main competitors, see the section 'Markets Served by ROSATOM'.

Key strategy implementation risks

Key risks that can influence the achievement of strategic goals include:

- Nuclear and radiation risks;
- Economic risks (including financial risks, such as currency, interest rate and credit risks, etc.);
- Commercial risks (including risks associated with the nuclear fuel cycle product and service market and reputational risks);

- Operational risks (including the risk of losing critical knowledge of existing and newly created products);
- Political risks;
- Technical (project) risks;
- Technological risks (including the risk of shortcomings in technology).

A detailed description and assessment of key risks for 2019 is provided in the section 'Risk Management'.

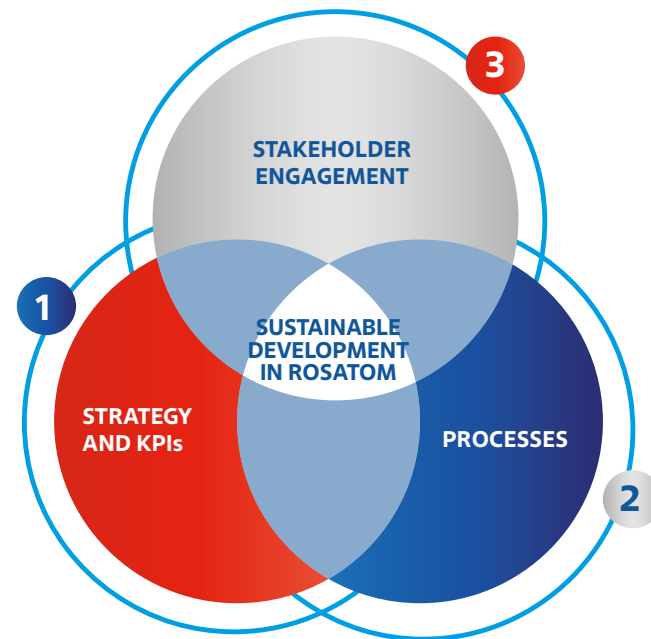
2.2. SUSTAINABLE DEVELOPMENT MANAGEMENT

In the course of its operations, ROSATOM seeks to contribute to the implementation of the global sustainable development agenda. The Corporation adheres to the 10 principles of the UN Global Compact (ESG principles) and contributes to the achievement of the 17 UN Sustainable Development Goals (SDGs) through its product line and its efforts to ensure the sustainability of internal environmental, social and governance processes.

ROSATOM has adopted a systematic approach to the development and implementation of sustainability practices. In 2019, the Corporation established a separate department, the Project Office for Sustainable Development Programmes, and the Expert Panel on Sustainable Development, which serves as a permanent platform for discussing sustainable development matters.

ROSATOM takes part in public events dedicated to sustainable development that are held in Russia and globally. These included the 11th ATOMEXPO International Forum, which took place in April 2019 in Sochi and was focused entirely on sustainable development topics (the forum was attended by representatives of more than 70 countries).

The Corporation is also taking part in the preparation of Russia's Voluntary National Review on the Achievement of the Sustainable Development Goals, which will be presented in 2020 at the UN High-Level Political Forum.



Implementation of sustainability practices in the industry covers the following areas:

- Strategy;
- Operational processes;
- Stakeholder engagement (see the sections 'Stakeholder Engagement' and 'Public Reporting System').

2.2.1. STRATEGY

As part of an update to ROSATOM's business strategy, in 2019, sustainable development was listed as one of the Corporation's fundamental business principles. Experts have been engaged to assess the Corporation's contribution to the achievement of the 17 SDGs taking into account the scale of impact.

ROSATOM'S CONTRIBUTION TO ACHIEVING THE SUSTAINABLE DEVELOPMENT GOALS

UN SUSTAINABLE DEVELOPMENT GOALS	CONTRIBUTION	ROSATOM'S ACTIONS ON THE STRATEGIC HORIZON
1 No Poverty	■■■	Working towards making energy solutions more available and affordable
2 Zero Hunger	■■■	Development of irradiation and sterilization systems
3 Good Health and Well-Being	■■■	Development of a strategic programme in the sphere of nuclear medicine
4 Quality Education	■■■	Development of educational platforms, including engagement of third parties
5 Gender Equality	■■■	Providing men and women with equal opportunities for career development at ROSATOM
6 Clean Water and Sanitation	■■■	Development of water treatment and desalination technologies
7 Affordable and Clean Energy	■■■	Improvement of technical and commercial performance of NPPs; development of new energy
8 Decent Work and Economic Growth	■■■	Implementation of business initiatives in new business areas
9 Industry, Innovation and Infrastructure	■■■	Development of industry infrastructure in the countries of operation; development of municipal infrastructure; Northern Sea Route

10		Reduced Inequalities		Making electricity more available and affordable and providing more opportunities for highly skilled labour in all regions of operation
11		Sustainable Cities and Communities		Development of various aspects of comprehensive municipal management
12		Responsible Consumption and Production		Development of solutions for the management of accumulated spent nuclear fuel and radioactive waste; use of recyclable materials in production
13		Climate Action		Development of technologies ensuring safe operation of nuclear facilities
14		Life Below Water		Development of environmental initiatives and industrial waste management
15		Life on Land		Development of environmental initiatives and industrial waste management
16		Peace, Justice and Strong Institutions		Development of a regulatory framework governing the use of nuclear technologies on markets served by ROSATOM in accordance with international rules
17		Partnerships for Sustainable Development		Development of cooperation with partners in Russia and abroad

The level of contribution is shown taking into account the scale of influence and the direct/indirect nature of ROSATOM's impact on the Sustainable Development Goals:

- Current level of contribution (low/medium/high)
- Potential for development (taking into account the scale of influence)
- Outside the scope of ROSATOM's direct influence

2.2.2. OPERATIONAL PROCESSES

The Corporation's sustainable development initiatives include environmental projects and industry-wide public reporting, corporate social responsibility initiatives, development of a supply chain management system, as well as personnel management.

Environmental aspect (E)

The Corporation is committed to the 'Do No Significant Harm' principle. This principle includes minimizing pollution and the negative impact on ecosystems, reducing water consumption and introducing a closed production cycle. The Corporation supports initiatives addressing climate change and is committed to ensuring full compliance of its business with international environmental standards.

Over the years, no events rated at level 2 or higher on the international INES scale have been detected at ROSATOM's nuclear facilities (level 1 and 0 deviations do not pose a risk to employees operating the facilities, local residents or the environment). A wide range of measures is implemented annually to improve environmental safety and preserve the environment.

A number of corporate environmental documents have been approved in the industry and are updated on a regular basis. The main document in this area is the Uniform Industry-Wide Environmental Policy (2008¹⁰).

To monitor progress and assess the efficiency of sustainable development processes in the sphere of environmental protection and environmental impacts, ROSATOM uses such indicators as the volume of pollutant and greenhouse gas emissions, water withdrawal and wastewater discharge, industrial and consumer waste generation, the area of restored land, the number of environmentally relevant organizations which use integrated management systems, etc.

For details, see the section 'Environmental Safety'.

Social aspect (S)

The top priority for the Corporation is to ensure occupational and process safety and to protect the life and health of employees in the industry. The Corporation is actively implementing its social policy, supports employees' career progression and safeguards their equal rights.

The Corporation's business development efforts in Russia and on foreign markets are aimed at driving systematic improvements in the standard of living by facilitating long-term and sustainable development in its regions of operation.

In the social sphere, the Corporation is implementing a wide range of projects aimed at supporting employees in the industry and residents of 'nuclear' towns and cities and promoting public initiatives.

The main corporate documents in the social sphere are the Uniform Industry-Wide Social Policy (2013) and the Single Industry-Wide Policy on Occupational Safety and Health (2013).

To assess the efficiency of sustainable development processes in the social sphere, the Corporation uses such indicators as the LTIFR, the personnel turnover rate, the number of employees who have undergone training, the gender balance, recruitment of university graduates, the number of employees engaged in NPP construction, contribution to the energy security of Russian regions, the number and value of contracts signed with small and medium-sized enterprises, etc.

For details, see the sections 'Occupational Safety and Health', 'Implementation of the HR Policy', 'Developing the Regions of Operation' and 'Procurement Management'.

Governance aspect (G)

The Corporation is building an integrated system of industry regulation and sustainable development standards and ensures the transparency of its business by disclosing as much informa-

¹⁰ Hereinafter in this section, the years of approval of the first versions of the documents are stated.

tion as possible. In its production processes, ROSATOM focuses on building a sustainable supply chain. It is proactively implementing anti-corruption measures and introducing the principles of ethical business conduct.

The ROSATOM Production System has been developed and is widely used in the industry; it is aimed at promoting a lean manufacturing culture.

A quality management system has been introduced, and the ISO 14001, ISO 9001 and OHSAS 18000 international standards are applied.

In 2019, the Corporation piloted a supply chain sustainability verification system. JSC TENEX developed a Supplier Code of Conduct and standardized implementation recommendations. A pilot sustainable development audit of suppliers in the industry is scheduled for 2020. The Corporation plans to replicate this experience in other organizations and enterprises in the industry.

2.2.3. TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT AND THEIR CONTRIBUTION TO THE ACHIEVEMENT OF THE SDGS

Nuclear technology drives positive systemic changes in the quality of people's life and generally contributes to the implementation of the sustainable development agenda. Nuclear power generation is sustainable because it is a low-carbon energy source (greenhouse gas emissions over the life cycle of an NPP total 12 grams of CO₂ equivalent per kilowatt-hour on average¹¹) and because it makes an important contribution to achieving SDG 7 Affordable and Clean Energy, SDG 8 Decent Work and Economic Growth, SDG 9 Industry, Innovation and Infrastructure, and SDG 13 Climate Action in the regions where NPPs are built and operated, both in Russia and abroad.

The Corporation's product portfolio comprises not only conventional solutions in the sphere of nuclear power, but also new areas involving the use of nuclear technology, such as nuclear medicine, radiation processing facilities, nuclear research and

Public sustainability reports are an integral part of ROSATOM's practices to ensure the transparency of its business and a tool for communication with stakeholders. Since 2010, the Corporation annually publishes non-financial reports in accordance with the international GRI Standards.

The main corporate governance documents are the Uniform Industry-Wide Public Reporting Policy (2009), the Uniform Industrial Procurement Standard (2009), the Uniform Industry-Wide Anti-Corruption Policy (2015), and the Code of Ethics and Professional Conduct (2016).

To monitor the efficiency of sustainable development processes in the sphere of corporate governance, ROSATOM uses such indicators as the findings of external audit of performance of the internal control system, the number of employees who have undergone anti-corruption training, financial losses prevented through anti-corruption measures, etc.

For details, see the sections 'Internal Control System' and 'Prevention of Corruption and Other Offences'.

technology centres based on research reactors, etc. In addition, the Corporation is developing its business in a number of related non-nuclear areas: water treatment, wind power, polymer composite materials, etc. Sustainable new products accounted for 77% of ROSATOM's total revenue from new businesses in 2019.







The Corporation applies sustainable development approaches in its business areas in the form of pilot projects. Such projects are focused on achieving four types of results: digitizing the SDG achievement impacts, developing indicators for performance evaluation from the perspective of sustainable development, a sustainable supply chain, and communication practices in the sphere of sustainable development. This practice was adopted in 2019 and will be continued on a regular basis in order to replicate the accumulated experience in industry organizations and business areas.

NUCLEAR POWER INDUSTRY

NPP construction and operation contributes to economic and infrastructure development both in Russia and in foreign customer countries. As high-technology manufacturing enterprises are guaranteed long-term stable capacity utilization, companies in related industries receive orders, and new jobs are created for

local communities, all this contributes to GDP through industry revenue and tax payments. NPP construction and operation provides employment for several thousand people, both at the plant itself and in the sphere of nuclear infrastructure.

DETAILED DESCRIPTION OF CONTRIBUTION OF THE NUCLEAR POWER INDUSTRY TO THE ACHIEVEMENT OF THE SDGS

GOAL	DETAILED DESCRIPTION
7 	NPPs ensure stable low-carbon power generation for 60 years, with a potential for further life extension.
8 	On average, about 10,000 people are employed in the construction of an NPP with two power units, while its operation provides about 3,000 jobs. Stable large-scale power generation makes a positive systemic impact on the development of local industry in the country where the NPP is located.
9 	NPP construction and operation involves building the relevant infrastructure and developing fundamental and applied science and a national personnel training system.
12 	In NPP construction and operation projects, special focus is given to the management of spent nuclear fuel (SNF), SNF processing products and operational radioactive waste (RAW), as well as to the decommissioning of facilities posing nuclear and radiation hazards. Waste management efforts are focused on preserving the environment and improving environmental safety.
13 	Nuclear power generation is a source of low-carbon energy that provides considerable environmental benefits. The operation of all Russian-design NPPs globally helps to prevent emissions totalling about 210 million tonnes of CO ₂ equivalent per year ¹² .
17 	The nuclear power industry offers solutions for different stakeholders: the government, local communities, industrial enterprises, etc. An open dialogue between all stakeholders is an integral part of successful implementation of NPP projects. The sustainable development agenda is actively discussed on international platforms: at conferences held by the IAEA and the World Nuclear Association (WNA), the World Association of Nuclear Operators (WANO), the World Energy Council, etc.

¹² Estimates by the Corporation's experts. Greenhouse gas emissions savings from the operation of Russian-design NPPs globally have been calculated based on an assumption that 100% of nuclear power generation is replaced with other electricity sources in proportion to their shares in the global power generation structure, with emissions of CO₂ equivalent reassessed accordingly by type of generation.

¹¹ Data from the Intergovernmental Panel on Climate Change (IPCC).

WIND POWER

ROSATOM adheres to sustainability principles and seeks to diversify its product offer in the sphere of power generation. As part of these efforts, it has been developing the wind power business jointly with Lagerwey since 2017.

As part of this business, in addition to wind power plant construction, the Corporation intends to create a technical regulation system, provide personnel training, localize the production of wind turbines, perform certification and carry out R&D.

For details, see the sections 'Markets Served by ROSATOM' and 'Business Diversification'.

NUCLEAR MEDICINE

ROSATOM offers nuclear medicine technologies and services that enable timely diagnosis and effective treatment of certain types of cancer.

The Corporation is developing new high-technology equipment and radiopharmaceuticals based on isotopes produced in-house. It supplies solutions for nuclear medicine centres comprising diagnostic and radiotherapy modules worldwide.

For details, see the sections 'Markets Served by ROSATOM' and 'Business Diversification'.



Wind power generation is a low-carbon energy source. According to the Intergovernmental Panel on Climate Change (IPCC), greenhouse gas emissions from onshore wind power plants over their life cycle average 11 grams of CO₂ equivalent per kilowatt-hour. By comparison, greenhouse gas emissions from hydropower plants average 24 grams of CO₂ equivalent per kilowatt-hour, while greenhouse gas emissions from coal-fired power plants are almost 75 times higher than those from wind power plants.



Technological solutions currently used in the nuclear industry enable diagnosis and treatment of more than half of all types of cancer. Millions of patients undergo diagnostic procedures and therapy that involve the use of isotope products manufactured by ROSATOM: for example, almost 2 million people per year undergo procedures that involve the use of molybdenum-99 and technetium-99.



2.3. VALUE CREATION AND BUSINESS MODEL

ROSATOM manages the assets of the Russian nuclear industry at all stages of the nuclear fuel cycle, the cycle of NPP construction, operation and decommissioning and in other segments related to the use of nuclear energy. Realizing the importance of its operations for the economy and society, ROSATOM seeks to develop its business sustainably, including by increasing its total

value for the Corporation and a wide range of its stakeholders. The term 'value' refers not only to products created, services rendered and financial results achieved by ROSATOM, but also to the combination of economic, social and environmental impacts of ROSATOM on its stakeholders, society as a whole and the environment.

ROSATOM defines the business model as a system that enables value creation in the short, medium and long term and is aimed at achieving strategic goals.

The business model is based on ROSATOM's long-term business strategy. It forms part of the business value chain, which also includes:

- Available capitals;
- A governance system aimed at ensuring the most efficient use of the capitals (*see the chapter 'Effective Management of Resources'*);
- Operating results and their contribution to the long-term increase in the capitals, which is measured by performance against the targets set in the strategy.

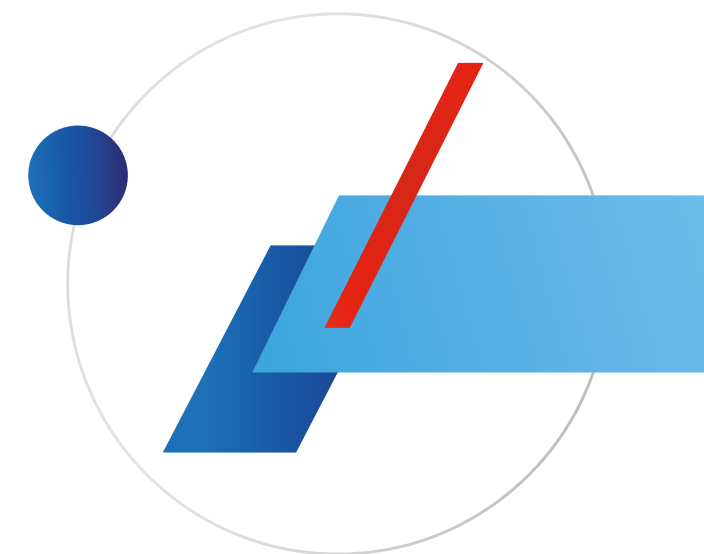
The business model gives special focus to the external environment because: a) some of ROSATOM's available capitals are obtained from the external environment, and many of its results are also related to it; b) the external environment is a source of risks and opportunities.

The scheme represents an integrated process of value creation. ROSATOM's business model is at the core of this process; it determines the set of different activities and results that contribute to the change in main types of capitals during the reporting period.

ROSATOM'S CAPITALS

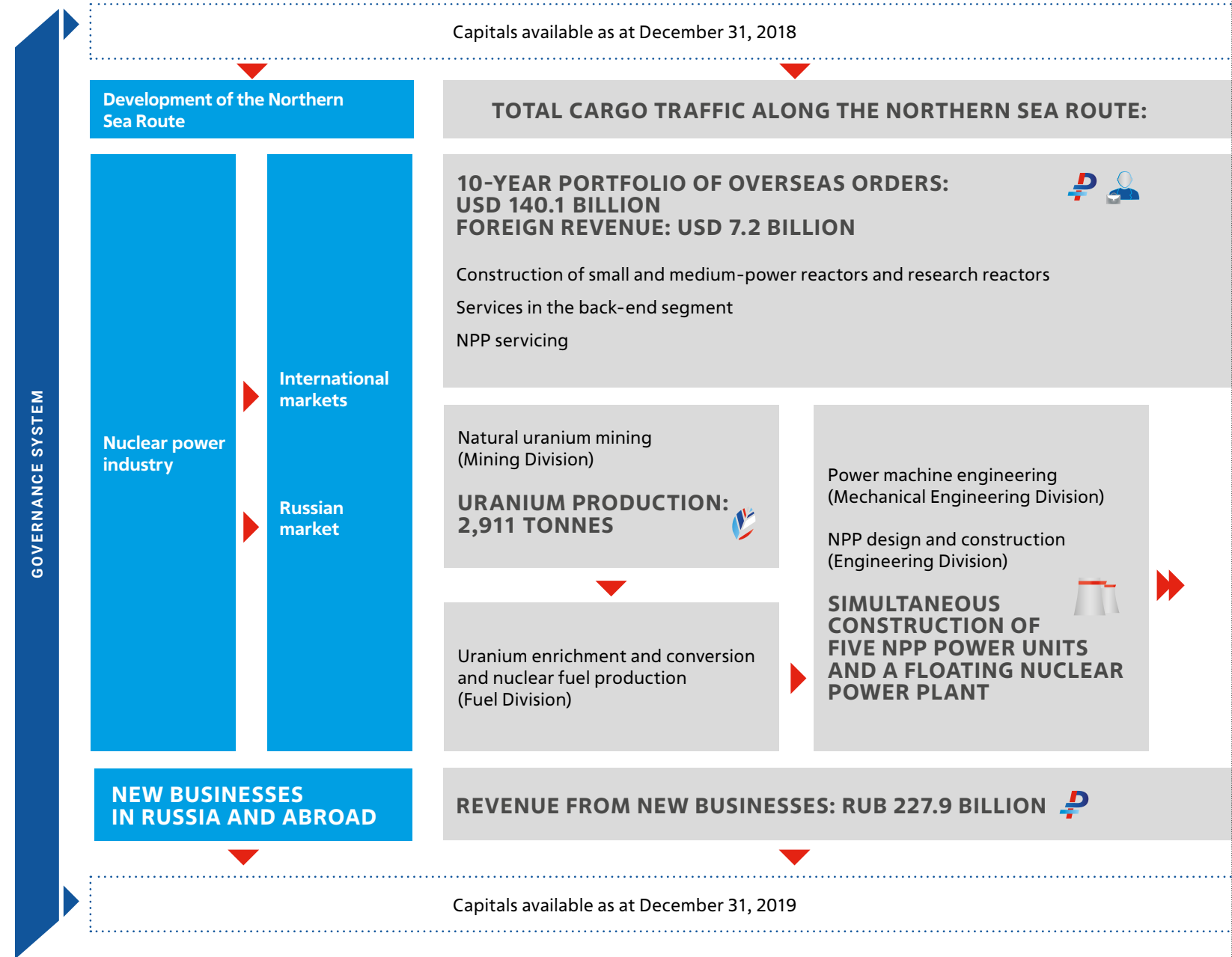
ROSATOM's capitals are one of the main elements of the value chain. In the course of commercial and other activities, they are changed (increased, reduced, transformed), which generally creates value in the medium and long term.

The Corporation defines capitals as specific resources (reserves) of tangible and intangible assets that ROSATOM uses in its operations. ROSATOM acknowledges that some of the available capitals are owned jointly with other stakeholders (e.g. natural resources or public infrastructure). Accordingly, it takes a responsible approach to handling them. ROSATOM identifies six types of capital it uses: financial, manufactured, human, intellectual, social and relationship, and natural. An integral increase or decline in capitals causes an increase or decrease in value; therefore, ROSATOM attaches great importance to managing the capitals available to it and using them more efficiently.



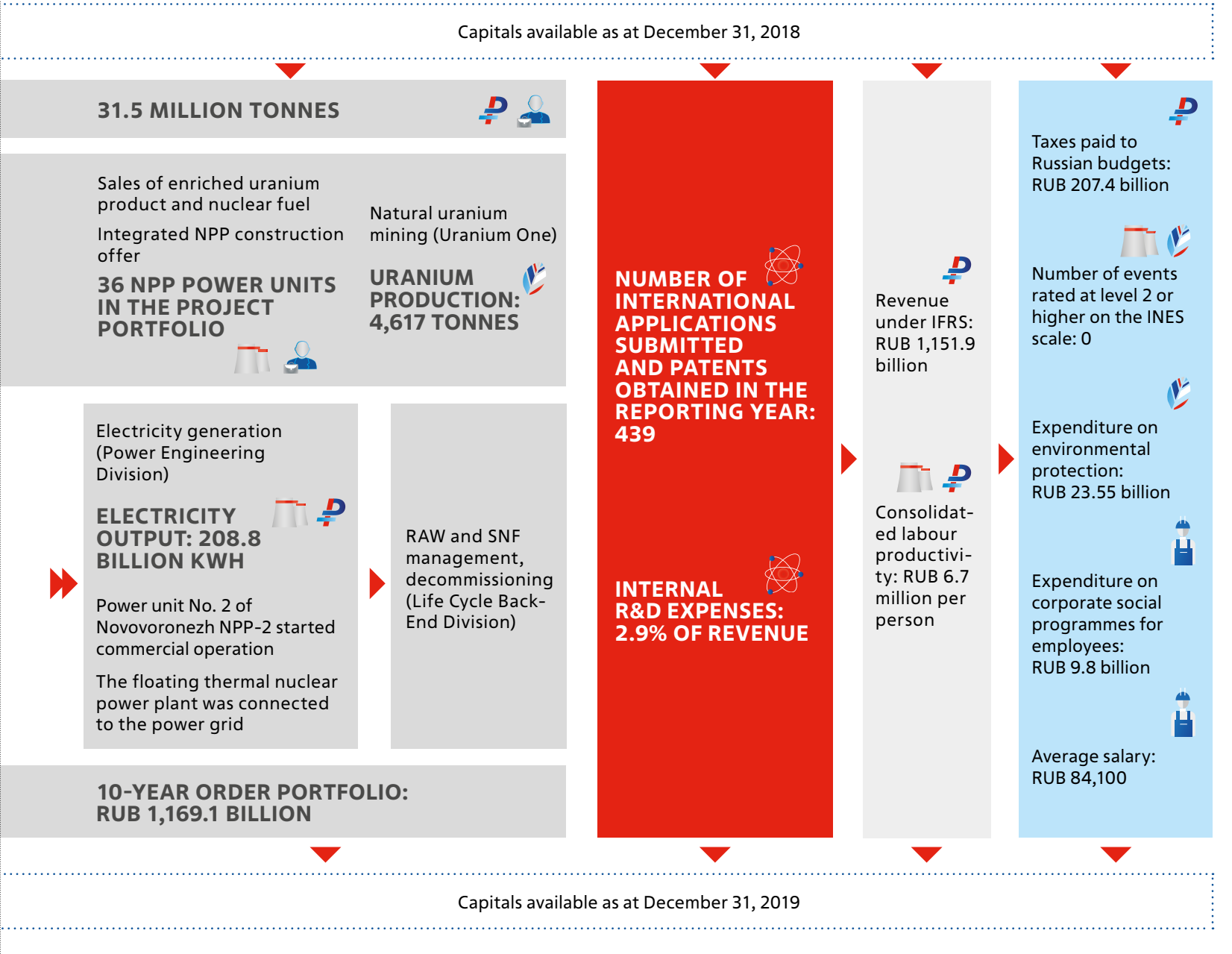
ROSATOM'S BUSINESS MODEL

● Areas of business ● Operating results ● Development of innovations ● External environment

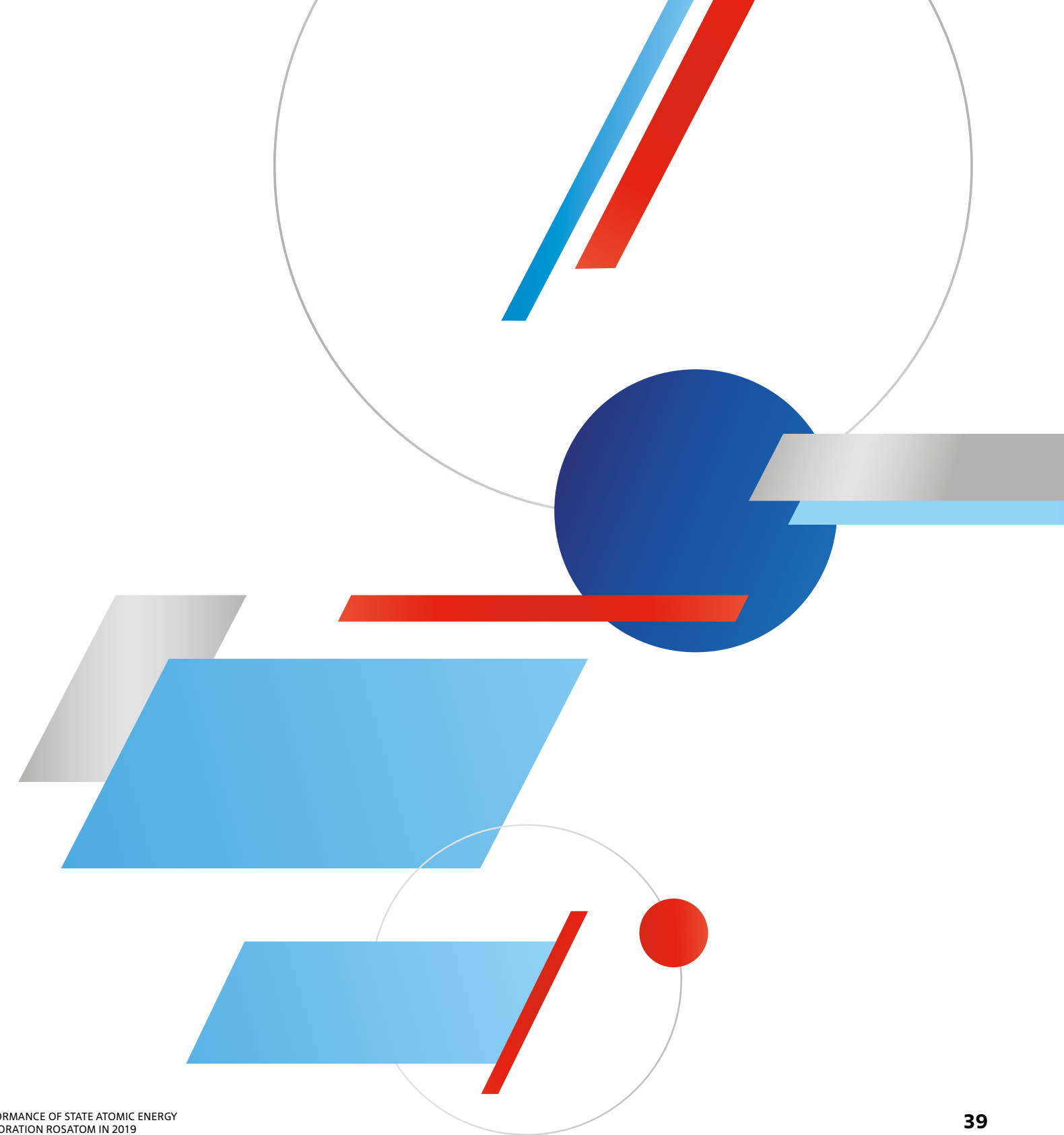


The diagram presents results for 2019 by type of capital

Manufactured Human Social and relationship Financial Intellectual Natural



Capital	Indicator	2017	2018	2019	2019/2018
VALUE CREATION RESULTS					
Financial	Adjusted free cash flow, RUB billion	308.7	321.5	328.7	+2.2%
	Revenue under IFRS, RUB billion	967.8	1,033.9	1,151.9	+11.4%
Manufactured	Number of power units in operation during the year, pcs.	35	37	36	-2.7%
	Capacity factor of Russian NPPs, %	83.3	79.9	80.4	▲
Intellectual	Intangible assets under IFRS, RUB billion	103.5	194	170.9	-11.9%
	Share of innovative products in revenue, %	13.5	17.5	20.6	▲
	Number of foreign patents obtained by ROSA-TOM, applications for foreign patents submitted and registered under the established procedure, registered trade secrets (know-how), pcs.	443	417	439	+5.3%
Human	Average headcount, '000 people	247.3	255.4	266.4	+4.3%
	Personnel turnover rate, %	10	12.7	13.2	▲
	Average training hours per employee	29.5	23.7	28.4	▲
	LTIFR	0.13	0.12	0.10	▼
Social and relationship	Level of support for the nuclear industry in Russia, %	73.9	74.5	73.7	▼
	10-year portfolio of overseas orders, USD billion	133.5	133.2	140.1	+5.2%
	Taxes paid, RUB billion	148.5	188.2	207.4	+10.2%
Natural	Uranium resources (Russian assets), kt	523.9	520.7	512.7	-1.5%
	Uranium resources (foreign assets), kt	216.2	197.1	192	-2.6%
	Water withdrawal from natural sources, million m ³	7,411	7,317.8	6,531.3	-10.7%

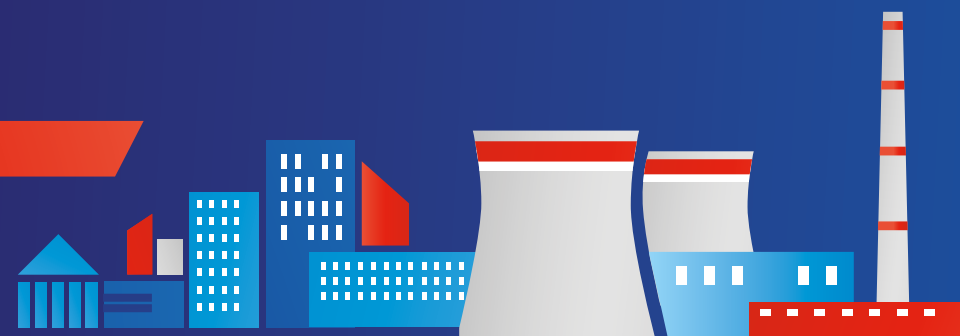




3

CONTRIBUTION TO GLOBAL DEVELOPMENT

3.1. Markets Served by ROSATOM	42
3.2. International Cooperation	55
3.3. International Business	63



3.1. MARKETS SERVED BY ROSATOM

In 2019, ROSATOM ranked:

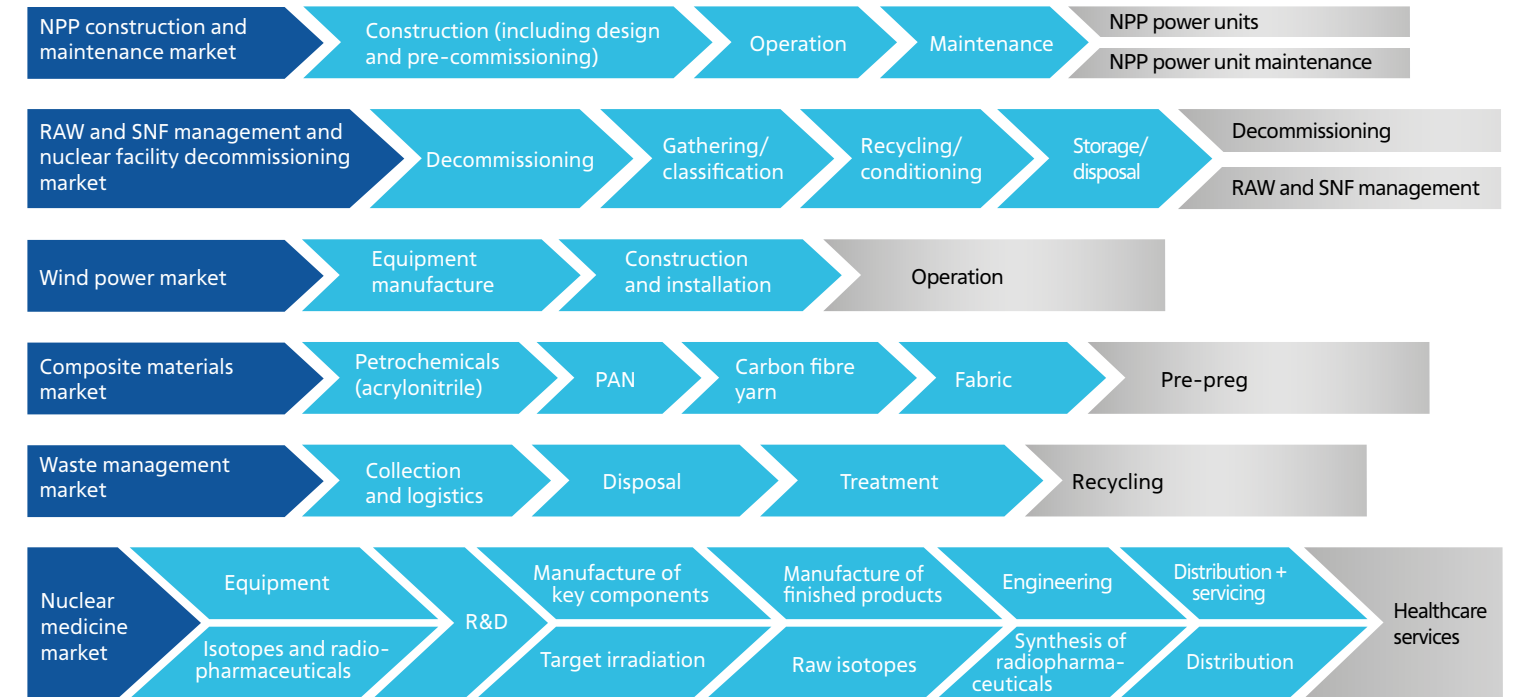
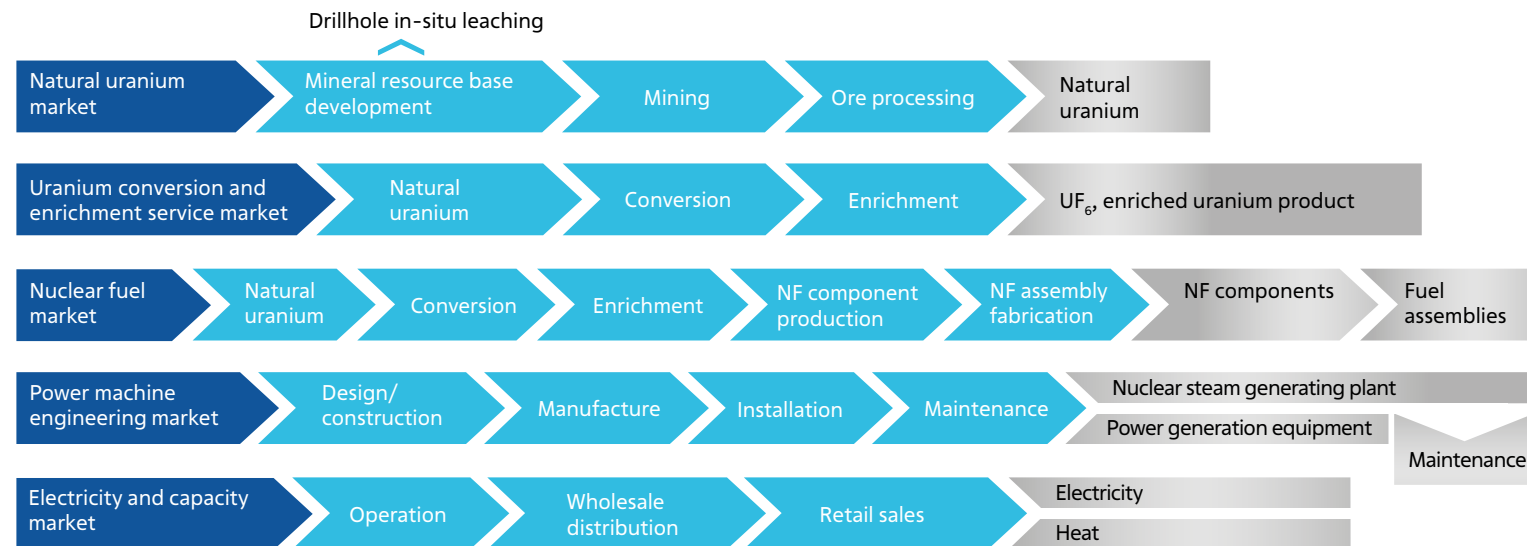
- First in the world in terms of the number of NPP power units in the portfolio of foreign projects (36 power units);
- First on the global uranium enrichment market (38%);
- Second in the world in terms of uranium production (14% of the market);
- Third on the global nuclear fuel market (16%).

ROSATOM's vision is to become a global technological leader. Accordingly, the Corporation intends not only to actively develop its business in traditional segments, but also to take active steps towards entering new high-technology markets as a leading research and technology company.

One of the key priorities of ROSATOM's business is to develop globally competitive products that are able not only to effectively replace imports, but also to become leaders on global markets.

MARKETS SERVED BY ROSATOM AND VALUE CHAINS

■ Markets ■ Value chain ■ Products/services



3.1.1. TRADITIONAL MARKETS

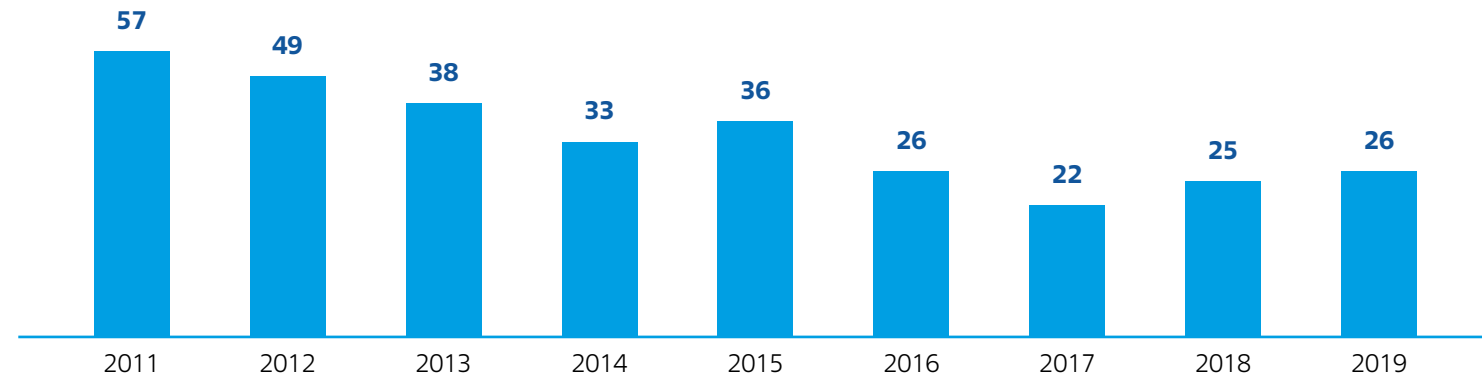
NATURAL URANIUM MARKET

Forecast for changes in uranium demand by 2030

After 2011, there was a significant drop in prices on the nuclear fuel cycle front-end markets, including a long-term decline in quotations for natural uranium. Throughout most of 2019, the natural uranium market was characterized by a low level of con-

sumer activity amid political and trade uncertainty. In the reporting year, spot market quotations averaged USD 25.8/lb of U₃O₈, which is 5% higher than in 2018.

AVERAGE ANNUAL SPOT MARKET QUOTATIONS FOR NATURAL URANIUM, USD/lb of U₃O₈

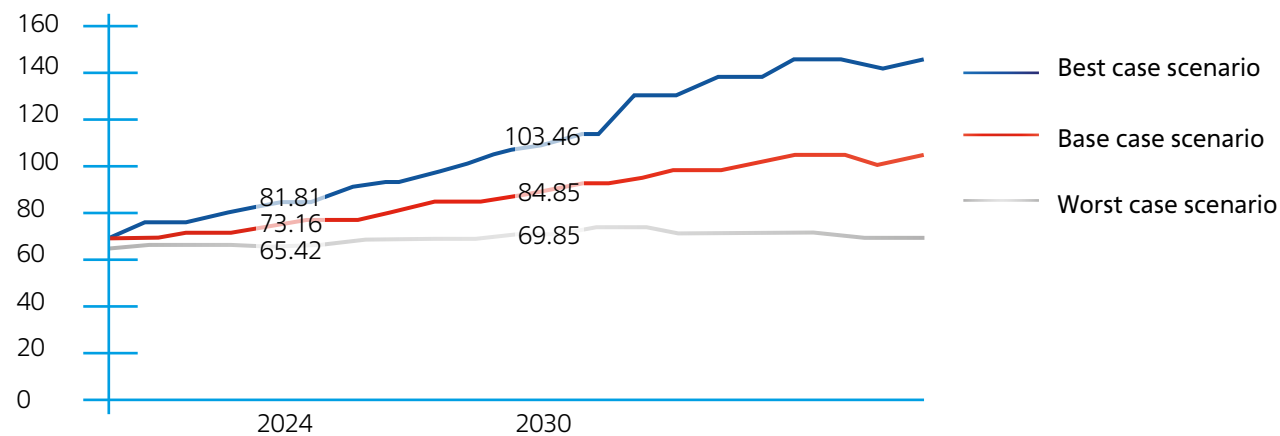


Sources: raw data from UxC¹³; average values have been calculated by JSC Atomredmetzoloto.

In 2019, global reactor demand for uranium totalled 64,300 tonnes. At the same time, global demand taking into account commercial and strategic stockpiling not intended for current consumption is estimated at 72,000 tonnes.

The uranium market fundamentals remain favourable. In the medium and long term, demand for natural uranium is expected to increase due to the commissioning of new power units at NPPs in China, India and other countries. According to the baseline forecast of the World Nuclear Association (WNA), global reactor demand for uranium will increase to 73,000 tonnes by 2024 and to 85,000 tonnes by 2030.

FORECAST FOR CHANGES IN URANIUM DEMAND, KT



Source: World Nuclear Association, 2019.

¹³ UxC, LLC (UxC) is an independent international company specializing in market analysis, research and forecasting covering the entire nuclear fuel cycle. It was founded in 1994 (<https://www.uxc.com/>).

Natural uranium market overview

In 2019, global uranium production increased by 2% year on year to 53,900 tonnes. Production in Kazakhstan increased in line with targets previously set in some mining contracts. Production growth was also recorded at the Husab mine in Namibia as part of a ramp-up to design capacity.

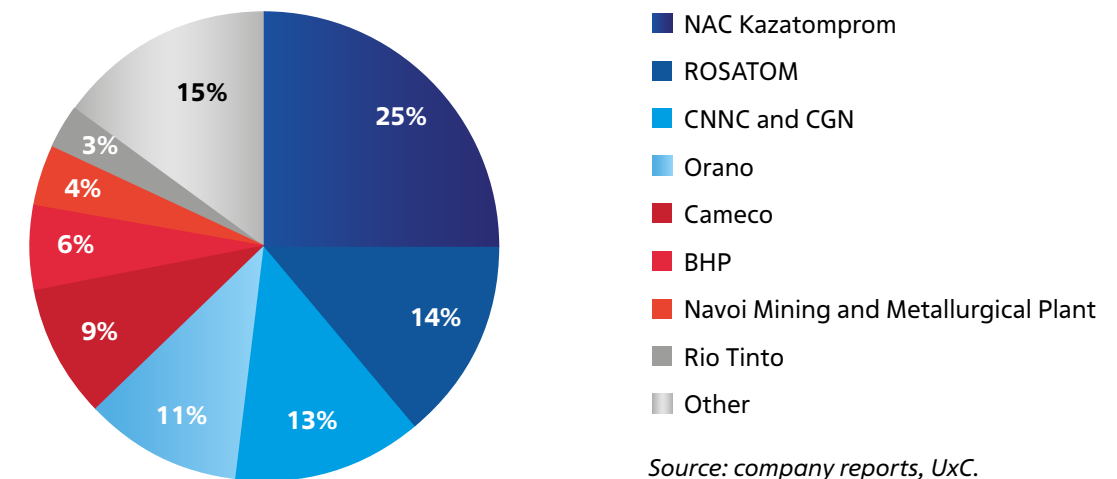
Supplies from secondary sources (inventories of energy companies and some states, reparation of depleted uranium hexafluoride, reprocessed uranium, etc.) are estimated at 20,000 tonnes of natural uranium equivalent.

In the reporting year, major producers remained committed to reducing oversupply. The McArthur River mine in Canada (the world's largest enterprise with a capacity of about 7,000 tonnes of uranium per year) and the Langer Heinrich mine in Namibia remained on care and maintenance. Production decreased in the US, Niger and other countries. Progress on most projects developed by junior companies remained slow due to difficulties with raising funds and arranging product sales.

A stable group of leaders has emerged on the natural uranium market. At year-end 2019, along with ROSATOM (14% of the global output), the group also included NAC Kazatomprom (Kazakhstan, 25%), an alliance of CNNC and CGN (China, 13%), Orano¹⁴ (France, 11%), Cameco (Canada, 9%), BHP (Australia – United Kingdom, 6%), Navoi Mining and Metallurgical Plant (Uzbekistan, 4%) and Rio Tinto (Australia – United Kingdom, 3%). The eight largest market players account for 85% of the total uranium output.

According to the UxC forecast¹⁵, in 2020, global uranium production will total 54,700 tonnes, while supply from secondary sources will total about 19,000 tonnes. Global production of natural uranium is expected to increase by 2030 due to rising demand. Supply from secondary sources will total about 8,000 tonnes of natural uranium equivalent in 2030¹⁶.

LARGEST PLAYERS ON THE NATURAL URANIUM MARKET IN 2019



Source: company reports, UxC.

¹⁴ In 2017, in the course of restructuring, the French company AREVA was divided into two companies: Orano (nuclear fuel cycle) and Framatome (nuclear mechanical engineering, NPP construction and maintenance). EDF became the main owner of Framatome.

¹⁵ Report by UxC (UxC UMO 1Q 2020).

¹⁶ Report by UxC (UxC UMO 1Q 2020).

URANIUM CONVERSION AND ENRICHMENT MARKET

Products offered on the market include uranium hexafluoride (UF₆), uranium conversion services, enriched uranium product (EUP) and uranium enrichment services measured in separative work units (SWU).

Forecast for changes in demand for uranium conversion services by 2030

According to the base case scenario of the World Nuclear Association, in 2019, global reactor demand for uranium conversion totalled about 65,000 tonnes.

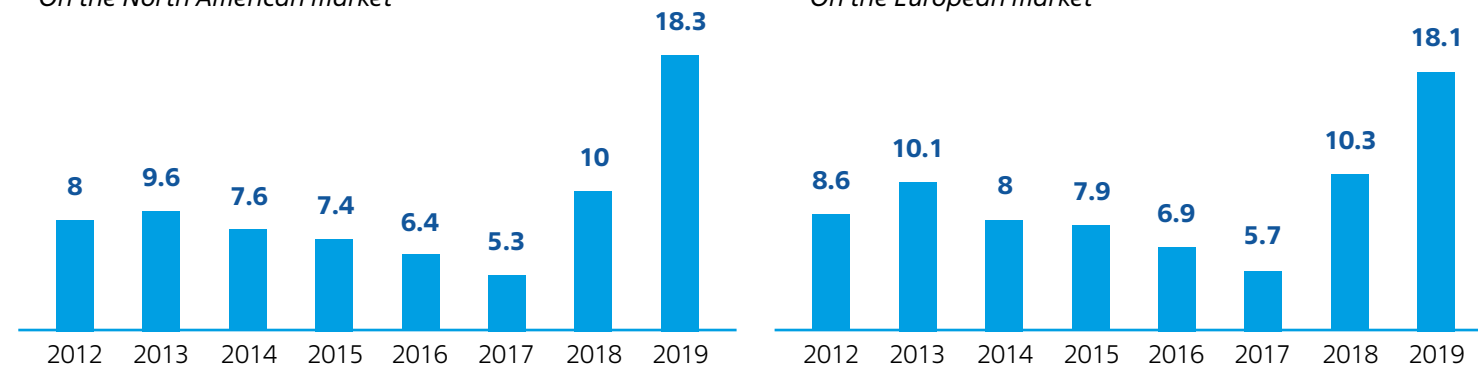
In 2019, average annual spot quotations on the North American and European markets soared by 83% and 76% respectively, while average annual long-term quotations on these markets increased by 17% and 15% respectively. This was the result of primary supply deficit combined with rapid growth of buying interest.

The development of the nuclear power industry until 2030 will have a positive impact on the market for uranium conversion services. According to the base case scenario of the World Nuclear Association, global demand for conversion services will grow to 70,000 tonnes by 2024 and 81,000 tonnes by 2030.

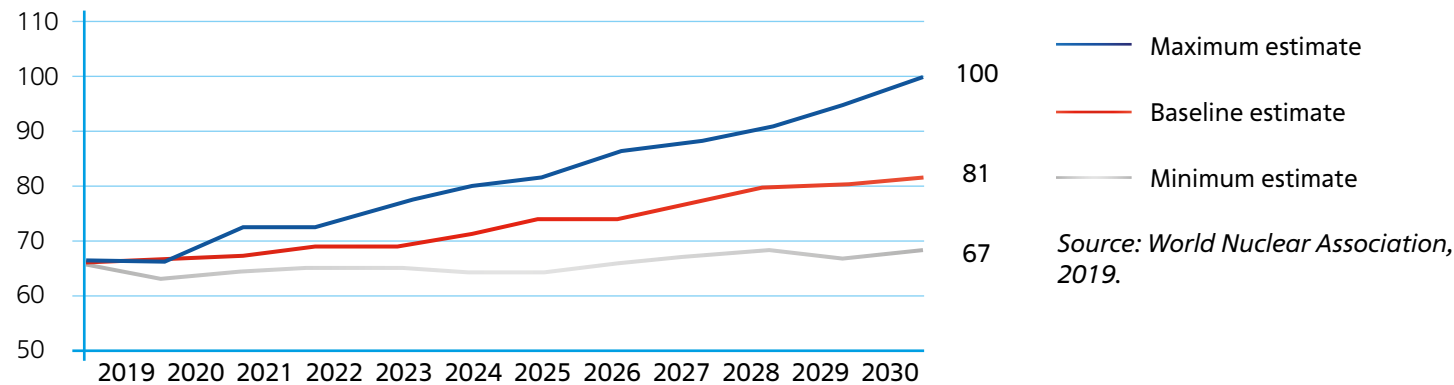
AVERAGE ANNUAL SPOT MARKET QUOTATIONS FOR CONVERSION SERVICES, USD/KG OF URANIUM

On the North American market

On the European market



FORECAST FOR CHANGES IN DEMAND FOR URANIUM CONVERSION BY 2030, KT

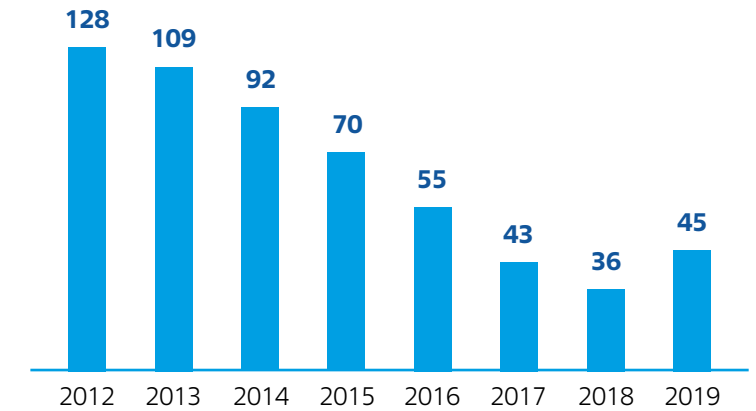


Forecast for changes in demand for uranium enrichment services by 2030

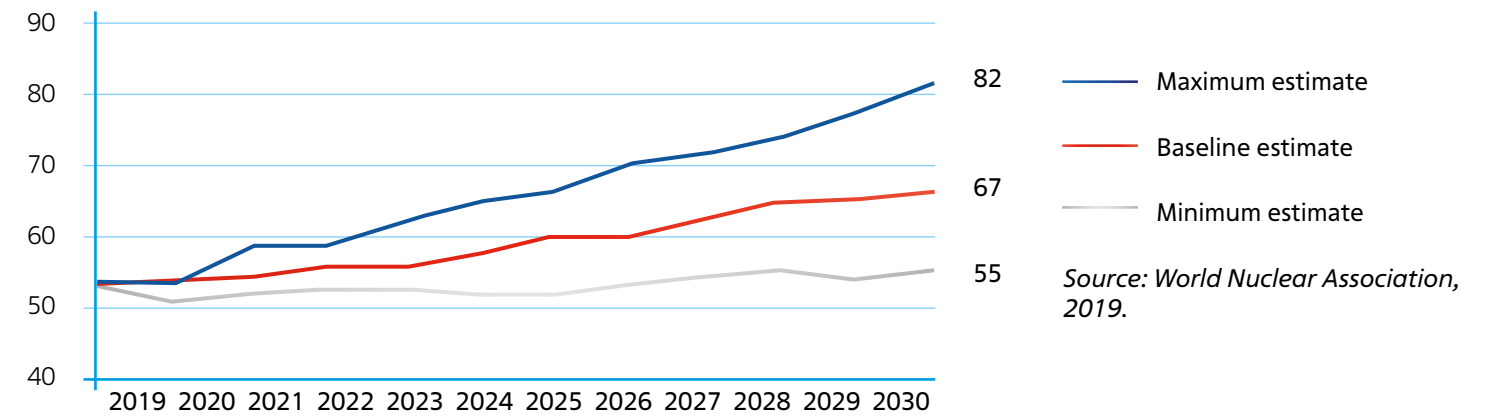
According to ROSATOM's estimates, global reactor demand for enrichment totalled about 56 million SWU in 2019. Amid gradual rebalancing of supply and demand on the uranium enrichment market, in 2019, average annual spot market quotations rose by 25%, while long-term quotations increased by 11%.

The development of the nuclear power industry until 2030 will have a positive impact on the market for natural uranium enrichment services. According to the base case scenario of the WNA, global demand for enrichment will grow to almost 58 million SWU by 2024 and 67 million SWU by 2030.

AVERAGE ANNUAL SPOT MARKET QUOTATIONS FOR ENRICHMENT, USD/SWU



FORECAST FOR CHANGES IN DEMAND FOR URANIUM ENRICHMENT BY 2030, MILLION SWU



Uranium conversion and enrichment market overview

Along with ROSATOM, key players on the global market for uranium conversion services include Orano (France), Cameco (Canada) and ConverDyn (US).

The main players on the global market for uranium enrichment services include ROSATOM (38% of the global market), URENCO (UK, Germany, Netherlands; 29%), Orano (France; 14%) and Chinese companies (10%). Together, they control about 90% of the market. At present, all players use modern gas centrifuge technology for uranium enrichment.

NUCLEAR FUEL FABRICATION MARKET

According to ROSATOM, in 2019, the global nuclear fuel market capacity totalled about 11,000 tonnes of heavy metal (tHM). This includes:

- Fuel for light-water reactors requiring uranium enrichment accounting for 7,400 tHM (including over 1,000 tHM of fuel for water-cooled water-moderated power reactors (VVERs));
- Fuel for heavy-water reactors accounting for 3,500 tHM.

As the reactor fleet will be expanding, the demand for fabrication services may increase to 12,000 tonnes or more by 2030.

Global suppliers on the fabrication market include Westinghouse (Canada), Framatome (formerly AREVA), Global Nuclear Fuel and ROSATOM.

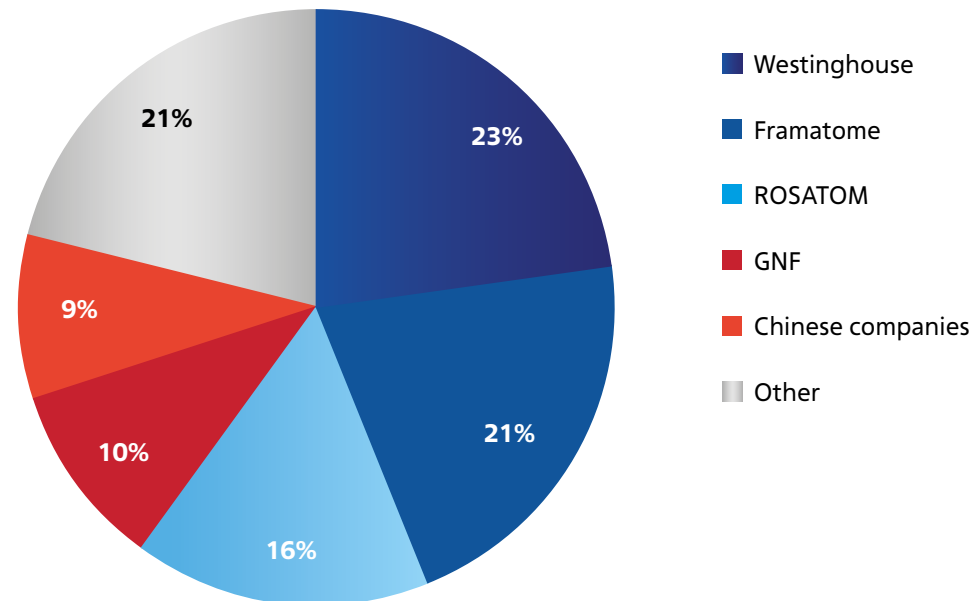
Westinghouse Electric Company fabricates nuclear fuel for nearly all types of light-water reactors (LWRs). Its major markets are the US and Western European countries. The company is the largest player holding 23% of the market.

The French Framatome produces fuel for PWR and BWR reactors and holds 21% of the global fabrication market, with Western Europe being its main end market.

Global Nuclear Fuel (GNF) is a joint venture of GE and Hitachi. It consists of two divisions: GNF-J operating in Japan and GNF-A operating on other markets. The company only produces fuel for BWR reactors and holds 10% of the market.

In 2019, ROSATOM's share on the global nuclear fuel fabrication market totalled 16%. In the reporting year, Russian nuclear fuel fully met the demand of Russia, the Czech Republic, Slovakia, Hungary, Bulgaria and Armenia for reactor fuel. The Corporation also partially met the demand of Ukraine, Finland, India and China for reactor fuel. ROSATOM, in cooperation with Framatome, also supplies fuel and components from reprocessed uranium to Western European NPPs.

SHARES OF PLAYERS ON THE NUCLEAR FUEL FABRICATION MARKET, %



Entering new nuclear fuel markets

In 2019, the Corporation continued to take steps towards entering the markets for fuel for Western-design power reactors, and fuel and components for Western-design research reactors.

A separate promising area is the manufacture of fuel for fast neutron reactors. In 2019, the first batch of MOX fuel assemblies was loaded into the BN-800 reactor.

POWER MACHINE ENGINEERING MARKET

The modern power machine engineering market is characterized by long lead times, high capital intensity and design for manufacturability. The global power machine engineering market is affected by trends in the development of the global electricity industry (improved energy efficiency, environmental programmes, etc.) and the commissioning of new generating capacities.

In 2019, the volume of the global market for commissioned power generation equipment totalled about 221 GW¹⁷. The shares of different types of commissioned power generation equipment (in physical terms, GW) were distributed as follows: equipment for increasing the thermal power generation capacity accounted for 74%, while the shares of equipment for the renewable energy sector, hydropower and the nuclear power industry stood at 14%, 9% and 3% respectively.

At the same time, the shares of power generation equipment that is already in operation were distributed as follows: equipment for thermal power generation accounted for 64%, while the shares of hydropower, renewable energy and nuclear power generation equipment stood at 19%, 11% and 6% respectively.

The Corporation continues to implement the Proryv (Break-through) Project. It involves building a fuel fabrication and refabrication module, which will produce mixed nitride uranium-plutonium fuel. 2019 saw the start of construction of a generation IV lead-cooled fast neutron reactor, BREST-OD-300.

See also the section 'Research and Innovations'.

The Russian power machine engineering market is affected by trends in the development of the global power machine engineering market, the economic situation in Russia and the DPM-2 modernization programme. According to the Federal State Statistics Service, in 2019, the production of new power generation equipment on the Russian power machine engineering market decreased by 12% to 20.4 GW. However, not all market segments saw a decline. The production of industrial gas turbines increased by 11% to 704 MW. By contrast, the steam turbine segment declined by 52% to 974 MW; the production of hydraulic turbines and water wheels decreased by 47% to 336 MW, while the production of central heating boilers (including hot-water and low-pressure steam boilers) decreased by 7% to 18.4 GW.

According to the Federal State Statistics Service, in 2019, the shares of key players on the Russian power machine engineering market remained unchanged. JSC Atomenergomash (the Corporation's Mechanical Engineering Division) accounted for 38% of production of key types of power generation equipment, ranking first on the Russian market.

¹⁷ According to a survey by the Industrial Marketing Research Group: Power Generation Equipment Market in 2020.

NPP CONSTRUCTION AND OPERATION MARKET

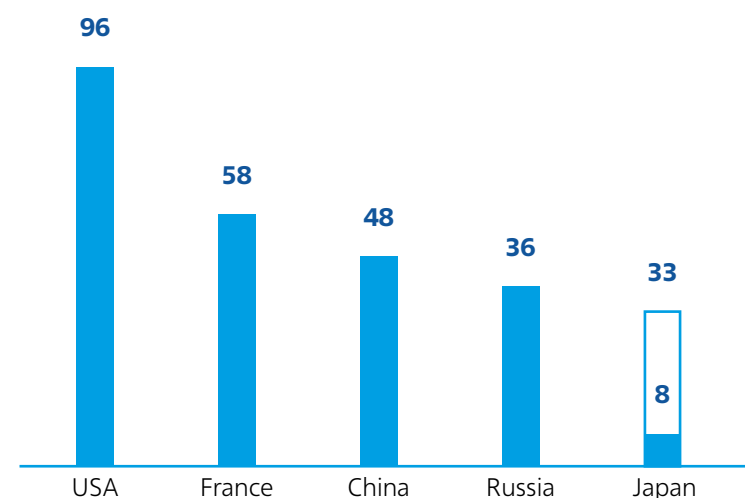
According to forecasts by international agencies and analysts¹⁸, an accelerating shift towards low-carbon energy is becoming the key trend in the development of global energy markets. Renewable energy is expected to replace carbon-based energy in the energy mix by 2030.

In 2019, the nuclear power industry accounted for about 11% of the global electricity supply. According to the IAEA¹⁹, in 12 states, more than a quarter of the electricity demand is met by nuclear power generation. Countries with the largest share of nuclear power generation include France (70.6%), Slovakia (53.9%) and Ukraine (53.9%).

According to the IAEA, as at December 31, 2019, 443²⁰ power reactors with a total capacity of 392 GW were in operation (including the suspended Japanese reactors). Another 52 reactors were under construction. In 2019, the number of power units in operation in Russia, including the newly commissioned power unit No. 2 of Novovoronezh NPP-2, reached 36, with their capacity totalling 30.3 GW. In 2019, ROSATOM ranked second among nuclear power generation companies globally in terms of installed NPP capacity, surpassed only by the French EDF.

Light-water reactors (VVER, PWR, BWR, LWGR) are the main type of reactors currently in operation in the world. They make up 92% of the global market (as a percentage of the total installed capacity).

LEADING COUNTRIES BY THE NUMBER OF OPERATING NPP POWER UNITS



According to the IAEA, new nuclear power generation capacities connected to the grid globally in 2019 totalled 5.2 GW. At present, demand for NPP construction comes primarily from Asian countries, which is due to rapidly growing electricity consumption in this region. ROSATOM is actively expanding its global footprint: it is currently the largest global player in terms of the number of NPP construction projects in its portfolio of overseas projects (74% of the market)²¹.

¹⁸ Sources: WTO, EY, WEO 2019 (Sustainable Development Scenario).

¹⁹ Power Reactor Information System (PRIS) developed by the IAEA (<https://pris.iaea.org>).

²⁰ Including a floating thermal nuclear power plant, which was in pilot operation at the end of 2019.

²¹ Excluding projects being implemented by manufacturers of heavy-water reactors (Candu Energy) and companies operating only on the domestic market.

OVERSEAS NPP SERVICING MARKET

The Corporation provides maintenance services for 49 Russian-design power units abroad that are currently in operation or at the design/construction stage.

ROSATOM competes against national operators and large international companies (Framatome, Engie (France), Westinghouse, Orano).

The Corporation is a market leader in China, Bulgaria and Armenia, acting as a general contractor for life extension, scheduled preventive maintenance and equipment modernization at NPPs

equipped with VVER reactors. To consolidate its position on the NPP servicing market in these countries, ROSATOM is considering localization through partnerships and joint ventures with local players, as well as the acquisition of local service companies.

See also the section 'International Business'.

3.1.2. NEW MARKETS

MARKET FOR RAW AND SNF MANAGEMENT, PROCESSING AND DISPOSAL

In 2019, the volume of SNF accumulated globally totalled 293,000 tHM. Most countries have chosen to postpone SNF management efforts, which necessitates long-term SNF storage due to a lack of available permanent disposal facilities and processing capacities. Every year, around 10,000 tHM of SNF is produced globally, of which less than 2,000 tHM is sent for processing. An increase in the amount of accumulated SNF encourages the development of the temporary waste storage market.

Key market players are Holtec (US), Orano, GNS (Germany) and SKB (Sweden).

ROSATOM promotes its own RAW and SNF storage solutions as part of an integrated offer for a balanced nuclear fuel cycle. The Corporation's basic solution in the field of SNF management involves spent fuel processing.

Orano and ROSATOM are the leaders on the SNF processing market. ROSATOM's development plans involve an expansion of SNF processing capacities at FSUE MCP. The development of this market is closely linked to the improvement of the relevant technologies and the use of regenerated SNF processing products in the nuclear fuel cycle. A reduction in the cost of processes and an improved efficiency of separation of SNF components will significantly increase processing volumes.

The market for permanent disposal of SNF and HLW is still at an early stage of development. There are no operating HLW disposal facilities at present. The possible use of deep repositories is being actively examined by the countries that have chosen the policy of direct SNF disposal: Sweden, Finland, the US and Canada.

MARKET FOR THE DECOMMISSIONING OF FACILITIES POSING NUCLEAR AND RADIATION HAZARDS

By 2019, more than 170 power units had been shut down in the world. According to ROSATOM's estimates, by 2030, the number of shut-down power units will almost double (the NPP construction activity peaked in the 1970s and 1980s, and by 2030 the

service life of many units will have reached 60 years). Most countries have opted for 'postponed decommissioning', i.e. maintaining NPPs in a safe condition for a long time in order to reduce radiation levels and improve the decommissioning technology.

Only a few countries, including the US and Germany, begin the decommissioning process immediately after a unit has been shut down. Some European Union countries (e.g. Belgium) are also making statements about 'accelerated decommissioning'.

Key market players include ROSATOM, Energy Solutions (US), Westinghouse, Orano, Bechtel (US), Studsvik (Sweden), AECOM (US), GNS, Cavendish Nuclear (UK), North Star (US), Siempelkamp (Germany), Onet Tech (France) and Holtec.

ELECTRICITY MARKET

In 2019, NPPs accounted for 19% of the total electricity output in Russia. In the reporting year, JSC AtomEnergobyt (an organization of ROSATOM) continued to operate as the power supplier of last resort in the Kursk, Tver, Smolensk and Murmansk Regions.

COMPOSITE MATERIALS MARKET

Until 2030, the global carbon fibre market is expected to grow by 10% per year, while the growth rate of the Russian market is projected to exceed 15% per year (in physical terms). A further increase in the global use of composite materials is expected due to replacement of conventional materials and expansion of the areas of application.

Key characteristics of the market include the following:

- Fabrics and pre-pregs account for 75% of demand from manufacturers of finished products;
- The maximum profitability of composite products is achieved in the final stages of the production chain (finished products).

WIND POWER MARKET

The global wind power market is actively developing; installed capacity of wind power plants (WPPs) is expected to increase significantly, from 0.6 TW in 2019 to about 1.0 TW and 1.3 TW in 2024 and 2030 respectively.

The Corporation is preparing to decommission power units of Novovoronezh, Leningrad and Beloyarsk NPPs and is participating in the decommissioning of Philippsburg NPP in Germany, Oskarshamn NPP in Sweden, Kozloduy NPP in Bulgaria and Ignalina NPP in Lithuania.

See also the section 'International Business'.

JSC AtomEnergobyt provides services to more than 50,000 legal entities and more than 2 million households in Russia.

See also the appendix to the Report on the performance of the Power Engineering Division in 2019 (www.report.rosatom.ru/en/rea).

The world's largest carbon fibre manufacturers include Japanese (Toray, Teijin, Mitsubishi Rayon), American (Hexcel, DowAksa, Cytec), German (SGL) and Chinese (Formosa Plastics) companies.

ROSATOM is the key Russian manufacturer of carbon fibre.

See also the section 'Business Diversification'.

The market is highly competitive, with the top five players accounting for 74% of the total installed capacity of onshore and offshore WPPs in 2019.

Onshore WPPs with a total capacity of 3.4 GW are expected to be commissioned in Russia by the end of 2024 under renewable energy capacity supply agreements on the wholesale market, with the existing competitive selection mechanism to be used with regard to investment projects for the construction of power plants. According to ROSATOM's estimates, by 2024, the market volume might reach 3.6 GW, with annual turnover totalling USD 1.6 billion.

NUCLEAR MEDICINE MARKET

In 2019, the global nuclear medicine market totalled USD 13.2 billion and is expected to reach USD 33.3 billion by 2030, with the shares of equipment and radiopharmaceuticals production almost equal in monetary terms.

The volume of the Russian market exceeds RUB 94 billion, and the market is expected to actively develop until 2030, with growth totalling up to 6-7% per year, according to ROSATOM's forecasts. Key growth drivers will include the implementation of the Healthcare National Project, a wider range of nuclear medicine procedures covered by mandatory health insurance and of high-technology healthcare services, as well as the development of healthcare infrastructure. In a number of Russian regions, new nuclear medicine centres are being built, and existing healthcare institutions are being provided with state-of-the-art nuclear medicine equipment for diagnostics and therapy.

ROSATOM sees considerable potential for the development of nuclear medicine services for the general public. The Corporation has initiated projects to create a network of radionuclide therapy and nuclear medicine centres in Russia and abroad, which will provide high-quality healthcare services to patients.

MARKET FOR CARGO TRANSPORTATION ALONG THE NORTHERN SEA ROUTE

Mineral extraction, oil and gas production in the Arctic are projected to grow significantly, resulting in an increase in cargo traffic along the Northern Sea Route (NSR) from 31.5 million tonnes in 2019 to 100 million tonnes in 2030.

Global cargo traffic can become a growth driver for cargo transportation along the NSR in the long term (after 2030). Cargo transportation along the Northern Sea Route provides a number

The portfolio of wind power plants to be built by ROSATOM by the end of 2022 totals 1 GW, or more than 30% of the Russian wind power market.

See also the sections 'Sustainable Development Management' and 'Business Diversification'.

ROSATOM is the largest supplier of isotopes and radiopharmaceuticals for nuclear medicine in Russia. About 40% of the world's reactor units producing medical radioisotopes are located in Russia. The Corporation accounts for 25% to 40% of global radioisotope production (depending on the types of radioisotope products). The Corporation's long-term goal is to rank third on the international market in terms of revenue.

In addition, the Corporation is a major player on the market for medical device sterilization using radiation processing technologies.

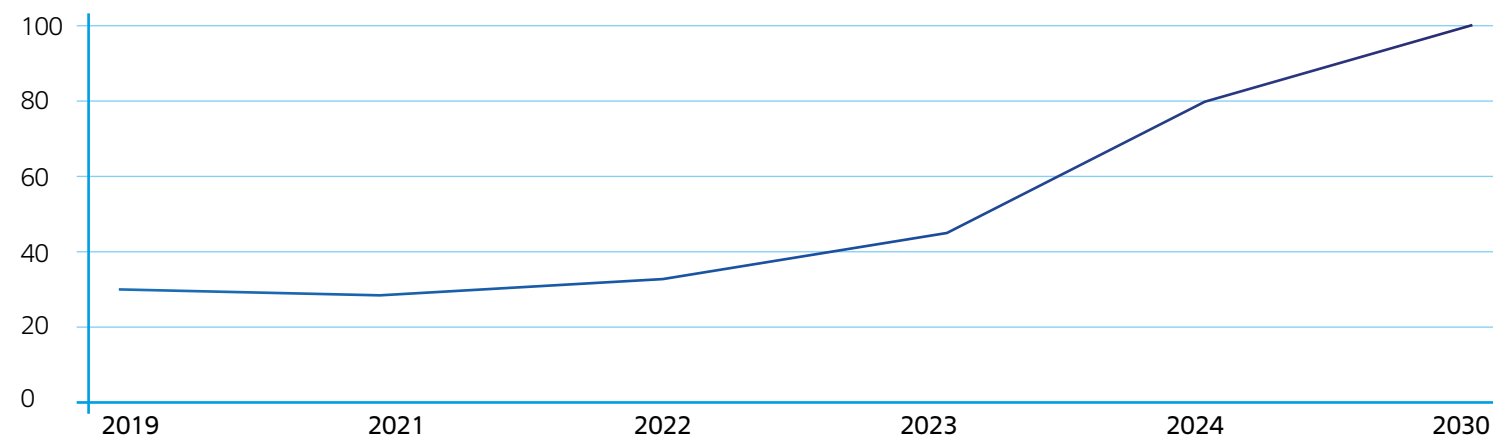
ROSATOM also produces and actively upgrades medical equipment for external beam radiotherapy and brachytherapy. By 2025, the Corporation intends to become a leading supplier of diagnostic and therapeutic equipment on the Russian market.

See also the sections 'Sustainable Development Management' and 'Business Diversification'.

of advantages compared to some traditional routes via the Suez and Panama Canals (the distance between Northern Europe and East Asia is reduced by up to 39%, while the distance between the western coast of North America and Northern Europe is reduced by up to 28%).

See also the chapter 'Development of the Northern Sea Route'.

PROJECTED CARGO TRAFFIC ALONG THE NORTHERN SEA ROUTE, million tonnes



Under the Northern Sea Route Federal Project.

WASTE MANAGEMENT MARKET

Until recently, the practice of managing highly and extremely hazardous industrial and consumer waste was virtually non-existent in Russia. The country is facing a shortage of capacities for the processing and storage of hazard class 1 and 2 waste. Only a small part of such waste is treated and recycled in an environmentally safe manner by operators that have licences for the relevant operations and the required capacities.

To achieve a fundamental transformation in the sphere of hazardous waste management, a Federal Project titled 'Infrastructure for the Management of Hazard Class 1 and 2 Waste' has been developed and approved as part of the Ecology National Project, with ROSATOM appointed as contractor under the Project. As the federal operator tasked with managing hazard class 1 and 2 waste, ROSATOM is creating environmental technology parks

for waste management, and is developing and implementing a federal scheme and a state information system for managing extremely and highly hazardous waste. The development of a system for hazard class 1 and 2 waste management will result in the emergence of a new market with a volume of up to RUB 20 billion per year.

To develop industry capabilities for the management of waste of all hazard classes, the Corporation is also implementing an investment programme to develop infrastructure for hazard class 3 and 4 waste management. ROSATOM forecasts that the market for hazard class 3 and 4 waste management will reach up to RUB 230 billion by 2024 and up to RUB 320 billion by 2030.

See also the section 'Business Diversification'.



3.2. INTERNATIONAL COOPERATION

Key results in 2019

- An international legal framework was developed to promote cooperation in the peaceful use of nuclear energy in Africa. Intergovernmental and interdepartmental agreements were signed with the Republic of the Congo, the Republic of Rwanda, the Republic of Uganda and the Federal Democratic Republic of Ethiopia. Practical work was initiated with Rwanda on a Nuclear Research and Technology Centre.
- Practical implementation of joint projects on the peaceful use of nuclear energy with the Republic of Serbia gained impetus following the signing of a package of documents, including an intergovernmental agreement on the construction of a Russian-design Centre for Nuclear Science, Technology and Innovation in Serbia.
- An agreement was signed with the IAEA on further implementation of a joint initiative to develop nuclear energy infrastructure in countries that are starting to develop the nuclear power industry from 2020 through 2023.



NIKOLAY SPASSKIY
Deputy Director General
for International Relations



— How do you think the coronavirus pandemic will affect international cooperation? All conferences have been cancelled; agreements cannot be signed in person; some states are already introducing export and import restrictions.

— Of course, the world will never return to its previous, pre-crisis state. After the end of the pandemic, the changes will not be reversed or slowed down; on the contrary, they will become even bigger.

Some of these changes are obvious and quite easy to predict. Over the past two or three months, we have realized that there is no need to travel across the world or organize a face-to-face meeting involving several dozens of people to tackle a couple of specific issues. Lots of issues can be addressed equally effectively in a remote format: by email, through phone calls or video conferencing. The video conference format has proved to be

especially popular and convenient. It is clear that this practice will continue to be actively developed.

The second, deeper layer of changes is much more serious. The shock from the pandemic has proved to be so strong largely due to overall systemic imbalance of the world order and the world economy. This imbalance manifests itself in a number of ways, including excessive focus on stimulating demand, an irrational increase in the consumption of material resources, a fragile balance between humans and the natural environment being upset, economic deformations and social conflicts. These accumulated deformations will require fundamental adjustments, but this time, most likely, they will be based on new technological platforms. A new globalization model is taking shape. Many businesses will not survive these profound changes; indeed, they are already dying off. For others, this is a historic chance.

I am convinced that these new realities open up unprecedented opportunities for ROSATOM, both in the flagship areas of our business and in the emerging ones, including those that seem quite futuristic. This is happening both domestically

and on global markets. We have already laid the groundwork required in order to achieve such a breakthrough in terms of technology, geographical footprint and negotiations, as well as human resources.

ROSATOM's international activities are aimed at creating a favourable international legal and political environment to promote Russian nuclear technologies on the global market, strengthen

the nuclear safety and non-proliferation regimes and actively cooperate with international organizations and forums.

3.2.1. STRENGTHENING THE INTERNATIONAL LEGAL FRAMEWORK FOR COOPERATION

In 2019, the Corporation continued to work to expand the international legal framework for cooperation in order to promote Russian nuclear energy technologies and enable the Russian nuclear industry to consolidate its position on global markets. 7 intergovernmental agreements (IGAs) and 23 major interdepartmental arrangements were signed (8 and 20 in 2018, 11 and 16 in 2017 respectively).

As at December 31, 2019, IGAs under which ROSATOM is an authorized body (a competent authority) or participates in their implementation were signed with 74 countries, including IGAs on the construction of nuclear facilities with 20 countries.

COOPERATION WITH KEY PARTNERS IN STRENGTHENING THE INTERNATIONAL LEGAL FRAMEWORK

Congo
Rwanda
Uganda
Ethiopia

As 2019 was declared the Year of Africa, additional efforts were focused on the African region:

- Framework IGAs were signed with Congo, Uganda and Ethiopia, providing a framework for nuclear cooperation with these countries;
- An IGA on the construction of a Nuclear Research and Technology Centre and memoranda on personnel training and on shaping a positive public opinion on nuclear power were signed with Rwanda;
- Road maps were signed with Congo, Rwanda and Ethiopia.

These documents stipulate key milestones and areas of further bilateral cooperation on nuclear projects.

Serbia

A framework was created for joint practical projects on the peaceful use of nuclear energy:

- A framework IGA was signed, providing a legal framework for nuclear cooperation;
- A joint statement on strategic partnership was issued, outlining plans for the construction of a Centre for Nuclear Science, Technology and Innovation in Serbia; the relevant IGA was concluded, and a Road Map was signed, which stipulates the key stages of the project preceding the signing of the general contract.

The Centre is expected to become the largest facility of this kind in Europe; it will be used for a wide range of fundamental and applied research projects;

- Memoranda were signed on shaping a positive public opinion on nuclear power and on cooperation in personnel training in the peaceful use of nuclear energy based on proven and innovative technologies.

Sweden

An IGA on amendments to the IGA on early notification of nuclear accidents and exchange of information on nuclear facilities dated January 13, 1988 was signed through an exchange of notes. The new IGA details the scope of information to be provided by each party. The document specifies that ROSATOM has been appointed as competent authority representing the Russian party under the Agreement.

Vietnam

An interdepartmental memorandum was signed on the schedule of the project to build a Nuclear Research and Technology Centre; the document stipulates prioritized activities and their timing.

Dominican Republic
Cuba
Laos
Slovakia

The following interdepartmental agreements were signed:

- Framework memoranda of cooperation in the peaceful use of nuclear energy with Slovakia and the Dominican Republic;
- Memoranda of cooperation in personnel education and training for the nuclear power industry with Cuba and Laos;
- A memorandum on shaping a positive public opinion on nuclear power with Laos.

The signing of these documents makes it possible to expand the scope of cooperation with Slovakia and initiate the development of nuclear power infrastructure in these countries.

Bolivia

A memorandum of cooperation in the development of the lithium industry was signed. The aim of the document is to examine opportunities for joint exploration and development of lithium deposits, exchange of information and scientific research on lithium mining and the manufacture of lithium products.

China	An agreement was signed on administrative arrangements regarding the procedure for granting Chinese specialists access to the premises of Russian organizations performing work under the IGA on cooperation in the construction and operation of a demonstration fast neutron reactor (CFR-600) in China dated June 8, 2018.
Japan	An Executive Agreement on Cooperation in the Construction of a Regional Centre for Radioactive Waste Conditioning and Long-Term Storage in the Primorsky Territory was signed. Under the Agreement, the Government of Japan will provide financing for the purchase of RAW management equipment necessary for the construction of the Regional Centre. The aim of the Agreement is to enable solid radioactive waste processing in the Far East without additional budget allocations.
US	An Administrative Arrangement was signed between ROSATOM and the US Department of Energy under the framework IGA on cooperation in the peaceful use of nuclear energy. The document establishes the procedure for accounting for and tracking nuclear materials with the US obligation codes supplied to Russian nuclear enterprises for processing and subsequent handover under contracts with third-party countries, including to US customers.

3.2.2. SUPPORT FOR LONG-TERM PROJECTS AS PART OF INFRASTRUCTURE DEVELOPMENT FOR INTERNATIONAL COOPERATION

In 2019, the Corporation continued to provide support for the implementation of major overseas projects, particularly for the construction of NPPs and Nuclear Research and Technology Centres, which are central to ROSATOM's international activities.

Belarusian NPP construction project

Support was provided for the Belarusian NPP construction project in cooperation with the Ministry of Energy, the Ministry of Emergency Situations and other government agencies of the Republic of Belarus. Working consultations were regularly held on current issues related to project implementation, including in the context of cooperation with international organizations, such as the IAEA, the European Nuclear Safety Regulators Group (ENSREG), etc.

In accordance with the action programme for the implementation of the provisions of the Treaty on the Establishment of the Union State, a draft road map for the development of the nuclear power industry was prepared and approved.

Cooperation with China

ROSATOM continued to cooperate closely with the Atomic Energy Authority and the National Energy Administration of the PRC. Steps were taken to complete a strategic package deal with Chinese partners: the Corporation signed general contracts for the construction of power units No. 7 and 8 of Tianwan NPP and power units No. 3 and 4 of Xudabao NPP.

A dialogue was opened on expanding the agenda for bilateral cooperation in the field of nuclear power. A number of areas were discussed, including closing the nuclear fuel cycle, spent nuclear fuel reprocessing and closer cooperation in the field of science and technology, including fundamental research.

Kudankulam NPP construction project (India)

Support was provided for work related to the operation of the first stage (power units No. 1 and 2), delivery of equipment for the second stage of the NPP (power units No. 3 and 4), handover of documentation and commencement of production of equipment for the third stage (power units No. 5 and 6) of Kudankulam NPP.

ROSATOM continues to hold consultations with the Indian party on the technical aspects of the project to build an NPP equipped with a VVER-1200 reactor unit at a new site.

Rooppur NPP construction project (Bangladesh)

Support was provided for the main phase of construction of Rooppur NPP. Issues related to the establishment of a physical protection system of the NPP, as well as the right of the Russian party to provide assistance in the operation and maintenance of power units throughout their life cycle were addressed.

NPP construction projects in Finland, Hungary, Turkey and Egypt

Regular contact was maintained with the relevant departments of these countries, which involved discussing the most important issues related to the implementation of NPP construction projects. Support was provided for arranging social and healthcare services for Russian personnel at the NPP construction sites.

Cooperation with Iran

In accordance with international commitments and national legislation of the Russian Federation, a dialogue was maintained on the whole range of issues related to cooperation in the peaceful use of nuclear energy, including ensuring safe operation of power unit No. 1 of Bushehr NPP.

NPP construction project in Uzbekistan

ROSATOM provided assistance for consultations on the draft general contract for NPP construction and carried out engineering surveys at the construction site in order to prepare engineering designs of the NPP. National Research Nuclear University MEPhI opened its first overseas branch in Tashkent.

Nuclear Research and Technology Centre construction project in Bolivia

Support was provided for the Nuclear Research and Technology Centre construction project in El Alto, as well as for work aimed at potential expansion of the agenda for cooperation with Bolivian partners.

Cooperation with Cuba

A dialogue was initiated at an expert level to ensure the country's energy security, including through land-based or floating small NPPs. Support was provided for the signing of a Memorandum on Personnel Training and an Agreement between JSC Rusatom Healthcare and Inversiones Gamma S.A. on the implementation of a project to build a Multipurpose Irradiation Centre in the Mariel Special Development Zone.

For more information on the promotion of ROSATOM's new products on foreign markets, see also the sections 'International Business' and 'Business Diversification'.

Cooperation with Germany

Pursuant to the memorandum of cooperation signed in 2018, consultations were regularly held with the German Committee on Eastern European Economic Relations. A traditional meeting with key representatives of German businesses interested in cooperation with ROSATOM was organized. Working contacts were maintained with the German Ministry for Economic Affairs and Energy. A joint coordination meeting was held concerning further scientific and technical cooperation in the field of reactor safety research and radioactive waste disposal.

See also the section 'International Business'.

3.2.3. COOPERATION WITH INTERNATIONAL ORGANIZATIONS

In 2019, ROSATOM continued to actively participate in international organizations and forums in order to contribute to the formulation of international rules and standards on nuclear power.

ROSATOM took part in all specialized international conferences and meetings held under the auspices of the IAEA and the OECD NEA. 946 Russian experts participated in 398 events organized by the IAEA, and 145 specialists took part in 83 events held by the OECD NEA. 68 events were held in Russia under the auspices of international organizations.

International Atomic Energy Agency (IAEA)

ROSATOM took part in all high-level events: the 63rd session of the IAEA General Conference, the International Conference on Climate Change and the Role of Nuclear Power, and the Officers Meeting for the 8th Review Meeting of the Convention on Nuclear Safety.

Resolutions adopted at these events, as well as resolutions approved by the policy-making bodies of the IAEA, reflect the Russian position and accommodate the interests of the national nuclear industry.

Budgetary and special-purpose contributions were made in full; their total amount exceeded EUR 17 million. Financing and participation of Russian organizations in major projects continued as part of the Technical Cooperation Programme, the Nuclear Security Fund, the Russian Safeguards Support Programme and the Programme of Action for Cancer Therapy.

A number of interdepartmental documents aimed at expanding cooperation with the IAEA were signed.

Consistent steps are being taken to strengthen Russia's presence in specialized international organizations, including through an industry-wide training programme for Russian personnel. In 2019, three Russian specialists from the pool of experts formed at ROSATOM were sent to work at the IAEA.

On July 29, 1957, the International Atomic Energy Agency was established with active involvement from the USSR. The Agency was established within the United Nations System as an independent international organization implementing the Atoms for Peace concept. The IAEA cooperates with member states and numerous partners around the world to promote the development of peaceful, safe and reliable nuclear technologies. In 2017, to mark the 60th anniversary of the IAEA, the motto of the Agency was changed to 'Atoms for Peace and Development'.

Practical cooperation continued on the development of nuclear infrastructure in the countries where ROSATOM is implementing its projects. 19 training events were organized and were attended by 248 foreign experts, primarily from the countries which are ROSATOM's potential partners.

Nuclear Energy Agency of the Organization for Economic Cooperation and Development (OECD NEA)

Two visits of William D. Magwood, the Director General of the OECD NEA, to Russia (Moscow and Sochi) were organized.

Support was provided for Russian participation in seven international projects and five programmes of the OECD NEA aimed at improving NPP safety and designing new-generation nuclear reactors. Preparations were underway to join the OECD NEA ARC-F Project, which involves analysing information on the spread of radioactive substances from reactor buildings and containment vessels of Fukushima NPP in Japan.

As part of a joint initiative in the field of nuclear education and training (NEST), preparations for its implementation were made at JSC PDC UGR and Tomsk Polytechnic University.

ROSATOM assisted in holding workshops at the OECD NEA headquarters to provide training for 20 Russian specialists in the SCALE, MCNP6-Cloud, PHITS and FISPACT codes.

Commission of the CIS Member States on the Peaceful Use of Nuclear Energy

As part of the CIS Intergovernmental Target Programme for Remediation, assistance was provided to Kyrgyzstan and Tajikistan in returning former uranium mining sites to a safe condition.

In Kyrgyzstan, remediation work was completed at the Kadji Say tailings dump; in October 2019, the facility was commissioned.

Support was provided for the ratification of the Agreement on Cooperation between the CIS Member States to Ensure Preparedness in the Event of a Nuclear Accident or a Radiation Emer-

gency (signed on November 2, 2018). The Agreement will simplify the procedures for the cross-border movement of specialists and special equipment in the event of a crisis, which will help to speed up the response to any potential incidents.

A scientific research programme was initiated at the Kazakhstan Tokamak for Material Testing. Plasma was obtained, and the experimental facility is being tested in different modes.

3.2.4. STRENGTHENING THE NUCLEAR NON-PROLIFERATION REGIME AND EXPORT CONTROL

In 2019, 369 draft contracts (arrangements, agreements) were reviewed in accordance with the Uniform Industry-Wide Procedure for Organizing Export Control in ROSATOM. The findings of the review were sent to organizations in the industry.

Two workshop meetings on export control were held for industry exporters (in Obninsk on May 21-23, 2019 and in Ekaterinburg on October 29-31, 2019). The workshops were attended by more than 150 specialists.

The Russian-US programme to import highly enriched uranium fuel from Russian-design research reactors in third countries into Russia continued. In 2019, preparations were made for the import of spent nuclear fuel from the IVG.1M research reactor of the National Nuclear Centre of the Republic of Kazakhstan (Kurchatov) for reprocessing. The delivery of the fuel is scheduled for 2022.

3.2.5. DEVELOPING THE NETWORK OF ROSATOM'S REPRESENTATIVE OFFICES AFFILIATED WITH EMBASSIES AND TRADE MISSIONS ABROAD

In 2019, ROSATOM expanded the geographic footprint of its representative offices abroad. New positions were introduced at the Russian embassies in Uzbekistan and Egypt. As at December 31, 2019, ROSATOM's representatives abroad worked in 15 countries around the world in embassies and trade missions of the Russian

Federation, as well as under the Permanent Mission of the Russian Federation to International Organizations in Vienna (Austria) and the Permanent Mission of the Russian Federation to the European Union in Brussels (Belgium).

3.2.6. CHALLENGES IN THE REPORTING PERIOD AND MECHANISMS FOR ADDRESSING THEM

In 2019, ROSATOM worked to promote Russian nuclear technologies on the global markets in an extremely challenging environment. Efforts to create a favourable environment for the development of the Russian nuclear power industry were made in close cooperation with the relevant ministries and agencies of the Russian Federation.

ROSATOM helps to maintain the influence of the Russian nuclear industry in the international arena through unconditional fulfilment of its obligations, including the supply of fuel, equipment and services, regardless of the current political situation and relations with specific countries.

3.2.7. PLANS FOR 2020 AND FOR THE MEDIUM TERM

ROSATOM will continue to expand the international legal framework for cooperation for the benefit of nuclear organizations and enterprises, with a focus on non-energy applications of nuclear technologies to promote the achievement of the UN Sustainable Development Goals.

The Corporation will expand cooperation in personnel training for international organizations, with the Human Resources Department of the ITER Organization to be engaged in the initiative along with the IAEA and the OECD NEA.

ROSATOM plans to intensify cooperation in making nuclear power more acceptable for society and fostering public demand for it.

To achieve its objectives, the Corporation will continue bilateral cooperation and work with specialized international organizations and institutions, as extensive international cooperation is a necessary prerequisite for the long-term, sustainable and safe development of nuclear power.

3.3. INTERNATIONAL BUSINESS

Key results in 2019

- The 10-year portfolio of overseas orders totalled USD 140.1 billion (USD 133.2 billion in 2018).
- The portfolio of overseas orders covering the entire NPP life cycle totalled USD 203.3 billion (USD 202.4 billion in 2018).
- Revenue from overseas orders reached USD 7.2 billion (USD 6.5 billion in 2018).
- The overseas NPP construction project portfolio included 36 power units in 12 countries around the world.
- Projects were underway in more than 50 countries worldwide.



KIRILL KOMAROV
First Deputy Director General
for Corporate Development
and International Business

— *ROSATOM has successfully maintained a sizeable portfolio of overseas orders for a long time; what products and services are expected to be of primary importance for ROSATOM's international business going forward?*

— Indeed, we have succeeded in maintaining a sizeable portfolio of overseas orders for years. But to do so, we have to work increasingly hard and systematically. This is due to the fact that most of our NPP construction projects are entering the on-site work stage, which drives an increase in our foreign revenue (at year-end 2019, it totalled USD 7.2 billion). As a result, the volume of the order portfolio decreases significantly, and we need to compensate for this decline by finding new projects to be implemented on the international market. At present, we have documented commitments to build 36 power units in 12 countries, with 25 power units in nine countries currently at the active implementation stage. We also maintain a foothold on the market for nuclear fuel cycle products. We are cautiously optimistic

about continuing price growth on the global natural uranium market: in 2020, spot quotations moved above the psychologically important level of USD 30/lb of U₃O₈.

As for international trends in the nuclear power industry, undoubtedly there is a strong focus on technological solutions for small NPPs. ROSATOM is a leader in this area too. At the very end of 2019, the floating thermal nuclear power plant (FTNPP) in Chukotka started to generate electricity, and in May 2020, it started commercial operation. This achievement in the segment that is crucial for the future of the nuclear power industry has attracted considerable interest from our foreign partners. We are currently developing a second-generation FTNPP based on RITM-200 reactors; it will be more powerful and compact, with a lower fuel reloading frequency. In addition, we are designing a land-based small nuclear power plant and selecting a site for it in Russia. We intend to complete this project by 2027.

— *ROSATOM currently has 81 new product areas and 7 strategic programmes. Which of them are the most promising?*

— We consider strategic programmes to be the key driver of ROSATOM's development. They are financed on a priority basis and closely monitored. We expect that by 2030, their share in ROSATOM's total revenue from new businesses will exceed 75% (by comparison, at year-end 2019, it totalled less than 15%).

Here are some examples of projects implemented as part of our strategic programmes.

Last year, we completed the construction of the Adygea Wind Power Plant, which is ROSATOM's first wind farm and the largest wind power plant in Russia. We are now actively building a second wind power plant in the Kochubeyevsky District of the Stavropol Territory, which will be even bigger; we have already completed civil engineering work. It should be emphasized that in this area of ROSATOM's business, the local content ratio currently stands at 65%, and we are targeting 85%. We cooperate with more than 50 Russian companies, including small and medium-sized enterprises. This has enabled us to create more than 2,000 new jobs.

Waste-to-energy is another promising area. We have signed contracts for 12 boiler units for four plants in the Moscow Region and two units for a plant in the Republic of Tatarstan. We have mastered the technology in Russia and have already entered the international market. Under a contract signed in 2019, we will supply a set of steam superheaters for steam boilers at a thermal waste treatment plant in the UK.

At the same time, ROSATOM is creating environmental technology parks for industrial waste management. In September 2019, a federal law came into force authorizing ROSATOM to create a comprehensive system for the management of such waste in Russia. At present, this sector is virtually non-existent in Russia, and the country is facing a shortage of capacities for the processing of such waste. Only a small part of waste is treated and recycled in an environmentally safe manner. Last year, we started to develop a national information system that will make it possible to accumulate all information on the management of such waste, monitor waste flows, keep records and detect violations.

We are also participating in the development of a fully-fledged and highly promising sector of the Russian manufacturing in-

dustry: the production of polymer composite materials. This involves designing and producing a wide range of state-of-the-art carbon-based materials for the Russian economy, e.g. for aircraft engineering, and obtaining the relevant certification. Moreover, starting from 2021, we will have our own capacities for all stages of production: in 2020, we plan to commission a plant that will produce feedstock for carbon fibre production in the Alabuga Special Economic Zone in the Republic of Tatarstan.

Last year, we also made good progress in the development of nuclear medicine. Front-end engineering design was initiated for the construction of the Nuclear Medicine Centre in the Irkutsk Region. ROSATOM completed bench tests of a KLT-6 linear particle accelerator and an upgraded AGAT-VT brachytherapy facility. This will enable us to complete the manufacture of final prototypes of new medical equipment, to commence clinical trials and then to start mass production of this equipment in 2021.

Finally, it is important to mention our newest business: logistics services. ROSATOM has started to actively develop this business area, and in late 2019, the Corporation acquired a shareholding in Delo Group, which is a leader on this market. By working together to expand the scope and geographical footprint of our logistics business, we are creating a new major player leveraging existing capabilities and assets. We will develop international transportation along the Asia – Europe – Asia route via the Northern Sea Transit Corridor (including developing a platform for the transportation of cargo for NPPs under construction).

— *ROSATOM has started to work systematically on a sustainable development agenda; could you provide more details on the Corporation's efforts in this area?*

— First of all, I would like to emphasize that sustainable development principles have been historically integrated into ROSATOM's operations. The nuclear industry is characterized by high safety standards and strict occupational and environmental safety requirements. We are a global leader in the nuclear industry and make an important contribution to the sustainable development agenda not only in Russia but also globally. ROSATOM operates in more than 50 countries worldwide, and in every country we seek not only to meet our customers' business needs but also to incorporate sustainable development principles into our operations. Thus, we are committed not only to achieving our strategic goals but also to promoting social and economic development in our re-

gions of operation. It should be pointed out that ROSATOM's new business strategy until 2030 expressly prioritizes contribution to the achievement of the UN Sustainable Development Goals (SDGs).

In 2019, ROSATOM established the Project Office for Sustainable Development Programmes, which is tasked with incorporating sustainable development approaches into operational processes and the business agenda in the industry. We are implementing pilot projects to systematize sustainable development practices adopted in the industry. The outcomes of these efforts include a report on the contribution of nuclear power to the achievement of the SDGs

3.3.1. PROMOTING ROSATOM'S TECHNOLOGIES ON FOREIGN MARKETS

In 2019, the Corporation worked to increase its share on international markets for nuclear energy technologies amid growing competition in the sphere of NPP construction and supply of nuclear fuel cycle products and services.

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

The Corporation is actively promoting Russian nuclear technologies 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 those based on Russian technology).

As at December 31, 2019, the foreign regional network²³ established in order to increase international sales and promote the Corporation's products comprised 14 regional centres and country offices in 65 countries around the world (including offices opened in the reporting year in Uzbekistan and Belarus).

²² <https://www.rosatom.ru/upload/iblock/d68/d687667b600aca117dc06560562ea503.pdf>

²³ <http://www.rosatominternational.com/en>

(it is available on ROSATOM's website²²) and the Supplier Code of Conduct developed by JSC TENEX and aligned with global best practices. We are also participating in the development of government regulation mechanisms to support the implementation of the Paris Agreement on climate change, which Russia ratified in 2019.

We are aware that in the coming years, the world will undergo a major systemic transformation, but we believe that sustainable development will still remain a priority. ROSATOM is committed to implementing this global agenda and willing to maintain an international dialogue.

Russian nuclear organizations have a track record in NPP construction spanning more than 60 years. The first nuclear power plant to be commissioned overseas was Rheinsberg NPP launched in 1966 in the German Democratic Republic. ROSATOM's specialists have designed and built a total of 92 NPP power units in 14 countries globally. Over the past 14 years, 15 NPP power units were commissioned: 8 in Russia and 7 in three foreign countries. In addition, the Corporation has provided assistance in building over 20 research reactors worldwide.

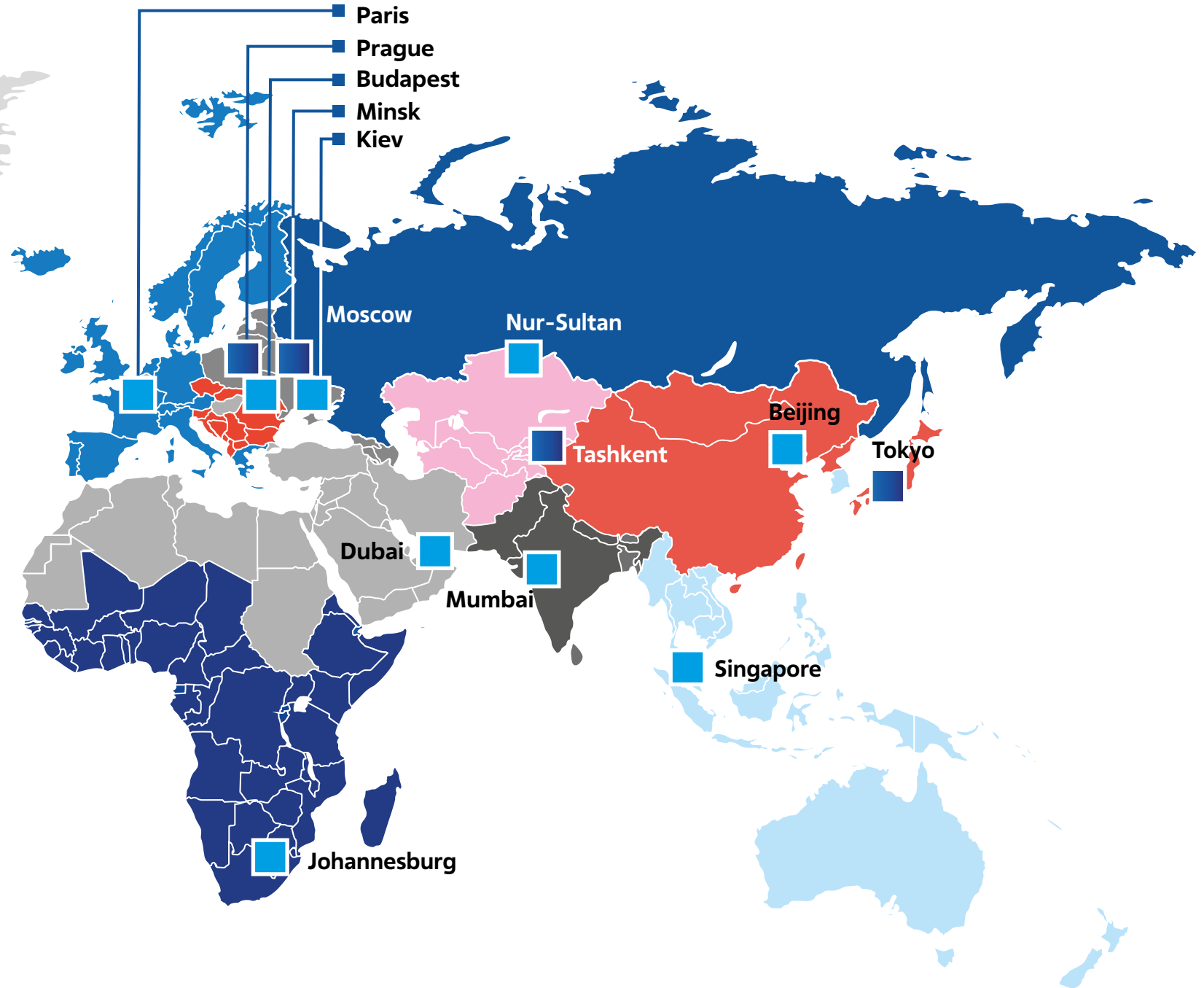
Global challenges and risks facing ROSATOM as it is entering international markets include the global economic slowdown, a trend towards protectionism, geopolitical factors influencing decision-making by potential customers for the Corporation's products and services, and a growing market for new materials and new production solutions.

See also the section 'Stakeholder Engagement'.

COUNTRY AND REGIONAL CENTRES OF ROSATOM

- Country offices
- Regional centres

- North America
- Latin America
- Eastern Europe
- Central Europe
- Western Europe
- Russian Federation
- Middle East and North Africa
- Central and South Africa
- Central Asia
- East Asia
- South Asia
- Southeast Asia



3.3.2. CHANGES IN THE PORTFOLIO OF OVERSEAS ORDERS AND OVERSEAS REVENUE

In the reporting year, ROSATOM's 10-year portfolio of overseas orders reached USD 140.1 billion²⁴ (USD 133.2 billion in 2018).

Indicator	2017	2018	2019
MOVEMENT IN THE PORTFOLIO OF OVERSEAS ORDERS, USD BILLION			
10-year portfolio of overseas orders, including:	133.5	133.2	140.1
NPP construction abroad	97.0	92.0	97.4
Uranium products	15.0	13.9	13.2
Nuclear fuel assemblies and other activities	21.5	27.3	29.5

At year-end, overseas revenue totalled USD 7.2 billion²⁵ (USD 6.5 billion in 2018).

Indicator	2017	2018	2019
MOVEMENT IN OVERSEAS REVENUE, USD MILLION			
Overseas revenue, including:	6,102	6,462	7,228
NPP construction abroad	2,458	2,820	3,595
Uranium products	1,724	1,717	1,742
Nuclear fuel assemblies and other activities	1,920	1,926	1,892

3.3.3. NPP CONSTRUCTION ABROAD

As at December 31, 2019, the Corporation had official commitments to build 36 nuclear power units abroad. 25 power units in 9 countries worldwide are currently at the implementation

stage. Russian-design nuclear reactors that are currently under construction fully meet international safety requirements.

²⁴ RUB 9.1 trillion at the weighted average RUB/USD exchange rate for 2019.

²⁵ RUB 467.9 billion at the weighted average RUB/USD exchange rate for 2019.

NPP, country | Results

KEY RESULTS OF NPP CONSTRUCTION PROJECTS IN 2019

ASIA

Rooppur NPP, Bangladesh	Concreting of foundation slabs of the turbine hall of power units No. 1 and 2 was completed. Concreting of the first layer of the internal containment vessel in the reactor building was completed at power unit No. 1. The core catcher was moved into final position, and the cantilever truss was installed at power unit No. 2.
Kudankulam NPP, India	The core catcher and the cantilever truss were installed at power unit No. 3.
Tianwan NPP, China	A general contract for the construction of power units No. 7 and 8 was signed.
Xudabao NPP, China	A general contract for the construction of power units No. 3 and 4 was signed. An engineering design contract was signed for power units No. 3 and 4.

EUROPE

Paks II NPP, Hungary	The engineering design of the future NPP was developed and approved by the foreign customer. The construction of the first construction and installation facilities was started. Contracts were signed for the supply of main APCS components. A contract was concluded for the manufacture and supply of the core catcher.
Belarusian NPP, Belarus	The commissioning of power unit No. 1 was commenced. Installation of main equipment was completed, and the equipment airlock was installed at power unit No. 2.
Hanhikivi NPP, Finland	Preparatory work continued, and further steps were taken to prepare the necessary licensing documents. A contract was signed for the supply of main APCS components.

MIDDLE EAST AND NORTH AFRICA

El Dabaa NPP, Egypt	Engineering surveys were completed at the site of the future NPP. A contract was signed for preparatory work at the site.
Akkuyu NPP, Turkey	Concreting of the foundation slab of the reactor building of power unit No. 1 was completed, and the core catcher was moved into final position. A licence was obtained for the construction of power unit No. 2. A package of licensing documents was submitted to the Turkish regulator to obtain a licence for the construction of power unit No. 3. The Republic of Turkey Transmission Grid Connection Agreement was signed.

In 2019, the Corporation signed a contract for engineering surveys on the NPP construction site in Uzbekistan to prepare engineering designs of the NPP (a contract for the construction of an NPP with two power units is being negotiated).

The Corporation continued to participate in tendering for NPP construction in Saudi Arabia.

ROSATOM submitted an offer as part of the procedure for selecting a strategic investor for the Belene NPP project in Bulgaria.

3.3.4. NPP SERVICING ABROAD

ROSATOM's product portfolio targeted at international markets includes a wide range of services covering the entire NPP life cycle: from assessing and developing key nuclear infrastructure components in customer countries to NPP decommissioning.

Major international projects covering Russian-design NPPs that are currently in operation abroad have a wide geographical scope, ranging from a large-scale project to extend the life of the Armenian NPP and provision of maintenance services in Central and Eastern Europe (Bulgaria, Hungary, Slovakia, Czech Republic) to regular supply of spare parts and equipment and NPP servicing in China and India.

3.3.5. URANIUM MINING ABROAD

In 2019, uranium mining enterprises of Uranium One (an organization of ROSATOM) implemented the annual production programme in full. They produced 4,600 tonnes of uranium, up by 5% year on year.

	2017	2018	2019
URANIUM MINING BY URANIUM ONE ENTERPRISES, TONNES			
Kazakhstan	5,063	4,375	4,617
US	39	10	0
Total	5,102	4,385	4,617

Following its review, ROSATOM moved to the next stage of tendering. The Bulgarian party is expected to make the relevant decision in 2020.

A technical and commercial proposal was submitted as part of a marketing procedure in Kazakhstan.

The Corporation continued to work towards an agreement on the construction of six new Russian-design power units at a new site in India.

In 2019, as part of the project to extend the life of power unit No. 2 of the Armenian NPP, the Corporation completed the replacement of main turbine hall equipment at the power unit, which enabled a 15% increase in the NPP capacity.

Under a comprehensive service contract, ROSATOM started to provide support for the commissioning of Akkuyu NPP and personnel training.

Overall, about 1,000 foreign specialists underwent training in 2019 as part of long-term and short-term training programmes for the personnel of foreign NPPs.

3.3.6. EXPORT OF URANIUM PRODUCTS AND NATURAL URANIUM ENRICHMENT SERVICES

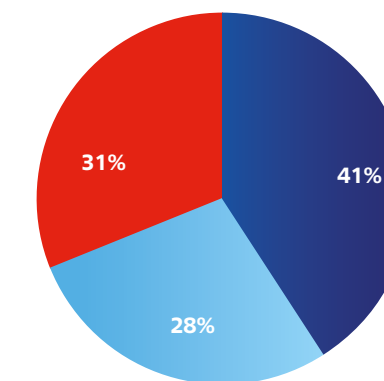
JSC TENEX is the Corporation's main organization promoting uranium conversion and enrichment services on the global market and supplying uranium products for power and research reactors. In 2019, JSC TENEX remained one of the leading suppliers of nuclear fuel cycle front-end products as it satisfied a significant share of the demand of Western-design reactors for uranium enrichment services.

All obligations under existing contracts in the reporting year were fulfilled by JSC TENEX on time and in full, with uranium products supplied to 42 customers in 16 countries worldwide. The annual sales volume totalled about USD 2 billion.

In the reporting year, JSC TENEX concluded 28 deals with 18 customers in 8 countries (including side agreements to existing contracts). The value of the deals totalled about USD 3 billion.

For more details, see the appendix to the Report on the performance of the Sales and Trading Division in 2019 (www.report.rosatom.ru/en/tenex).

REGIONAL STRUCTURE OF URANIUM PRODUCT SALES OF JSC TENEX IN 2019



- America
- Europe
- Asia Pacific, Middle East and Africa

3.3.7. NUCLEAR FUEL EXPORT

The foreign revenue of JSC TVEL, ROSATOM's organization which exports nuclear fuel, totalled USD 0.9 billion in 2019. The 10-year portfolio of overseas orders reached USD 13.9 billion.

In the reporting year:

- A contract was signed for fuel supply for power units No. 7 and 8 of Tianwan NPP (China);
- A contract was signed for fuel supply for power units of Xudabao NPP (China);
- Contract documents were signed for fuel supply for NPPs in Slovakia (until 2030) and Kozloduy NPP in Bulgaria (until 2025).

3.3.8. NEW PRODUCTS FOR INTERNATIONAL MARKETS

CONSTRUCTION OF NUCLEAR RESEARCH AND TECHNOLOGY CENTRES (NRTCS)

As part of the NRTC construction project in Zambia, in 2019, work was completed under contracts for the preparatory period.

Construction of an NRTC was underway in Bolivia. The first and second stages of the Centre were nearing completion, as main equipment for a cyclotron radiopharmacy preclinical complex and a multipurpose irradiation centre was delivered to the construction site.

PROMOTING LIFE CYCLE BACK-END SERVICES

The Corporation is promoting the Balanced Nuclear Fuel Cycle, an integrated product for the back end of the nuclear fuel cycle, on the global market. This is an offer incorporating certain elements of a closed nuclear fuel cycle and enabling effective reuse of regenerated nuclear materials in the nuclear fuel cycle and a significant decrease in the volume and radioactivity level of radioactive waste sent for disposal. This is achieved through spent nuclear fuel processing and high-level waste fractionation.

In 2019, a National Strategy for SNF Management based on conceptual solutions forming part of the Balanced Nuclear Fuel Cycle was developed and approved in Belarus with active support from JSC TENEX.

SUPPLY OF ISOTOPE PRODUCTS

In the reporting year, the Corporation obtained a licence from the French Nuclear Safety Authority for importing Russian-made sources of cobalt-60 into France, which enabled it to expand the geography of supply of sources for sterilization centres.

As part of its efforts to expand its footprint, ROSATOM supplied a pilot batch of medical isotopes (molybdenum-99, iodine-131 and lutetium-177) to the Republic of Cuba.

In 2019, agreements were signed on projects to build multipurpose irradiation centres in Uzbekistan and Cuba.

As part of its efforts to develop integrated sales on international markets, ROSATOM held workshops on its product offers for NRTC and NPP construction in Uganda, Congo, Ethiopia, Brazil, Azerbaijan, Kazakhstan, Rwanda and Argentina.

A project to build a container-based dry storage facility for SNF was underway at El Dabaa NPP in Egypt.

A consortium of ROSATOM's organizations headed by JSC TENEX continued to take an active part in the Fukushima disaster clean-up in Japan; it performed molten nuclear fuel (corium) characterization and took measures to ensure safety during its removal. In 2019, after completing research on forecasting changes in corium properties during its ageing, JSC TENEX was appointed as contractor under the second project in this field.

In the reporting year, the Corporation (as part of a consortium) signed a contract for the dismantling of reactor vessels at Oskarshamn NPP and Barsebäck NPP in Sweden.

Lithium-7 hydroxide monohydrate was successfully registered with the European Chemicals Agency, and the first batches of this chemical were supplied under a long-term contract with a major European NPP operator.

3.3.9. PLANS FOR 2020 AND FOR THE LONG TERM

In 2020, ROSATOM plans to maintain its 10-year portfolio of overseas orders at the level of at least USD 140 billion.

The Corporation will continue to implement its current NPP and NRTC construction projects. It will continue to prepare the necessary licensing documents and hand them over to the customers of NPP construction projects in Hungary, Finland, Egypt and China. ROSATOM expects to obtain a licence for the construction of power unit No. 3 of Akkuyu NPP in Turkey.

In the long term, ROSATOM plans to consolidate its position on the global uranium market, develop its mineral resource base and work consistently to improve the economics of natural uranium mining projects that it is implementing.

The Corporation plans to continue active work with energy companies to conclude new and renew existing contracts for the supply of uranium products.

ROSATOM plans to develop cooperation with foreign energy companies and industrial partners to promote TVS-K fuel and expand the range and the sales geography of fuel and components for foreign-design research reactors.

ROSATOM's plans also include further diversifying its product offer and promoting new products on new markets. It also plans to implement a pilot project to create a multipurpose irradiation

centre abroad. In the small NPP segment, ROSATOM intends to accelerate pre-feasibility studies carried out jointly with foreign customers for the first construction projects.

ROSATOM's long-term priorities on the international market include:

- Fulfilling all obligations under NPP and NRTC construction contracts;
- Building a reliable and transparent supply chain to fulfil overseas orders;
- Making the Corporation's integrated offer more competitive by building a project management system covering the marketing and contract negotiation stages, and consistently communicating and cooperating with ROSATOM's organizations implementing various elements of the integrated offer.

By 2030, ROSATOM plans to sign comprehensive service contracts for the maintenance of Russian-design power units that are currently under construction or are planned to be built.

ROSATOM is considering diversifying into the foreign-design NPP servicing segment by 2030 and developing service capabilities in other sectors of the energy industry (including alternative energy).

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4.4. Engineering Division	84
4.5. Power Engineering Division	86

4

PERFORMANCE OF DIVISIONS



4.1. MINING DIVISION²⁶

Key results in 2019

- Uranium resources totalled 512,700 tonnes.
- 2,911 tonnes of uranium were produced (the production programme was 105% completed).
- Uranium production at JSC Khiagda reached design capacity.

The Mining Division of ROSATOM (its holding company is JSC Atomredmetzoloto) consolidates Russian uranium mining assets in the Zabaykalsky Territory (PJSC PIMCU), the Republic of Buryatia (JSC Khiagda), the Kurgan Region (JSC Dalur) and the Sakha Republic (Yakutia) (JSC Elkon MMP)²⁷.

The Division has unique uranium mining capabilities and performs a full range of operations, from geological exploration, design and pilot operation to the decommissioning of production facilities and land rehabilitation. In-house uranium production in Russia enables the Corporation to guarantee reliable supplies to customers, to secure long-term resources for nuclear power generation and maintain a competitive cost of production.

The Division is implementing a number of non-uranium projects, including the construction of a lead and zinc concentrate plant in the Novaya Zemlya Archipelago, scandium mining (as a

February 20, 1968 marked the start of construction of the Priargunsky Mining and Chemical Works at the Streltsov group of uranium deposits. Within eight years, it evolved into an integrated enterprise producing high-purity natural uranium oxides. In 1976, the enterprise produced the first batch of finished products, and in 1987, the Priargunsky Mining and Chemical Works accounted for as much as 30% of the country's total uranium output. Today, PJSC PIMCU is the largest enterprise in ROSATOM's Mining Division.

by-product), geological exploration and pilot production of gold at the Severnoye deposit, pyrite cinder processing, etc.



4.1.1. OPERATING RESULTS

Indicator	2017	2018	2019
MINERAL RESOURCE BASE AND URANIUM PRODUCTION			
Mineral resource base, kt	523.9	520.7	512.7
Uranium production, tonnes, including:	2,917	2,904	2,911
PJSC PIMCU	1,631	1,456	1,300
JSC Dalur	592	590	595
JSC Khiagda	694	858	1,016

²⁶ For more details, see the appendix to the Report on the performance of the Mining Division in 2019 (www.report.rosatom.ru/en/armz).

²⁷ Uranium is mined abroad by Uranium One, an organization of ROSATOM (see the section 'International Business').

The Division produced 2,911 tonnes of uranium, which totals 105% of the target volume.

Construction of Mine No. 6 continued at PJSC PIMCU. Principal work on infrastructure facilities was completed, and the construction of a headframe was started. In 2020, the Division will start capital development, i.e. the construction of the mine itself.

One of the highlights of 2019 was the fact that production at JSC Khiagda reached the design capacity of 1,000 tonnes, which is almost 19% more than in 2018. JSC Khiagda has become Russia's first digitized uranium mining enterprise. It has created a smart production management system covering the entire production cycle and has started commercial operation of a 'smart mine'. In cooperation with a partner (PJSC Rostelecom), the Division has built fibre optic links with a total length exceeding 200 kilometres and has created the relevant IT landscape, providing towns and villages in the Bauntovsky District of Buryatia with Internet connectivity.

4.1.2. NEW PRODUCTS

In 2019, commercial production was started under the Scandium project, with 230 kilograms of the rare metal produced and shipped to customers.

An industrial partnership agreement was concluded with Aramine (France) on the localization of mining equipment production at PJSC PIMCU under a Russian trademark, Argo. The start of mass production of battery-powered load-haul-dump machines for mining operations is scheduled for 2020.

The Division was developing engineering, drilling and maintenance services: in the reporting year, it concluded contracts with foreign companies in China, Australia and Namibia.

In the reporting year, JSC Dalur started geological exploration of the Dobrovolnoye deposit. Pilot operation of a modular sulphuric acid regeneration plant with a throughput of 5,000 tonnes per year (which can be increased to 10,000 tonnes per year) started at the Khokhlovskoye deposit.

In 2019, as part of the Vision Zero campaign joined by ROSATOM (for details, see the section 'Occupational Safety and Health'), the Division became one of the first in Russia to implement the Smart Hard Hats project. This is a personnel positioning system that enables remote monitoring of compliance with safety rules, the movement and health status of employees and thus helps to improve workplace safety.

As part of the Pavlovskoye project in the Novaya Zemlya Archipelago, in the reporting year, the Division finalized design documentation and obtained a positive opinion on engineering surveys at the deposit.

A project to start gold production was launched at the Severnoye deposit in Yakutia.

See also the section 'Business Diversification'.

4.1.3. SOCIAL PROJECTS

In the reporting year, the annual competition of charity and social projects was held for the sixth time in Krasnokamensk (Zabaykalsky Territory). The aim of the competition is to support social entrepreneurship and foster self-employment. Following the competition, 28 important social projects received financial support totalling RUB 2.5 million. In addition, the Division held the Social Entrepreneur's Day, which included:

- A crash programme titled Regional Social Development Accelerator;
- A forum titled From Social Initiatives to Social Entrepreneurship;
- A Path to the Future career guidance project for teenagers.

In 2019, the competition of charity and social projects organized by ROSATOM's Mining Division was ranked in the top three in the Best Corporate Social Investment Programme in the Regions of Operation Aligned with the Business Strategy in the Context of Sustainable Development category in the Corporate Philanthropy Leaders in the Sustainable Development Paradigm rankings compiled by the Donors' Forum, an international consultancy PwC and the Vedomosti newspaper.



4.1.4. PLANS AND DEVELOPMENT PROSPECTS

The Mining Division is the centre of responsibility for supplying ROSATOM and the Russian Federation with uranium and other strategically important metals used in cutting-edge areas of economic development, such as additive manufacturing, robotics, energy storage systems, high-temperature and renewable energy, etc.

One of the Division's priorities is to develop projects in the mining and related industries that are focused on producing strategically important metals. This includes the following initiatives:

- Expanding the range of metals produced by the Division (rare and rare-earth metals and their compounds);
- Improving the processing depth of raw materials produced by the Division (production of metals, alloys and other high-technology products);
- Providing engineering, drilling and maintenance services.



4.2. FUEL DIVISION²⁸

Key results in 2019

- The Division fulfilled all commitments related to the supply of nuclear fuel to Russian and foreign customers.
- Industrial production of MOX fuel for fast neutron reactors was started.
- The Division was assigned the functions of an integrator for a new business area of ROSATOM in the sphere of decommissioning of facilities posing nuclear and radiation hazards.

The Fuel Division of ROSATOM (its holding company is JSC TVEL) is a leading player on the global nuclear fuel cycle front-end market and the only supplier of nuclear fuel for Russian NPPs and the nuclear-powered icebreaker fleet.

The Division is the main supplier of fuel for Russian-design VVER reactors abroad and has the necessary capabilities for the fabrication of nuclear fuel for PWR and BWR reactors and its components from reprocessed uranium (in cooperation with Framatome), as well as fuel pellets for BWR and PHWR reactors.

The Division also supplies the Russian and global markets with a wide range of non-nuclear products and services in the metals, chemical and mechanical engineering sectors, in the sphere of additive manufacturing and energy storage.

The Division comprises enterprises in ten regions of Russia.

In 1952, the team of the special design bureau of Leningrad Kirov Plant (OKB LKZ, later renamed Experimental Design Bureau Centrotech) designed the first prototype of a gas centrifuge for industrial separation of uranium isotopes. In 1962, the world's first uranium enrichment plant using centrifuge technology started operation at the Ural Electrochemical Integrated Plant. The first gas centrifuges helped to improve the efficiency of uranium enrichment by a factor of almost 2.5 and to reduce electricity consumption 10-fold. Their adoption brought about a real technological revolution. Efficient gas centrifuge technology enabled Russia to become a global leader on the uranium enrichment market for decades to come.



²⁸ For more details, see the appendix to the Report on the performance of the Fuel Division in 2019 (www.report.rosatom.ru/en/tvel).

4.2.1. OPERATING RESULTS

In 2019, significant progress was made on the project to produce mixed oxide (MOX) fuel consisting of a blend of uranium and plutonium. Industrial production of MOX fuel for fast neutron reactors was launched for the first time in Russia. The first batch of this fuel was loaded into the core of the BN-800 reactor at Beloyarsk NPP. A performance level was reached signalling the possibility of initiating a phased transition of the BN-800 reactor to operating with its core fully loaded with MOX fuel.

The first phase of reactor testing of Russian accident tolerant nuclear fuel resistant to beyond-design-basis accidents was completed. The first experimental fuel assemblies for the VVER-1000 reactor were produced and underwent acceptance inspection.

A unit for separating zirconium chloride and hafnium chloride was put into operation, and a technology for fractional distillation of zirconium tetrachloride was introduced. This project will

4.2.2. NEW PRODUCTS

In the reporting year, an agreement was signed with Hermith GmbH (a major European titanium supplier) on establishing a joint venture to manufacture titanium alloy products. The joint venture will specialize in high value-added products for knowledge-intensive sectors, such as the aerospace, automotive and medical industries. Plans for the initial stage include starting the production of titanium wire for additive manufacturing (3D printing) and seamless pipes for aircraft hydraulic systems. As the business will be developing, its product range might be expanded to include such products as aircraft fasteners, titanium springs for the automotive industry, workpieces for the production of prosthetic implants, superconductors, etc.

PJSC NCCP, an organization forming part of the Division, successfully completed a qualification procedure as a supplier of battery materials and concluded contracts for the supply of battery-grade lithium metal with leading global producers of primary lithium batteries.

In 2019, specialists from the Fuel Division of ROSATOM received a science and technology award from the Russian Government for developing and starting mass production and commercial operation of radically new generation 9+ gas centrifuges for uranium isotope separation.

enable the Corporation to start producing zirconium sponges, which some foreign NPP operators require to be used in nuclear fuel fabrication.

In the reporting year, the relocation of production capacities of JSC Vladimir Tochmash Production Association to the site of PJSC Kovrov Mechanical Plant in Kovrov (Vladimir Region) was completed.

In 2019, the Fuel Division started pilot operation of the first Russian-made multi-powder 3D printer with two laser sources. Mass production of 3D printers was started, with the first two sets supplied to ROSATOM's Additive Manufacturing Centre.

The Division completed a contract for the supply of strands for a prototype superconducting dipole magnet for upgrading the Super Proton Synchrotron (SPS) at the European Organization for Nuclear Research (CERN) in Switzerland.

In 2019, the Division was appointed as integrator for a new business area of ROSATOM in the sphere of decommissioning of facilities posing nuclear and radiation hazards. The relevant competence centres were formed in the Division's enterprises.

See also the section 'Business Diversification'.

4.2.3. SOCIAL PROJECTS

In 2019, the Division organized a competition of important social projects. More than 90 applications were submitted by non-governmental organizations in the Division's regions of operation in the sphere of sports, culture and arts, support for the disabled and fostering patriotic, ethical and spiritual values. 24 projects worth a total of about RUB 23 million were supported and implemented.

In 2019, a cooperation agreement was signed with the Agency for Strategic Initiatives to implement a programme titled 'Future Talent for the Region' in Glazov and the CATFs of Zelenogorsk, Novouralsk and Seversk. The aim of the project is to form and

develop leader teams comprising proactive, ambitious and passionate school students who are able and willing to participate in designing and implementing social and economic projects crucial for their home region. Following the completion of the programme, authors of the best projects were awarded trips to the Artek International Children's Centre (with five people selected from each town).

An IT Cube was opened in Elektrostal with support from JSC TVEL. This is the first digital education centre of this kind for children and teenagers in the Fuel Division's home towns.

4.2.4. PLANS AND DEVELOPMENT PROSPECTS

- To participate in competitive tendering for nuclear fuel supply for European NPPs;
- To sign contracts for the supply of nuclear fuel and its components for Western-design research reactors;
- To produce MOX fuel assemblies for the first full reloading of the BN-800 reactor and to start the transition of the BN-800 reactor to fully operating on MOX fuel;
- To develop the production of additive manufacturing equipment at LLC RME Centrotech and JSC UEIP (organizations forming part of the Division);
- To conclude new contracts with third-party customers for the supply of energy storage systems for logistical electric vehicles;
- To expand lithium metal production capacities.

4.3. MECHANICAL ENGINEERING DIVISION²⁹

Key results in 2019

- Mechanical engineering products were delivered on time to seven NPPs in Russia and abroad.
- A contract was signed for the package supply of RITM-200 reactor units for the fourth and fifth Project 22220 icebreakers.
- Pumps were produced and delivered for the fourth line of the Yamal LNG project.

The Mechanical Engineering Division of ROSATOM (its holding company is JSC Atomenergomash) is one of Russia's largest groups of mechanical engineering enterprises offering a full range of solutions for the design, manufacture and supply of equipment for the nuclear and thermal power industry, the gas and petrochemical industry, shipbuilding and the special steel market.

The Division controls the entire production chain of key equipment for the nuclear island and the turbine hall, from R&D and the release of detailed engineering designs to process engineering and manufacture of equipment. The Division comprises major power machine engineering enterprises, including manufacturing, research and engineering organizations in Russia, Europe and the CIS.

4.3.1. OPERATING RESULTS

In the reporting year, mechanical engineering products were delivered on time to seven NPPs, including three NPPs in Russia (Kursk NPP-2, Leningrad NPP-2 and Kola NPP) and four NPPs abroad (Akkuyu NPP, Kudankulam NPP, Rooppur NPP and the Belarusian NPP).

The Division completed the manufacture of a reactor unit and heat exchange equipment for the turbine hall of power unit No. 4 of Kudankulam NPP (India).

December 27, 1976 marked the start of operation of the first manufacturing site of the Soviet nuclear engineering giant: the Atomash plant in Volgodonsk (Rostov Region). Its rated capacity totalled eight sets of reactor equipment per year. To support the enterprise's manufacturing operations, roads and railways were built, and air links were established. In addition, to support the manufacturing and business operations of Atomash, a new part of the city, including all the relevant infrastructure, was built in Volgodonsk (the so-called 'New City').

Over many years of operation, the enterprise has produced more than a hundred items of key equipment for NPP power units in Russia, Ukraine, Belarus, India and other countries. Today, Atomash is Russia's only supplier of comprehensive equipment packages for nuclear power plants and a key enterprise in ROSATOM's Mechanical Engineering Division.

In 2019, a contract was signed for the package supply of RITM-200 reactor units for the fourth and fifth Project 22220 icebreakers. A cooperation agreement was signed as part of the work on the Lider icebreaker.

4.3.2. NEW PRODUCTS

As part of its gas and petrochemical equipment business, in 2019, the Division continued to work on import substitution projects covering a wide range of critical equipment for the Russian oil and gas industry. Pumps were produced and delivered for the fourth line of the Yamal LNG project. Russian-designed and Russian-made equipment will be used for the first time at an operating medium-scale LNG plant.

As part of the thermal power equipment business, the Division concluded a contract for the package supply of electromechanical and process systems and the provision of services for the construction of four waste incineration plants in the Moscow Region. In addition, a contract was signed for the replacement of steam superheaters for steam boilers at a thermal waste treatment plant in the UK.

As part of the shipbuilding business, agreements were concluded with foreign manufacturers on the localization of production of marine equipment.

An important achievement on the special steel market was the fact that in the reporting year, the Division underwent product certification as a supplier of parts for long-lead rotor blanks for NPP construction projects being implemented by ROSATOM abroad.

See also the section 'Business Diversification'.

4.3.3. SOCIAL PROJECTS

In 2019, six enterprises of the Division in Moscow, Ekaterinburg, Saint Petersburg, Volgodonsk, Petrozavodsk and Podolsk participated in a charity donation of essential items and food for people in need (residents of retirement homes, care homes for elderly and disabled people, and refuges). Employees of the Division in Volgodonsk conducted a volunteer campaign to mark the International Day of Older Persons: they organized celebrations for elderly people and congratulated them.

A campaign was conducted in Volgodonsk to provide humanitarian aid for children at the Aistenok children's social rehabilitation centre, for low-income families with many children and for disabled children at boarding school No. 2.

The Green Office Change Support Team formed in the Division set up a used battery collection point (the batteries are subsequently sent for recycling), conducted an environmental clean-up, organized waste paper collection and installed a health-food vending machine in the Moscow office of the Division.

²⁹ For more details, see the appendix to the Report on the performance of the Mechanical Engineering Division in 2019 (www.report.rosatom.ru/en/aem).

4.3.4. PLANS AND DEVELOPMENT PROSPECTS

In 2020, the Division plans to:

- Produce equipment for ROSATOM's NPP construction projects on schedule;
- Produce equipment for the second waste incineration plant in the Moscow Region and conclude contracts for new waste incineration plant construction projects in Russia;
- Conclude contracts for thermal power plant upgrade projects in Russia;

- Conclude contracts and produce a batch of LNG loading pumps for a large-scale LNG plant.

The Division's long-term priority is to become part of a global production chain by participating in partner projects. To achieve this goal, the Division will leverage its reputation as a reliable partner and a leader on the Russian market and develop its own capabilities, technological solutions and products.

4.4. ENGINEERING DIVISION³⁰

Key results in 2019

- Five NPP power units were under construction in Russia during the year. *(For details on NPP construction abroad, see the section 'International Business').*
- All key milestones were completed on the construction sites of Kursk NPP-2 and Leningrad NPP-2.

The Engineering Division of ROSATOM (its holding company is JSC ASE EC) has extensive capabilities for managing the construction of complex engineering facilities.

The main business areas of the Division include the following:

- Design and construction of large NPPs in Russia and abroad;
- Developing digital technologies for managing complex engineering facilities based on the Multi-D platform.

The Division actively engages local and international suppliers in the implementation of its projects. The Division comprises major design institutes in Moscow, Saint Petersburg and Nizhny Novgorod.

Historically, the roots of all design institutes in the nuclear industry can be traced back to the All-Union State Design Institute Teploelektroproekt, which was established in Moscow in 1924 in order to implement the ambitious GOELRO Plan for the electrification of the country. Initially, Teploelektroproekt focused only on the construction of hydro- and thermal power plants. It was only in 1958 that a separate division tasked with NPP design was formed, and Teploelektroproekt was appointed general contractor responsible for NPP design pursuant to a special government decree. Novovoronezh NPP was one of the first projects implemented by the institute in this new capacity. Commissioned in 1964, it was the country's first nuclear power plant equipped with a VVER reactor.



³⁰ For more details, see the appendix to the Report on the performance of the Engineering Division in 2019 (www.report.rosatom.ru/en/ase).

4.4.1. OPERATING RESULTS

Kursk NPP-2

All 12 key construction milestones for 2019 were completed, including:

- The start of concreting of the second layer of the internal containment vessel at power unit No. 1;
- Moving the thrust truss at power unit No. 1 into position;
- Installation of the core catcher at power unit No. 1;
- The completion of concreting of the foundation slab of the reactor building at power unit No. 2.

Leningrad NPP-2

All six key milestones were completed, including:

- The start of trials and testing of power unit equipment;
- Moving diesel generators into final position;
- Completing the assembly of the reactor in order to carry out hot and cold trial runs.

For information on NPP construction abroad, see the section 'International Business'.

4.4.2. SOCIAL PROJECTS

The Division held the annual competition of charity projects for non-profit organizations in its regions of operation. The competition included the following categories: The Young Generation; Environment; Culture and Sports; Patriotic Initiatives; The Future Lies with Science. In 2019, financial support for projects totalled RUB 16 million. Considerable emphasis was placed on important social, patriotic, cultural and sporting initiatives undertaken by local communities in Ostrovets and its vicinity, near the construction site of the Belarusian NPP.

In the reporting year, more than 100 employees of the Division volunteered to take part in a blood typing campaign launched in order to compile a nation-wide bone marrow register.

4.4.3. PLANS AND DEVELOPMENT PROSPECTS

The design and construction of large NPPs remains the main business focus of the Engineering Division; its main priority is to strictly comply with the terms and conditions of all contracts (primarily those related to the duration and cost of construction).

The key objective is to make the Division more competitive on the international market (including in terms of the LCOE).

4.5. POWER ENGINEERING DIVISION³¹

Key results in 2019

- Electricity output at Russian NPPs totalled 208.8 billion kWh (which is comparable to electricity consumption in Moscow and the Moscow Region over two years).
- Power unit No. 2 of Novovoronezh NPP-2 started commercial operation ahead of schedule.
- The floating nuclear power plant in Pevek (Chukotka Autonomous District) was connected to the power system.
- The capacity of 10 Russian NPPs (36 operating power units) totalled 30.3 GW.
- The NPP capacity factor totalled 80.4%.

The Power Engineering Division of ROSATOM (its holding company is JSC Rosenergoatom) is the only NPP operator in Russia and a major player on the Russian electricity market.

Its main business areas include power and heat generation at NPPs and acting as the operator of nuclear facilities (nuclear power plants), radiation sources and facilities storing nuclear materials and radioactive substances in accordance with Russian legislation.

The Division includes operating NPPs, directorates of NPPs that are under construction, the Capital Projects Implementation Branch Office, the Directorate for Construction and Operation of Floating Thermal Nuclear Power Plants, the Technology Branch Office, the Pilot and Demonstration Engineering Centre for Decommissioning and the Akkuyu Engineering Centre; they all have the status of the Division's branches.

On May 16, 1950, the Soviet government issued a Decree on Research, Design and Experimental Work for the Peaceful Use of Nuclear Energy, whereby a resolution was adopted to build the world's first nuclear power plant. A 5 MW NPP was put into operation in 1954 in Obninsk (Kaluga Region). Following the successful launch of Obninsk NPP, the Council of Ministers of the USSR approved a large-scale NPP construction programme in the country.

Obninsk NPP had an accident-free service life spanning 48 years; it was decommissioned in 2002. It now houses an industry museum and a memorial.



³¹ For more details, see the appendix to the Report on the performance of the Power Engineering Division in 2019 (www.report.rosatom.ru/en/rea).

4.5.1. OPERATING RESULTS

In 2019, electricity output at 36 power units of 10 operating NPPs totalled 208.8 billion kWh, reaching a new all-time high in the history of Russian nuclear power generation (in 2018, electricity output totalled 204.3 billion kWh). The balance target set by the Federal Antimonopoly Service of Russia was exceeded by 3%. The NPP capacity factor totalled 80.4% (79.9% in 2018).

The increase in electricity output was driven mainly by the following factors:

- NPP power units commissioned in 2018 (power unit No. 4 of Rostov NPP and power unit No. 1 of Leningrad NPP-2) operating at rated capacity;
- Power unit No. 2 of Novovoronezh NPP-2 starting commercial operation ahead of schedule (this is the third state-of-the-art generation 3+ power unit in Russia, meeting the highest safety standards);

- Shorter duration of scheduled maintenance and repairs at power units.

In 2019, the floating nuclear power plant in Pevek (Chukotka Autonomous District) was connected to the isolated power system of the Chaun-Bilibino energy hub and will now provide power supply to the region. The mobile thermal nuclear power plant using marine technology will facilitate the development of the Chukotka region, including local manufacturing enterprises and infrastructure.

4.5.2. NEW PRODUCTS

In 2019, a 48 MW Data Centre near Kalinin NPP started full-scale operation. This is the largest data centre in Russia and one of the largest data centres in Europe. A joint project was launched in cooperation with IBM to create a cloud service based on open source technology; this will enable project teams, institutes, the scientific community, start-ups and other organizations interested in digital innovations to use the capabilities of the Data Centre. An agreement was signed with PJSC FGC UES on building a hyperscale data centre in Moscow.

The Division is implementing a large-scale project to produce cobalt-60 on an industrial scale. This isotope is used for sterilization in agriculture, healthcare and industry, as well as for ma-

terial modification. It is produced at seven power units equipped with RBMK reactors at Smolensk, Kursk and Leningrad NPPs. In late 2019, the loading of the first batch of cobalt absorbers was completed at Kursk and Smolensk NPPs. In addition, the Division started to produce medical isotopes (molybdenum-99, iodine-131 and iodine-125) in RBMK reactors.

In 2019, JSC AtomEnergoSbyt (an organization forming part of the Division) continued to operate as the power supplier of last resort in the Kursk, Tver, Smolensk and Murmansk Regions through the branches established in these regions. Electricity sales totalled 15.7 billion kWh.

4.5.3. SOCIAL PROJECTS

In 2019, the Division implemented the Megawatt of Health project, which is aimed at promoting a healthy lifestyle among its employees: for every kilometre of distance that they covered as part of this sporting project, funds were donated to charity. About 2,500 employees of the Division took part in the campaign; they walked a total of 527,000 kilometres, ran more than 111,000 kilometres, swam 9,000 kilometres and cycled more than 215,000 kilometres. A total of RUB 4 million

was raised as part of the campaign; the funds were donated for charity projects to support children in the towns and cities where NPPs are located.

The Division held the annual competition of important social projects for non-profit organizations in its regions of operation. Following the competition, 64 projects worth a total of RUB 60 million were implemented.

4.5.4. PLANS AND DEVELOPMENT PROSPECTS

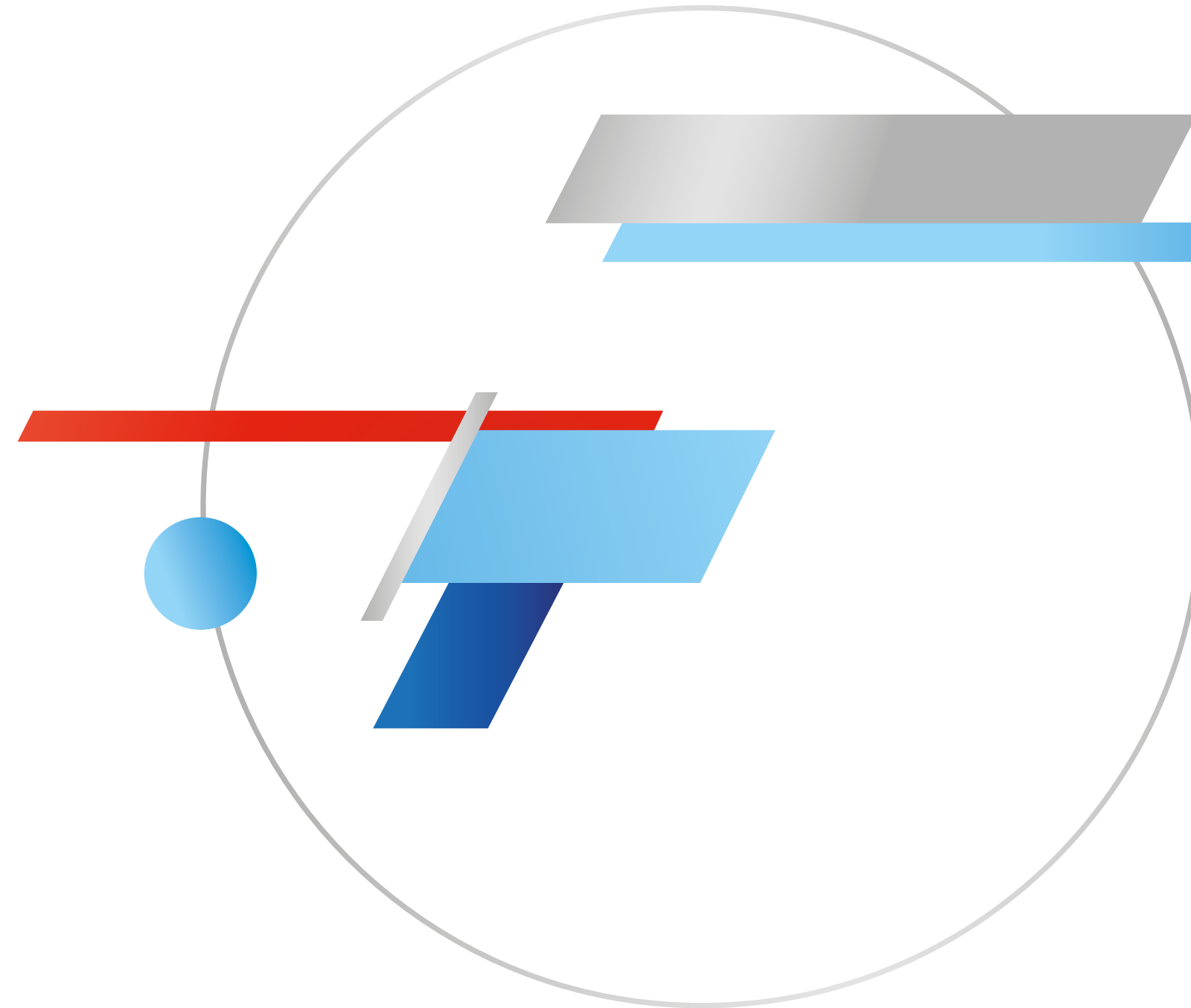
The balance target for nuclear power generation for 2020 has been set by the Federal Antimonopoly Service of Russia at 207.6 billion kWh.

In addition, in 2020, the Division plans to put the floating thermal nuclear power plant in Chukotka³² into operation and to start up power unit No. 2 of Leningrad NPP-2.

The Division's long-term priorities include:

- Ensuring safe and reliable NPP operation and minimizing the negative impact on people's health and the environment;
- Protecting employees' health;
- Increasing nuclear power generation and reducing unit costs;
- Developing the Division's regions of operation;
- Developing promising solutions and competitive products.

³² The floating thermal nuclear power plant was commissioned in May 2020.



5

INNOVATIONS AND NEW PRODUCTS TO IMPROVE THE QUALITY OF PEOPLE'S LIFE

5.1. Research and Innovations

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5.2. Business Diversification

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5.1. RESEARCH AND INNOVATIONS

Key results in 2019

- The Corporation's Innovative Development and Technological Modernization Programme was updated and submitted to the Ministry of Economic Development of Russia. As part of the Programme, greater emphasis was placed on projects in prioritized areas of scientific and technological development of the nuclear industry, as well as on innovative projects and digital transformation initiatives.
- Internal research and development costs amounted to 2.9% of revenue.
- Over 50 technological projects were underway.
- The number of international applications filed and patents obtained in the reporting year totalled 439.
- A cooperation agreement was signed with the Russian Academy of Sciences.



YURY OLENIN
Deputy Director General
for Science and Strategy

– How does ROSATOM organize its efforts to attract and retain promising young scientists?

– Staffing is one of the most important problems in modern science. To achieve the objective of promoting large-scale development of the Russian nuclear industry, ROSATOM needs a steady inflow of young specialists, primarily from core universities: MEPhI, MIPT, MISIS, etc. Every year, more than 150 young researchers embark on a career in nuclear science, taking advantage of ample opportunities provided by ROSATOM for working on relevant, challenging, exciting and extremely important scientific problems in the field of nuclear power, controlled thermonuclear fusion, development of new materials and in numerous other high-technology areas.

As part of our cooperation with universities, we focus on high-quality technical education and subsequent practical application of knowledge gained during studies, as we know that

in the high-technology industry it is impossible to become real professionals immediately after graduation. What is needed is experience of working on complex real-life tasks in a team of highly professional specialists. Today, a young scientist, regardless of his or her future specialization, needs a good command of information technology, a high level of proficiency in English, an understanding of economic theories, excellent communication and presentation skills.

To train personnel in ROSATOM's research organizations, specialized departments have been established in core universities, where students are deeply immersed in research tasks of the enterprises. We also implement large-scale career guidance initiatives for students, regularly invite them to technology tours, and inform them about the opportunities and challenges in specific enterprises. Our best researchers are lecturers and employees of core universities. For example, in the research department alone, more than 50 employees are university teachers.

Together with universities, we are adjusting existing and developing new, 'ROSATOM-centric', general education programmes and invariably engage leading industry experts in their implementation. We are also developing our technological capabilities and equipping laboratories at key universities.

Already in 2020, a special programme was launched in the industry to attract talented students who wish to pursue a career in scientific research. The programme includes a three-year paid internship with an opportunity to combine study and work on large-scale research projects. To do an internship and get a job in the industry, students go through a rigorous multi-stage selection process. 40 trainees have already been recruited at the pilot stage, and we plan to select 60 more students by the end of the year. Starting from next year, we will recruit 150 trainees annually. After completing the internship, the best students will be offered full-time employment at ROSATOM.

In addition, we attach special importance not only to attracting but also to retaining young employees. To achieve this, we seek to create a modern innovation environment where advanced ideas are supported, young scientists have access to the necessary resources, and all employees have equal opportunities for career advancement and professional development.

Only two years ago, more than a third of young employees would leave science after a year of work. This not only led to an increase in annual staffing needs, but also forced us to spend

a lot of effort on the onboarding of new employees instead of their active development. But now the measures that we have taken have produced a significant improvement. Working conditions in the research department have improved considerably. Over the past two years, some organizations have more than doubled the salaries of their researchers. New housing benefits are now provided to young scientists. An expert career path has been introduced, which enables an employee to develop professionally and gain experience. I can confidently say that the profession of a scientist in ROSATOM is now a prestigious, well-paid and promising job.

In addition, we support new ideas put forward by young scientists. There are a number of competitions and programmes in the industry, such as the Innovation Leader, the competition of conceptual designs, training programmes forming part of the Business Workshop and a number of other initiatives. They are all aimed at developing skills required to search for promising ideas and put them into practice to achieve business results.

And, of course, the scale of the tasks to be solved is an important factor in terms of retaining and developing young talent. Young employees play a major role in all key projects being implemented by ROSATOM, including a comprehensive programme titled 'Development of Technical Capabilities, Technology and Scientific Research in the Use of Nuclear Energy in the Russian Federation until 2024', which is currently under development, and the Consolidated Plan of R&D Topics of ROSATOM.

ROSATOM creates breakthrough technologies and innovation infrastructure to facilitate long-term development and meet the energy needs of mankind.

5.1.1. IMPLEMENTATION OF THE INNOVATIVE DEVELOPMENT AND TECHNOLOGICAL MODERNIZATION PROGRAMME OF ROSATOM

In 2019, a new version of the Innovative Development and Technological Modernization Programme of ROSATOM was prepared. It includes national projects, prioritized projects promoting scientific and technological development in the nuclear industry, and innovative digital transformation projects.

In the reporting year, more than 50 technological projects aimed at creating technologies to transform existing and encourage the emergence of new markets were being implemented as part of the Innovative Development Programme.

KEY PERFORMANCE INDICATORS OF THE INNOVATIVE DEVELOPMENT AND TECHNOLOGICAL MODERNIZATION PROGRAMME OF ROSATOM

Share of innovative products and services in total sales of products and services in the industry, %

Number of items of intellectual property: foreign patents obtained by ROSATOM, applications for foreign patents submitted and registered under the established procedure, registered trade secrets (know-how) reflecting the commercialization and expansion of the sphere of application of research results in the nuclear industry (cumulative total), pcs.

Share of work performed by universities, small and medium-sized enterprises and other organizations outside the industry, %

	2017	2018	2019
Share of innovative products and services in total sales of products and services in the industry, %	13.5	17.5	20.6
Number of items of intellectual property: foreign patents obtained by ROSATOM, applications for foreign patents submitted and registered under the established procedure, registered trade secrets (know-how) reflecting the commercialization and expansion of the sphere of application of research results in the nuclear industry (cumulative total), pcs.	922	1,339	1,778
Share of work performed by universities, small and medium-sized enterprises and other organizations outside the industry, %	12.8	15.6	16.7

Implementation of the Innovative Development and Technological Modernization Programme of ROSATOM was focused on the following areas:

- Upgrading existing technologies for energy markets;
- Creating new technologies for energy markets;
- Creating new technologies and upgrading existing technologies for non-energy markets;
- Developing an innovation management system and innovation infrastructure, cooperating with third-party organizations.

In the reporting year, 15 'process' projects were being implemented; they are aimed at streamlining organizational processes in the sphere of research and innovation, including speeding up the development of ROSATOM's new products and their launch on the market.

Upgrading existing technologies for energy markets

Creating new technologies for energy markets

Creating new technologies and upgrading existing technologies for non-energy markets

KEY INNOVATIVE PROJECTS FORMING PART OF THE INNOVATIVE DEVELOPMENT AND TECHNOLOGICAL MODERNIZATION PROGRAMME

Transition to integrated geological, mining and process simulation techniques; research and technical support for the development of uranium deposits

Establishment of a pilot and demonstration facility comprising a power unit equipped with a fast neutron reactor and an on-site unit for SNF reprocessing, fabrication and refabrication of dense fuel (on-site nuclear fuel cycle)

Organization of cobalt-60 isotope production in RBMK reactors

Development of generation 11 gas centrifuges and the relevant structural materials

Transition of the BN-800 reactor to operating with its core fully loaded with MOX fuel

Establishment of a regional centre for irradiation technologies

R&D to provide a rationale for the VVER TOI design

Participation in the project to create the International Thermonuclear Experimental Reactor (ITER)

Creation of a high-technology digitized facility for the production of high-precision products for the medical industry using additive manufacturing technologies

R&D to provide a rationale for the development of new NPP designs with high- and medium-power VVER reactors

Research and development in the field of controlled thermonuclear fusion

Creation of an external beam radiotherapy facility based on a 6 MeV linear electron accelerator to substitute imported analogues

Start of pilot operation of six TVS-2M assemblies with REMIX fuel

Design and construction of small NPPs

Development of new materials and technologies

Development and implementation of innovative technologies for the decommissioning of NPP power units equipped with VVER reactors

Laser technology development

Development of technology for the dismantling of uranium-graphite reactors and methods for the certification of radioactive graphite waste

SNF processing based on innovative technologies

5.1.2. PRORYV (BREAKTHROUGH) PROJECT AIMED AT CLOSING THE NUCLEAR FUEL CYCLE

ROSATOM is implementing a long-term project, Proryv (Breakthrough), aimed at developing fast neutron reactors and closing the nuclear fuel cycle. This project will result in the development of technologies that will help to solve the problem of radioactive waste accumulation and make nuclear power plants more cost-effective. The ultimate goal is to create a two-component nuclear power system with a closed fuel cycle, in which power units equipped with thermal-neutron VVER reactors, which are the mainstay of the global nuclear power industry, will be operated alongside power units equipped with fast neutron reactors. As a result, the nuclear power industry will shift to a circular economy consistent with sustainable development principles and objectives.

In 2019, out-of-reactor tests of main equipment for the core of the BREST-OD-300 reactor unit were completed. A positive opinion was obtained on innovative solutions for a power unit equipped with the BREST-OD-300 reactor following an expert review by the Russian Academy of Sciences. Preparations were started for the construction of the power unit equipped with the BREST-OD-300 reactor.

In 1956, the world's first mercury-cooled fast neutron research reactor with plutonium metal fuel, BR-2, was launched at the Leypunsky Institute for Physics and Power Engineering (Obninsk). The BOR-60 research reactor, which was launched in 1969 in Dimitrovgrad and is currently in operation, became the first demonstration fast reactor. The BN-600 reactor has been in operation at Beloyarsk NPP since 1980, and in 2016, at the same power plant, power unit No. 4 equipped with the BN-800 reactor started commercial operation.

Tests of innovative mixed nitride uranium-plutonium (MNUP) fuel continued successfully in the BOR-60 research reactor and the BN-600 power reactor.

In 2020, ROSATOM plans to obtain a licence for the construction of the power unit equipped with the BREST-OD-300 reactor and to start the production of long-lead equipment for the BREST-OD-300 reactor.

5.1.3. PARTICIPATION IN INTERNATIONAL MEGA RESEARCH PROJECTS

ITER

ITER is the world's first experimental fusion reactor being built by the international community near the Cadarache nuclear centre in France. The objective of the project is to demonstrate the scientific and technological feasibility of using fusion energy on an industrial scale and to master the relevant technological processes. Successful implementation of the ITER project will contribute to meeting the energy needs of humankind.

Soviet physicists pioneered the use of nuclear fusion. The first toroidal magnetic confinement devices (tokamaks) were developed in the 1950s. The concept was proposed by academicians Andrey Sakharov and Igor Tamm. The Russian acronym 'tokamak' has been borrowed by other languages around the world, in the same way as the word 'sputnik'.

In 2019, scheduled work to manufacture 25 systems included in the list of Russia's obligations under the project was performed in full. Special equipment manufactured for ITER as part of Russia's obligations, including four central upper nozzles of the vacuum vessel and components of switching equipment, was delivered on schedule.

Researchers from ROSATOM will conduct experiments in inertial confinement fusion: in 2019, a target chamber, where targets will be irradiated by laser beams, was assembled for the world's largest laser facility currently under construction in Sarov. The idea for this facility was proposed in 1961 by Nikolay Basov and Oleg Krokhin.

CONSTRUCTION OF THE MULTIPURPOSE FAST NEUTRON RESEARCH REACTOR (MBIR)

A landmark event in 2019 was the completion of construction of the MBIR reactor vessel. Its delivery to the site of JSC SSC RIAR is scheduled for 2020.

In the reporting year, the formation of the International Research Centre based on the MBIR reactor continued. A multilateral research programme for MBIR was being developed.

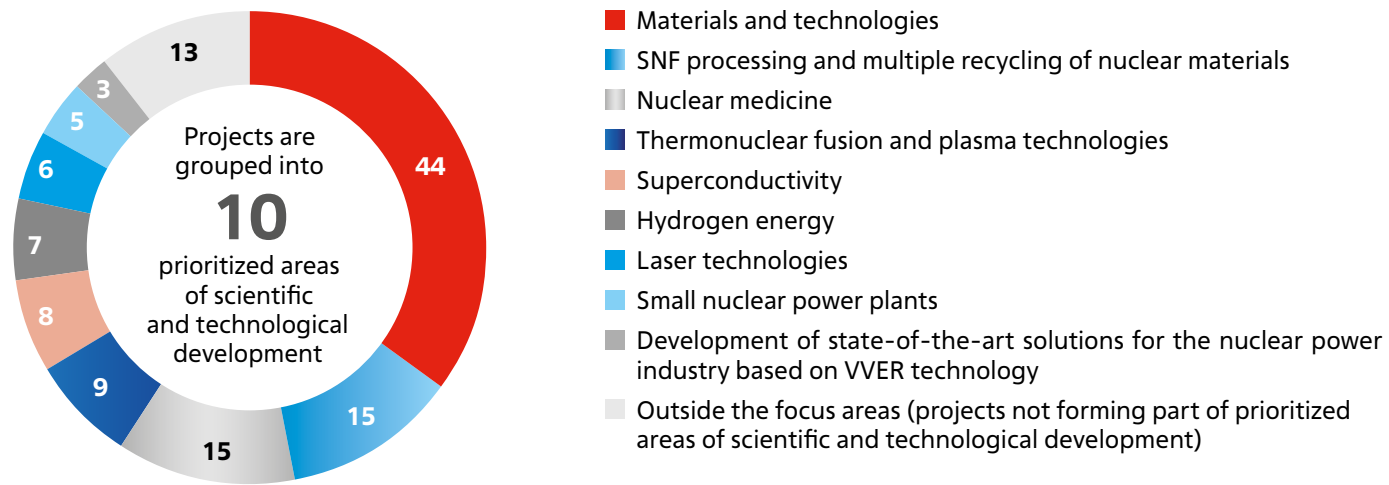
5.1.4. PLAN OF R&D TOPICS OF ROSATOM

In 2019, ROSATOM started to implement the Consolidated Plan of R&D Topics. The Plan is aimed at promoting scientific and technological development in the Corporation across a number of prioritized areas, including VVER technology, small-scale reactors, new materials, hydrogen energy, thermonuclear fusion, superconductivity, nuclear medicine, etc. The R&D plan is prepared according to a number of criteria, such as ensuring that the product/technology being developed by ROSATOM outperforms existing analogues in terms of their main technical characteristics, as well as the export potential and national security. It also takes into account the findings of benchmarking, patent search and technology readiness assessment and commitment to accelerating research and development.

In 2019, ROSATOM established the Council for Investing in Scientific Projects.

In 2019, 125 projects worth a total of more than RUB 5.5 billion were underway. More than two thirds of the projects progressed to the next technology readiness level (TRL).

STRUCTURE OF ROSATOM'S PLAN OF R&D TOPICS (NUMBER OF PROJECTS BY AREA)



5.1.5. COOPERATION ON SCIENTIFIC RESEARCH WITH RESEARCH INSTITUTIONS AND UNIVERSITIES

In 2019, 30 universities, more than 20 organizations of the Russian Academy of Sciences, 50 third-party research organizations and the National Research Centre Kurchatov Institute were involved in R&D.

The volume of orders for R&D performed by universities totalled RUB 1.4 billion (up by 18% year on year). Projects were implemented primarily by core universities, including National Research Nuclear University MEPhI, Nizhny Novgorod State Technical University, Bauman Moscow Technical University, Moscow State National Research University of Civil Engineering, Moscow State University, the Ural Federal University named after the First President of Russia Boris Yeltsin, National University of Science and Technology MISIS, Moscow Power Engineering Institute, Tomsk Polytechnic University and Tomsk State University.

In the reporting year, a joint project to create a high-technology digitized facility for the production of high-precision metal implant systems using additive manufacturing technologies was completed in cooperation with the Ural Federal University named after the first President of Russia Boris Yeltsin.

Innovative solutions developed by ROSATOM are also actively used in other high-technology industries. In 2019, the Astronomical Roentgen Telescope X-Ray Concentrator (ART-XC) developed by researchers from ROSATOM in cooperation with specialists at the Space Research Institute of the Russian Academy of Sciences was launched into space as part of the Spektr-RG space observatory. The objective of the observatory is to survey the universe in the X-ray region of the electromagnetic spectrum. Researchers intend to use the unprecedentedly sensitive instruments of the Spektr-RG observatory to study large galaxy clusters and black holes in greater detail.



In the reporting year, a cooperation agreement was signed with the Russian Academy of Sciences to develop fundamental and applied research. Areas of cooperation include development of laser technologies and charged particle accelerators, design of modern diagnostic equipment, nuclear medicine and external

beam radiotherapy, controlled thermonuclear fusion, nuclear power of the future, new materials, the nuclear fuel cycle and measures to close it, nuclear power safety, and environmental aspects of RAW management.

5.1.6. SCIENCE COMPETITIONS

In 2019, the competition of conceptual designs³³ was held again at ROSATOM. The purpose of conceptual designs is to provide a robust rationale for future R&D, reduce the likelihood of expenditure on costly work with low implementation potential, and reduce the cost and the amount of time required to develop a new product or technology. 271 applications were submitted for the competition by 40 industry organizations and members of the consortium of core universities of ROSATOM. Following an assessment by the Corporation's Science Committee, 114 conceptual designs were approved for implementation.

The 2019 Innovative Leader of the Nuclear Industry competition³⁴ was held. Employees of the Corporation's organizations aged under 35 participating in the development and implementation of innovative projects were invited to participate in this event. Participants of the competition received 20 main prizes and 15 honourable mentions.

5.1.7. KNOWLEDGE MANAGEMENT SYSTEM

In 2019, ROSATOM continued to develop a system for systematizing industry knowledge. More than 7,000 documents were added to the Research and Technical Information Portal, including specially designed bulletins, e-books on industry topics, as well as multimedia modules for the preservation of critical knowledge. The formation of specialized information collections was completed; they enable employees in the industry to use knowledge in a particular area more effectively.

In 2019, a project was launched to develop a Digital Science platform-based solution. It is an integrated publicly available tool for the consolidation of information on scientific and technical developments based on technology readiness levels. The Digital Science solution will provide support for information services designed for managing content, communities and intellectual property.

As part of the project, ROSATOM plans to develop:

- The conceptual design of a set of digital services describing its boundaries and integration protocols;
- An IT infrastructure landscape, including potential technological solutions and requirements for ensuring the reliability, completeness, relevance and differentiation of access to information and services on the platform;
- A road map for the roll-out of the platform-based solution.

In 2020, ROSATOM plans to:

- Incorporate the Research and Technical Information Portal into the Digital Science concept;
- Continue to implement the industry-wide programme to digitize archives containing research and technical information until 2022;
- Develop the knowledge management methodology and continue to develop the relevant corporate culture.

³³ <http://www.innov-rosatom.ru/network/contests/avanproekt/>.

³⁴ <http://www.innov-rosatom.ru/network/contests/atomidler/>.

5.1.8. PERSONNEL MANAGEMENT

One of the top priorities for ROSATOM's research organizations is to attract and retain young talent. By the end of 2019, ROSATOM created a favourable environment for the development of young specialists:

- An expert career path was introduced; a uniform approach to remuneration was adopted with regard to expert and managerial careers; career paths and succession plans for executive positions were developed;
- Development programmes were introduced for employees at all levels: research schools for novice researchers and a scientific talent pool, where employees gain knowledge about the research strategy and government relations, for more experienced employees;
- The Business Workshop Programme was implemented for researchers who are willing to initiate projects and put their ideas into practice;
- Support was provided for the participation of young people in the competition of conceptual designs; in the reporting year, a separate youth competition of projects was launched;
- Steps were taken to increase the level of involvement of young people in the industry-wide scientific events and programmes, including conferences and workshops.

In 2019, JSC Science and Innovations, an organization of ROSATOM, was ranked first in the Project Olympus national competition in the sphere of professional project management in the main category, Project Management Systems in State-Owned Corporations, Companies Partially Owned by the Government, Commercial and Non-Governmental Organizations and Development Institutions.

In 2020, ROSATOM plans to launch a new long-term internship programme for students, which will enable them to participate in real-life R&D projects while they are still studying.

See also the section 'Implementation of the HR Policy'.

5.1.9. INTELLECTUAL PROPERTY MANAGEMENT

In 2019, protection of the industry's key products and technologies abroad remained the main priority of the intellectual property management system. The number of international applications filed and foreign patents received in 2019 totalled 439 (against a target of 361). As at December 31, 2019, the

number of patents obtained for inventions, utility models and industrial designs, certificates for computer software and databases, and registered items of know-how totalled 10,411.

Indicator	2017	2018	2019
PATENT ACTIVITY			
Number of patents obtained for inventions, utility models and industrial designs, certificates for computer software and databases, number of registered items of know-how, pcs.	1,286	535	735

Number of applications filed for inventions, utility models and industrial designs, certificates for computer software and databases in the Russian Federation, pcs.	1,073	315	371
Number of foreign patents obtained by ROSATOM, applications for foreign patents submitted and registered under the established procedure, registered trade secrets (know-how), pcs.	443	417	439

In 2019, a methodology was developed for forming intellectual property portfolios linked to products and technologies.

More than 12,400 items of intellectual property owned by the Corporation and its organizations were entered into the information system for managing intellectual property rights.

In 2020, ROSATOM plans to:

- Submit 600 foreign patent applications and obtain foreign patents;
- Establish a Technology Readiness Assessment (TRA) system for forming intellectual property portfolios across various products and technologies as part of its R&D efforts;
- Centralize the management of the industry network of patent experts to ensure optimal allocation of resources and increase the level of competence of patent offices in the industry.

5.1.10. LONG-TERM PRIORITIES IN THE SPHERE OF SCIENTIFIC DEVELOPMENT

- Development of two-component nuclear power technologies with a closed nuclear fuel cycle;
- Development of controlled thermonuclear fusion technologies and innovative plasma technologies;
- Development of experimental test benches and infrastructure for the Russian thermonuclear facility;
- Development of new materials and technologies for advanced energy systems;
- Design of reference power units of NPPs, including small NPPs;
- Establishment of an international consortium of users of the MBIR reactor.

5.2. BUSINESS DIVERSIFICATION

Key results in 2019

- ROSATOM's revenue from new products totalled RUB 227.9 billion, making up 19.8% of the total revenue.
- The Corporation's 10-year portfolio of orders for new products reached RUB 1,169.1 billion.

One of ROSATOM's strategic goals is to develop new products. They provide new opportunities for developing healthcare and municipal infrastructure, improving environmental safety and making progress in other key areas relevant to sustainable development. In accordance with the Corporation's business strategy, it is intended that new products will make up 40% of the total revenue by 2030.

New businesses (those that cater primarily to markets outside the scope of the industry) are developed first and foremost in those segments where ROSATOM has capabilities and technological know-how. This approach helps it to mitigate market and technological risks. 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 the Corporation's enterprises.

The Corporation has developed an effective system for managing new businesses; it includes integrators and enterprises in the relevant business areas. The responsibility for business

Technologies and capabilities originally developed for the nuclear industry soon started to be applied in other related areas. Isotope production for medical applications started as early as in the 1940s. Initially, isotopes were produced in the first nuclear reactor of the Mayak plant, reactor A-1. Subsequently, the USSR became a leader in nuclear medicine.

development at all levels is reflected in overarching key performance indicators:

- Short-term indicators, such as revenue from new products during the year;
- Long-term indicators, such as the 10-year portfolio of orders for new products.

As at December 31, 2019, the Corporation's portfolio of new products covered 81 areas, including seven strategic programmes: Wind Power, Composite Materials, Nuclear Medicine, Waste Management, Oil and Gas Services, Digital ROSATOM and the Smart City³⁵.

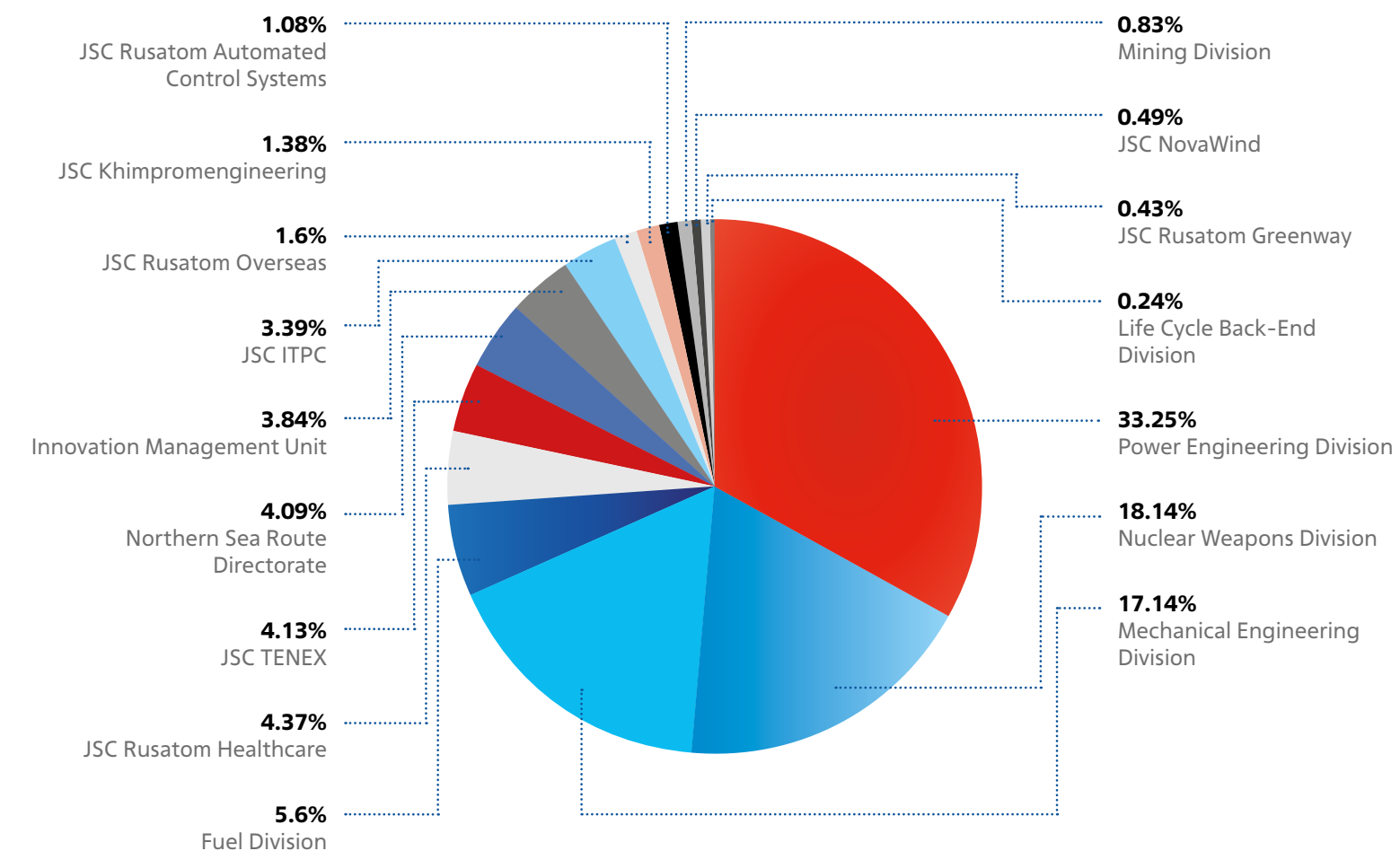
RUB 1,169.1 billion, which is 8% above the target (RUB 1,082.5 billion) and 8% more than in 2018.

5.2.1. RESULTS IN 2019

In the reporting year, revenue from new products totalled RUB 227.9 billion, which is 1.7% above the target (RUB 224 billion) and 15.9% more than in 2018. The 10-year order portfolio reached

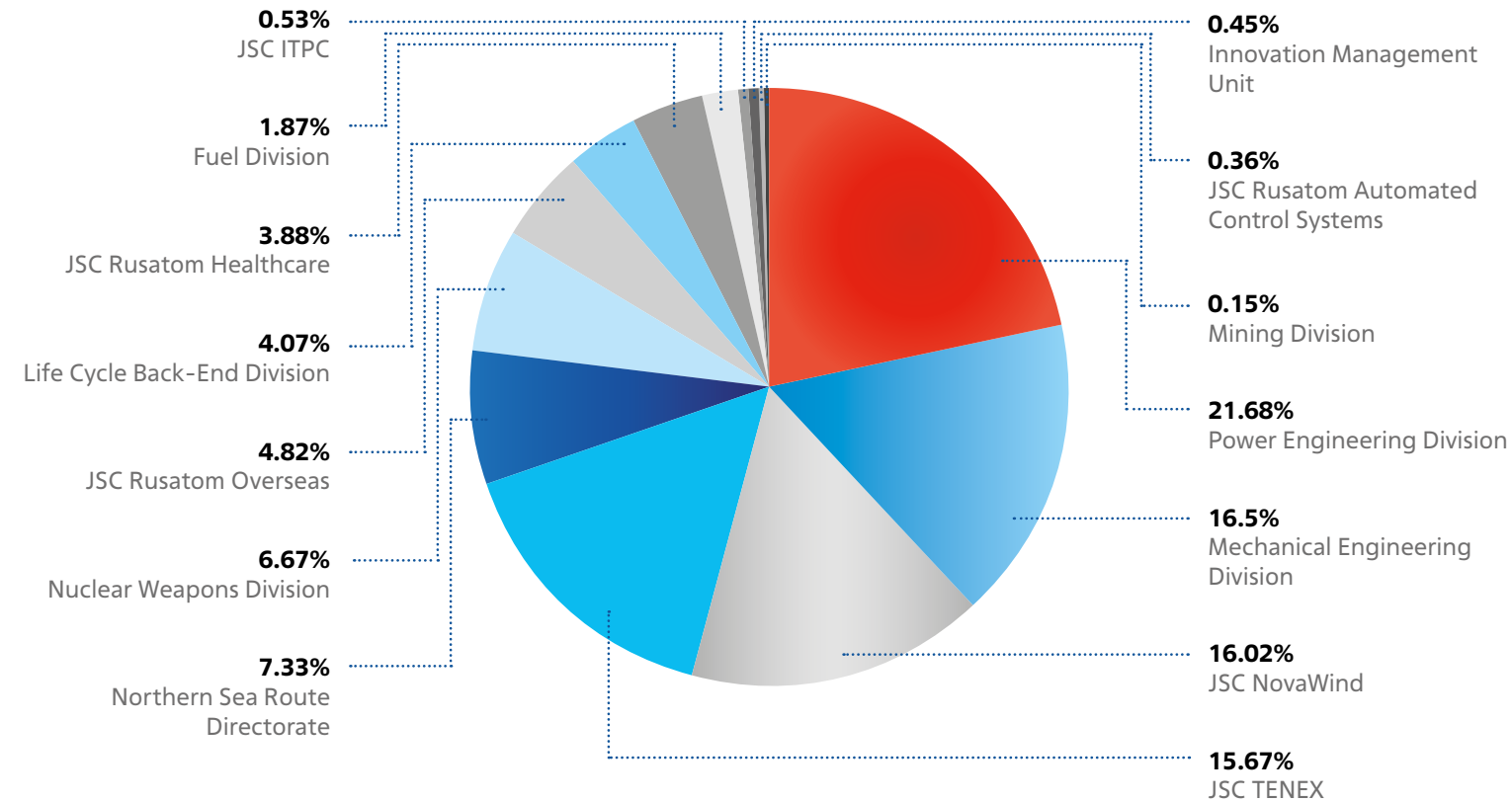
Indicator	2017	2018	2019
REVENUE FROM NEW PRODUCTS AND 10-YEAR PORTFOLIO OF ORDERS FOR NEW PRODUCTS, RUB BILLION			
Revenue from new products	170.9	196.7	227.9
10-year portfolio of orders for new products	814.1	1,082.6	1,169.1

STRUCTURE OF REVENUE FROM NEW PRODUCTS IN 2019



³⁵ See also the section 'Developing the Regions of Operation'.

STRUCTURE OF THE PORTFOLIO OF ORDERS FOR NEW PRODUCTS IN 2019



WIND POWER

ROSATOM is actively developing the Russian wind power market. In March 2020, the Adygea Wind Power Plant (WPP) started to supply electricity to the Russian wholesale market. This is the Corporation's first wind farm, which comprises 60 wind turbines with a total installed capacity of 150 MW.

NUCLEAR MEDICINE

In the reporting year, the Corporation signed a memorandum of cooperation with the Federal State Budgetary Institution National Medical Research Radiological Centre of the Ministry of Health of Russia. The memorandum sets out plans for expanding

ROSATOM is implementing a WPP construction programme on four more sites in the Stavropol Territory and the Rostov Region. The next major wind farm will be built in the Kochubeyevsky District of the Stavropol Territory. Its installed capacity will total 210 MW.

cooperation on clinical trials of radioisotope products and medical equipment developed and produced for nuclear medicine and medical radiology.

In 2019, bench tests of a KLT-6 linear particle accelerator and an upgraded AGAT-VT brachytherapy facility were completed. Upgraded facilities for the production of molybdenum-99, lutetium-177 and iridium-192 for use in nuclear medicine started commercial operation.

NEW MATERIALS

In 2019, the Corporation signed an agreement with the Government of the Russian Federation titled 'Technology for New Materials and Substances'. A draft road map was prepared for developing innovative areas, such as additive manufacturing, polymer composite materials, rare and rare-earth metals, new structural and functional materials, and for stimulating domestic demand.

In 2019, ROSATOM played an active role in establishing the Composites Without Borders Inter-Regional Industry Cluster, which includes the Republic of Tatarstan and the Saratov and Moscow Regions. It is intended that the Tula and Ulyanovsk Regions will be included in the Cluster in 2020. The Cluster will facilitate cooperation between the regions in order to launch full-cycle

MANAGEMENT OF HAZARD CLASS 1 AND 2 WASTE

In 2019, a federal law came into force whereby ROSATOM was authorized to create a comprehensive system for the management of hazard class 1 and 2 waste in Russia. Pursuant to a decree of the Government of the Russian Federation, FSUE Federal Environmental Operator (formerly FSUE RosRAO), an enterprise of ROSATOM, was appointed as federal operator responsible for the management of hazard class 1 and 2 waste.

In the reporting year, key targets were set for ROSATOM's Strategic Programme titled 'Industrial and Consumer Waste Management'. FSUE Federal Environmental Operator and another organization of ROSATOM, JSC Rusatom Greenway, became its main participants. FSUE Federal Environmental Operator will focus on the management of hazard class 1 and 2 waste and environmental remediation. JSC Rusatom Greenway is responsible for developing the commercial part of the Strategic Programme.

The first batch of xenon-133 designed for the production of a radiopharmaceutical was manufactured.

production of composite materials in Russia, including the production of carbon fibre, glass fibre, basalt fibre, fabrics and pre-pregs based on them, and finished composite products for end users, and to create the relevant process chain.

The Corporation signed an agreement with PJSC RusHydro on cooperation in the field of composite materials. The cooperation includes such areas as composite solutions for main and auxiliary equipment and structural components of small-scale hydropower plants, wind power plants and external reinforcement systems.

In 2019, all targets set under the Infrastructure for the Management of Hazard Class 1 and 2 Waste Federal Project were achieved.

The development of a national information system for the management of hazard class 1 and 2 waste was initiated. The system will make it possible to accumulate all information about the waste management system, monitor waste flows from waste generation sources to waste processing sites, keep records, detect violations, optimize logistics and select the best infrastructure location.

Targets for environmental remediation as part of municipal land-fill reclamation in Chelyabinsk were exceeded.

INDUSTRIAL EQUIPMENT

In 2019, ROSATOM won a tender announced by the Ministry of Industry and Trade of Russia for the construction of a test bench for the testing of equipment for large-scale liquefied natural gas (LNG) plants.

The Corporation signed an agreement with PJSC ROSSETI on cooperation in energy markets, digitization of the electricity in-

dustry and producing substitutes for imported electrical equipment. The cooperation will involve joint design and construction of power grid infrastructure in order to integrate Russian-design power generation facilities into foreign power grids using digital solutions and Russian electrical equipment.

HYDROGEN ENERGY

In 2019, a memorandum of cooperation was signed with the Ministry of Economy, Trade and Industry of Japan; under the memorandum, a feasibility study will be conducted for developing a supply chain for hydrogen produced by the Corporation's organizations.

An agreement was concluded with the Government of the Sakhalin Region, JSC Russian Railways and JSC Transmashholding on building and developing a passenger rail system on Sakhalin Island which will use trains powered with hydrogen fuel cells, as well as the relevant support systems.

5.2.2. PLANS FOR 2020

In 2020, the Corporation plans to approve programmes for additive manufacturing and the development of the lithium business. In the future, international logistics and hydrogen energy may also be given the status of strategically important business areas. In addition, in 2020, the Corporation plans to approve a product strategy in the sphere of nuclear instrumentation engineering.

Competence Centre as part of implementation of the road map for developing a high-technology area, Technology for New Materials and Substances, in Russia.

In 2020, construction and installation work will start at the site of the Nuclear Medicine Centre in Irkutsk.

As part of its environmental initiatives in the sphere of class 1 and 2 industrial waste management, ROSATOM intends to build an ash and slag processing facility.

As part of its composite materials business, in 2020, the Corporation plans to commission a PAN precursor plant. The Corporation will initiate the establishment of the Polymer Composite Materials



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6 DIGITAL TRANSFORMATION



Key results in 2019

- Digital products: a trading firm, Rusatom Digital Solutions, was established; industry revenue from the sales of ROSATOM's digital products was consolidated. A number of products were unveiled: Logos Thermo, a system for mathematical modelling of heat and mass transfer; the Kalininsky Data Centre; Volna, a solution supporting decision-making on the management of gas pipeline systems; and the Technical Documentation E-Shop. Enterprises in the industry started to adopt the Logos product; migration of ROSATOM's information systems to the core data centre, Kalininsky, was initiated.
- Digital economy of Russia: as a competence centre, ROSATOM initiated the preparation and approval of seven road maps for developing end-to-end digital technologies as part of the Digital Economy National Programme. A large-scale project to create a Russian-designed quantum computer was launched, with ROSATOM as the responsible contractor.
- Internal digitization: a design concept of architecture of an integrated digital platform for the nuclear industry was developed. A digital import substitution programme was launched, and four key areas of its implementation were singled out.
- Digital technologies: enterprises in the industry were audited in order to identify their needs for end-to-end digital technologies. The Digital Seasons Production Technology Club was started.
- The organizational structure for digital transformation management in ROSATOM was established. Executives responsible for digital transformation were appointed in the Divisions, functions and enterprises directly subordinate to ROSATOM.



EKATERINA SOLNTSEVA
Chief Digital Officer



– 2019 saw the launch of a large-scale project to create a Russian-designed quantum computer. Could you give more detail about the goals, objectives and expected outcomes of this project?

Our main objective is to create a 100-qubit quantum computer by 2024 in order to close the gap between Russia and front runners in the 'quantum race'. At the moment, our country is lagging behind by 7 to 10 years: in Russia, two-qubit processors have been produced so far, whereas US researchers have already developed a 53-qubit processor.

Quantum computers are more than just new-generation computers. They are a major global breakthrough in the sphere of digitization that is expected to be achieved in the coming decade. This is a new class of computers that are fundamentally more powerful; they will enable countries to become more competitive and improve national security, and will bring about a transformation of the economic structure.

A quantum computer will be many times faster than existing supercomputers. The use of quantum computers will make it possible to design new materials for the aerospace industry and new pharmaceuticals. They will help to take the capabilities of AI-based systems to a whole new level.

In 2019, we prepared a road map for developing a new high-technology area, namely quantum computing. This road map successfully underwent stress tests conducted by the expert community and the federal executive government. It is focused on both addressing research and engineering tasks and creating a favourable environment conducive to the development of this promising area.

Measures outlined in the road map are aimed primarily at developing competitive quantum computing technologies. Our efforts will be focused on four main types of quantum processing platforms that are currently considered to be the most promising globally (superconducting, ion-based, based on neutral atoms and photon-based). At the moment, no-one in the entire world can yet predict which of these technologies will eventually become mainstream. Moreover, it is possible that different versions of quantum computers will be best suited to different tasks. This is why we will also launch a number of projects on new platforms that are currently at an early stage of development, such as magnon- and polariton-based ones.

Similarly to conventional computers, in order to build a functioning quantum computing system, it is necessary to develop a full stack of solutions, from physical qubits, control systems and the operating system to logic programming languages, applications and a cloud-based platform. Accordingly, objectives set out in the road map include developing both hardware and software.

The road map also includes creating a science and technology ecosystem for developing quantum computing; it will cover a number of areas, such as infrastructure, opportunities for talent development, educational programmes, support for start-ups, and cooperation with financial, industry and technology partners. The National Quantum Laboratory is a major element of this ecosystem; it will serve as a platform for cooperation between key participants of initiatives to develop quantum computing.

– What results achieved in 2019 as part of ROSATOM's Uniform Digital Strategy do you consider to be the most important?

In the sphere of internal digitization, one of the key achievements in 2019 was the fact that we successfully set up a systemic digital import substitution process. A Centre for Re-

search, Testing and Evaluation of Solutions Independent from Imported Technology (CRTESIIT) was established and is now in operation; key performance indicators in the sphere of import substitution were developed and approved for organizations in the industry. This enabled us to start working towards a steady reduction of the industry's dependence on foreign technology. In 2019, we launched our first major projects aimed at producing substitutes for imported products across several main classes of IT solutions.

Speaking of developing and promoting ROSATOM's digital products, it should be pointed out that we put several new solutions on the market. Enterprises in the industry started to adopt modules forming part of the Logos software suite for engineering calculations (Logos Aero-Hydro and Logos Thermo) on a large scale. We expect that over the next few years it will replace foreign analogues.

Other prioritized digital products unveiled in 2019 include the Kalininsky Data Centre. This is a core data centre to which most of ROSATOM's IT systems have already been migrated.

In 2019, several of our digital products were officially launched on new commercial markets. ROSATOM's customers include major industrial, energy, and oil and gas companies, which are leaders in strategically important sectors of the Russian economy. Consolidated revenue from the sales of digital products and services is now a key performance indicator for the entire Digitization Unit of ROSATOM.

At year-end 2019, ROSATOM's potential digital product portfolio comprised 150 promising solutions developed by 33 enterprises in the industry, 20 of which were at the stage of active development and launch on the market.

In 2019, we created the organizational structure for digitization management. ROSATOM's Digital Transformation Department, which is responsible for the uniform digital strategy, Rusatom Digital Solutions, a trading firm, and Private Institution Cifrum, a digital technology laboratory, were established within the Digitization Unit and started to operate as planned. Persons responsible for digital transformation were appointed in the Divisions, functions and enterprises directly subordinate to ROSATOM.

In 2019, ROSATOM as one of the key participants of the digitization process in the Russian Federation initiated the development of seven road maps under the Digital Technology Federal Project, which forms part of the Digital Economy National Programme. We achieved all the targets that had been set for us.

We received recognition for our contribution to the digitization of the Russian economy at the Global Technology Leadership Forum. As part of this event, awards were given:

- To ROSATOM as a whole for initiating the preparation of road maps for developing end-to-end digital technologies;
- To JSC Rosenergoatom for implementing the Kalininsky Data Centre project, which leverages the company's key capabilities in designing and building failure-free operation systems;
- To NIKIRET (an organization managed by ROSATOM) for developing the Pilot Access Control System designed for use at public events, which proved a great success during the 2014 Winter Olympics and the 2018 FIFA World Cup. The system continues to be used at stadiums across the country to ensure the safety of spectators and sports fans.

In the reporting year, we also implemented a wide range of important projects that involve developing end-to-end digital technologies (EDTs). We conducted a large-scale technology audit, which enabled us to identify and systematize the needs of enterprises in the industry for such solutions. ROSATOM started the Digital Seasons Production Technology Club, whose main task is to roll out best practices in the sphere of practical integration of EDTs into production processes. We held two conferences on new production technologies and industrial applications of artificial intelligence. The pool of data management tasks was singled out as a separate group of projects.

We made significant progress in 2019. But we realize that this is just the beginning. Digital transformation is only just starting to gain momentum globally, and we have a lot of challenging but exciting and important tasks ahead of us.

Digitization of the economy and everyday life is a key modern trend. ROSATOM leverages its extensive experience in respond-

ing to major technological challenges to develop efficient innovative solutions for operating in the digital world of the future.

6.1. UNIFORM DIGITAL STRATEGY

Since 2018, ROSATOM has been implementing a Uniform Digital Strategy (UDS), which is focused on supporting the digitization of the Russian economy, developing the Corporation's own digital products and putting them on the market, and internal digitization. In 2019, ROSATOM prioritized yet another cross-cutting area: digital and technological research and development. In addition, the UDS was updated taking into account the results achieved by ROSATOM and changes in the market.

As part of the strategy update, ROSATOM placed greater emphasis on end-to-end technologies, expanded its approach to mergers and acquisitions (M&A), developed uniform principles and identified key priorities of digitization programmes in its Divisions, and built an integrated system and organizational structure for digitization management. The Steering Boards (SBs) of the Digital ROSATOM Programme and the SBs in the Divisions play a key role in the organizational structure.

The Uniform Digital Strategy relies on the following major pillars:

- Strategic partnerships and M&A;
- Organizational change;
- Digital competences and culture.

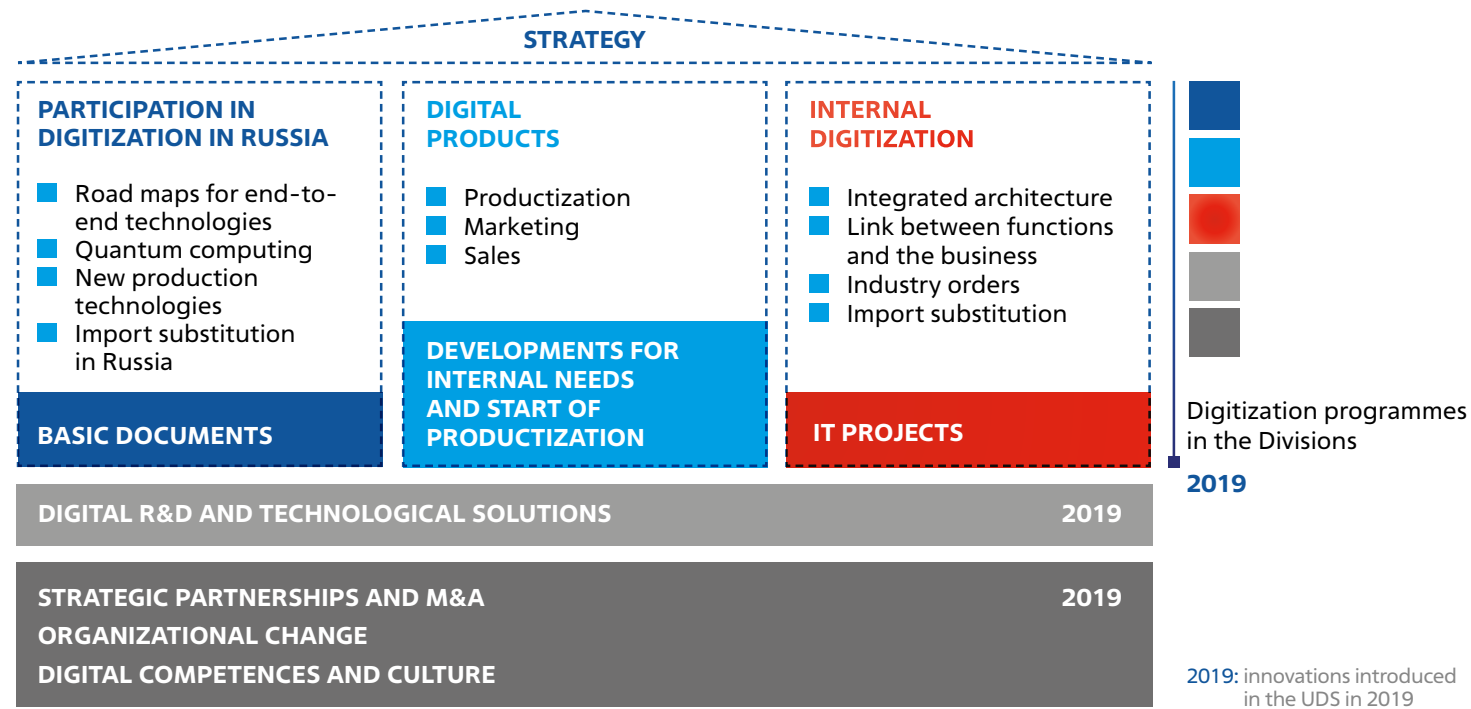
The key driver of effective implementation of the UDS is its close integration with digitization programmes that are being implemented in ROSATOM's Divisions and enterprises in the industry.

In addition, 2019 saw the development of uniform methodological guidelines for assessing economic benefits from digitization projects. Projected total benefits from projects initiated in 2019 exceed RUB 10 billion.

In order to implement the UDS, the Digitization Unit has been formed within the Corporation; it includes the following divisions and companies:

- The Digital Transformation Department (established in 2019);
- The Information Technology Department;
- The IT Department of JSC Greenatom (including the CRTESIIT);
- The Digital Economy of Russia Project Office;
- LLC JV Kvant, an operator under the road map for the development of a quantum computer (established in 2019);
- Private Institution Cifrum, ROSATOM's digital technology laboratory (established in 2019);
- LLC Rusatom Digital Solutions, a trading firm selling digital products and solutions (established in 2019);
- The Process Architecture Centre at JSC RPS.

CONCEPT OF THE UNIFORM DIGITAL STRATEGY



6.2. PARTICIPATION IN DIGITIZATION IN RUSSIA

ROSATOM is a competence centre under the Digital Technology Federal Project, which forms part of the Digital Economy National Programme. In the reporting year, all targets set under the project were achieved. ROSATOM initiated the preparation of seven road maps for developing end-to-end digital technologies in Russia.

Based on the developed road maps, government support was provided for 105 projects of various Russian companies worth a total of RUB 14 billion, including RUB 941 million allocated for seven projects directly involving ROSATOM.

In order to prepare road maps for developing end-to-end digital technologies in Russia, ROSATOM has formed a unique expert community. In December 2019, the Corporation received an award for these efforts in the Contribution to Technological Development category at the Global Technology Leadership Forum.

In 2019, an agreement was signed with the Russian Government on developing a high-technology area: quantum computing. Under the agreement, a large-scale project was launched to develop a Russian-designed quantum computer. The use of quantum computers will enable a major breakthrough in solving a wide range of problems, such as modelling the behaviour of molecules to develop new drugs and tailored materials, complex logistical problems, big data management, ensuring information security, etc.

ROSATOM's road map for quantum computing successfully underwent stress tests conducted by the expert community and the federal executive government.

A project code-named Liman was successfully completed in 2019 under the supervision of FSUE Dukhov Automatics Research Institute (VNIIA). The project involved developing technology for creating superconducting two-qubit systems (a prototype quantum computer) and demonstrating single-qubit and two-qubit operations.

ROSATOM is not the only participant of the project to design a quantum computer, which is scheduled to be completed in 2024. The Corporation coordinates the efforts of key teams and organizations performing R&D in the sphere of quantum computing, as well as potential users of quantum technologies. ROSATOM is developing quantum computing for the benefit of the nuclear industry, the Corporation's new businesses and the Russian economy as a whole. ROSATOM is the organizer of the National Quantum Laboratory. It is an integrated ecosystem comprising a variety of R&D centres, research institutes, technology start-ups and university laboratories in order to efficiently coordinate joint initiatives on quantum computing.

One of the strategic objectives of digitization in Russia is to create a Russian-designed quantum computer, as this will help to close the gap separating the country from global technological leaders. Quantum computers are new-generation computers that are thousands of times more powerful than existing ones. Potentially, they will be able to perform those tasks that are currently impossible, including in the sphere of cybersecurity, artificial intelligence and the modelling of new materials.

In 2019, ROSATOM signed a memorandum of cooperation in the sphere of digital healthcare with PJSC Sberbank of Russia and the Federal Biomedical Agency. The cooperation involves developing a digital ecosystem in the healthcare sector. The ecosystem incorporating global best practice will enable effective operation of secure, government-controlled digital services for patients, healthcare regulators and healthcare institutions. Its key areas include decision-making support services (managerial, clinical, expert and those based on big data analytics and machine learning), including centralized diagnostic services; remote consultation, rehabilitation and health monitoring services; the Smart Clinic, which is a set of information systems and services using a combination of medical devices, information technologies and technical capabilities of the Internet of Things.

6.3. DIGITAL PRODUCTS

REGISTER OF DIGITAL PRODUCTS



✓ Unveiled on the market

⌘ At the preparation stage, to be unveiled in 2020/2021

In 2019, the development of ROSATOM's digital product portfolio was focused on six prioritized areas:

- Science-based modelling and R&D;
- Enterprise and production management;
- Digital infrastructure;
- Design and construction/digital twins;
- Information security and digital physical security;
- Digitization of municipal services and processes.

Flagships have already been developed in each of these areas. They were created by various Divisions and enterprises of the Corporation, and the first customers for these products include

SCIENCE-BASED MODELLING AND R&D

Logos

Logos is a software package designed following several years of development efforts initiated in 2009 by FSUE RFNC VNIIEF.

The Logos product family comprises three modules:

- Logos Aero-Hydro (launched on the market in 2018 and designed for the modelling of aero- and hydrodynamic processes);
- Logos Thermo, which was launched in 2019; it is designed for assessing thermal performance and behaviour of components and assemblies;
- Logos Strength (scheduled to be launched on the market in 2020). It is designed primarily for solving static and dynamic strength problems.

Volna

Volna ('Wave') is a programming and computing system for the management of gas pipeline systems

major industrial, energy, and oil and gas companies, which are leaders in strategically important sectors of the Russian economy. At year-end 2019, the Corporation's digital product portfolio included about 150 products.

In 2018 and 2019, the Corporation officially launched its digital products on new commercial markets across all segments of its portfolio. Going forward, the key priority for the Corporation is to pool the industry expertise and to progress from local IT systems to developing integrated digital solutions not only for the nuclear industry but also for other segments of the Russian economy.

A well-functioning user training and support system is an important prerequisite for launching digital products on the market. In 2019, a training centre was opened at JSC NIKIET (an organization of ROSATOM). The centre will provide training in the use of all modules of the Logos software suite for numerical simulation specialists from the nuclear and other industries. In the future, the range of training programmes run by the centre and covering various digital products and competences will be expanded.

In addition, in 2019, ROSATOM cooperated with Russian technical universities to establish competence centres in the field of mathematical modelling that will train students and conduct scientific research.

ENTERPRISE AND PRODUCTION MANAGEMENT

Digital Enterprise FLCS

The Digital Enterprise full life cycle system (FLCS) is a management system designed for enterprises combining different types of production operations. It has a modular design (its key elements are Enterprise Management, Production Management and Personnel Management). This approach makes it possible to implement the system on a piecemeal basis and enables customers to further develop it independently, as the product is made available to them in source code form.

Prizma 2.0

Prizma ('Prism') 2.0 is a Russian-designed automated system for discrete production management. It has been designed specifically for ROSATOM's instrumentation engineering enterprises and similar enterprises in other industries. The key advantages

of this system include compliance with information security requirements, independence from foreign vendors, and a high level of availability for fast deployment.

Technical Documentation E-Shop

The Technical Documentation E-Shop created by JSC Rosenergoatom is a state-of-the-art online service that can be used to search for, order and receive regulatory, research and design documents governing all stages of the life cycle of NPPs equipped with VVER reactors. At year-end 2019, the Shop contained more than 1,100 technical documents (more than 75,000 pages) with abstracts. Foreign users can purchase materials in English.

DIGITAL INFRASTRUCTURE

Data centres

The construction of data centres is one of the Corporation's priorities in the development of digital products. The data centres are operated by JSC Rosenergoatom. Core data centres located in the vicinity of NPPs are a major area. Data centres located at NPP sites have important competitive advantages, such as stable power supply and compliance with strict safety and security requirements. In 2019, the Kalininsky Data Centre in Udomlya (Tver Region) started commercial operation; it is the first project of this kind. This is one of Russia's largest data centres, with a rated capacity of 48 MW. ROSATOM's data centres are ready to provide services to third-party customers on a commercial basis: for instance, the administration of the Tver Region has become the first customer of the Kalininsky Data Centre. *See also the section 'Power Engineering Division'.*

In the data centre segment, FSUE RFNC VNIITF develops, produces and puts into operation low-load (up to 10 kWh per rack) and high-load (more than 10 kWh per rack) data centres. In terms of design, data centres built by FSUE RFNC VNIITF comprise capital structures and easy-to-build modular elements that are then combined into a single structure. This design concept serves as a basis for both low-load and high-load modular, mobile and containerized data centres tailored to the needs of individual customers.

DESIGN AND CONSTRUCTION

Multi-D digital platform

Multi-D is an integrated technological solution for managing the life cycle of complex engineering facilities; it enables the monitoring of key aspects, such as the duration of construction, the cost of implementation and the required quality standards.

In 2019, ROSATOM worked to optimize processes and solutions used in this product with a focus on platform-based design. The Corporation continued to develop both the solution as a whole and the stack of prioritized modules (the underlying platform, a single information space for the participants of the project, a consolidated schedule, construction management, electronic document management and resource planning, an enterprise service bus), some of which are already being implemented as alienable solutions. For instance, in 2019, the Multi-D Docs and Resources module (a document management solution for overseas sites) was put into operation as part of the projects to build El Dabaa NPP (Egypt) and Paks II NPP (Hungary).

Its modular design enables phased implementation of individual elements of the platform at different stages of the NPP construction cycle and makes it possible to combine the modules in a way that is tailored to a specific project. This approach is necessitated by rapid development of digital technologies globally; it helps to meet the following key requirements:

- Compliance with the requirements for digital products set out in EPC contracts;
- Independence from vendors and imported solutions; adaptability to individual needs of business customers;
- Improved accuracy of monitoring, forecasting and modelling of key milestones of the projects that are being implemented;
- Managerial decision-making based on accurate data.

INFORMATION SECURITY AND DIGITAL PHYSICAL SECURITY

Pilot Access Control System

The Pilot Access Control System is designed to check passes in real time using bar codes or RFID technology as visitors are entering secure facilities or public event venues. The Pilot Access Control System is a distributed information system covering buildings and structures (such as stadiums) in different cities.

The system was successfully used during the 2014 Winter Olympics in Sochi and the 2017 FIFA Confederations Cup. The Pilot Access Control System was also in full use during the 2018 FIFA

World Cup and the 2019 Winter World University Games in Krasnoyarsk; by the end of the reporting year, it had been installed at stadiums across Russia.

In December 2019, the Pilot Access Control System won an award in the Contribution to Technological Development category at the Global Technology Leadership Forum.

6.4. INTERNAL DIGITIZATION

An important milestone in 2019 was the development of a concept of integrated IT architecture in the nuclear industry.

A number of projects entered the commercial operation stage; these include the Project Review automated information system, an Electronic Document Management System for ROSATOM's overseas branches, representative offices and subsidiaries, ROSATOM's Unified Industry-Wide Quality Management System, etc.

At year-end 2019, more than 40 projects based on end-to-end Industry 4.0 technologies were at the pilot operation stage in various organizations of the Corporation (including developing a secure corporate email system, online accounts for employees, and the monitoring of financial period closure).

Import substitution in the sphere of IT is one of the key priorities of ROSATOM's internal digitization initiatives. The CRTESIIT was established and is now in operation. Key import substitution targets for 2022 were approved for Russian nuclear organizations. All projects forming part of ROSATOM's Uniform Digital Strategy potentially involve prioritizing the use of Russian-designed solutions. Projects were initiated to replace imported solutions for core systems in a number of areas, such as standardized workstations for the industry, enterprise resource planning (ERP) systems, the integrated industry-wide document management system (IIDMS), and standardized infrastructure for the industry.

ROSATOM headed a subgroup on the development of the Russian software market, which forms part of a working group on import substitution under the Committee on Digital Economy of the Russian Union of Industrialists and Entrepreneurs. ROSATOM started to cooperate closely with the ICT Competence Centre and the relevant Russian ministries and government agencies in order to share experience and effectively implement the Corporation's import substitution programme.

To support NPP construction, automated handover of equipment specifications from the design and procurement functions was introduced. A digital dashboard for the site manager was piloted at Rooppur NPP (Bangladesh). The configuration of design systems was approved for the NPP in Uzbekistan.

In ROSATOM's overseas branches, an open-access document management system was introduced, and a two-way connection to the IIDMS was provided.

More than 9,000 cyberattacks were prevented during the year. In addition, ROSATOM piloted a system for raising users' awareness of information security matters.

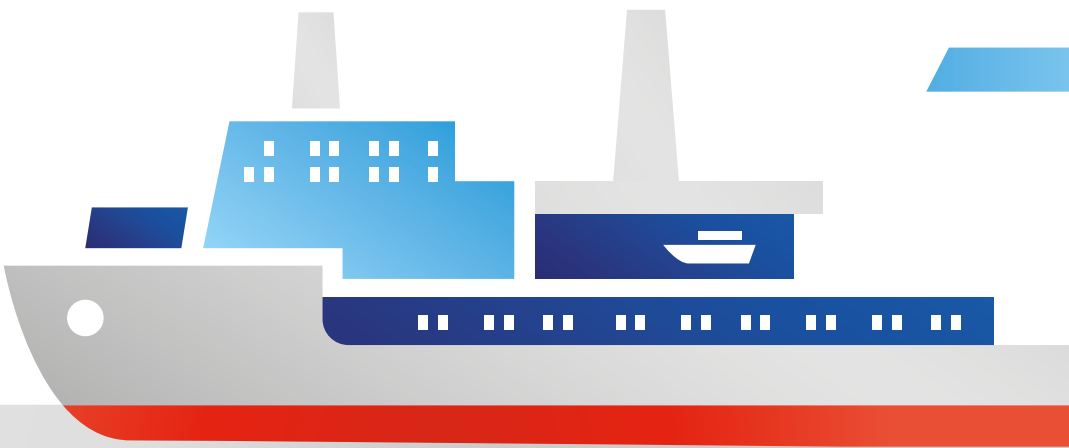
6.5. TECHNOLOGICAL DEVELOPMENT

Surveys were conducted in 27 enterprises in the industry to collect information on demand for solutions based on EDTs and prioritize the relevant needs. For instance, new production technologies account for 25% of the total volume of orders for EDTs in the industry; neurotechnology and artificial intelligence account for 22%, while the share of virtual and augmented reality technologies totals 15%. These areas have been deemed to be most in demand.

By year-end, some projects had entered the pilot operation stage or were being prepared for roll-out in ROSATOM's enterprises (including the Smart Mine solution, video analytics solutions for the monitoring of the use of personal protective equipment, and the use of artificial intelligence and robots in procurement).

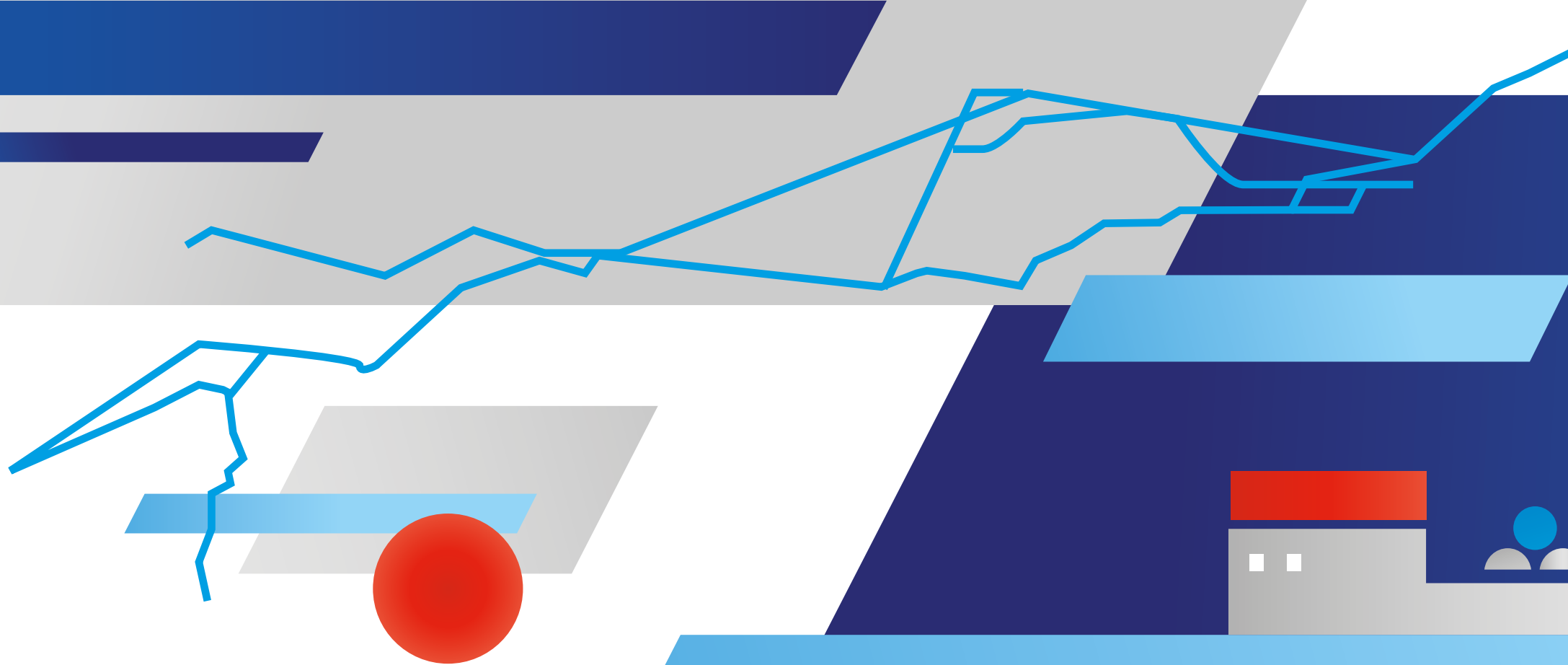
In addition, in 2019, design concepts were developed for another 17 projects based on the use of EDTs and scheduled for implementation in 2020; these projects cover a wide range of the Corporation's activities, from research to NPP operation. These include:

- Monitoring and forecasting the likelihood of failure of different types of industrial equipment (such as turbine generators) in enterprises;
- The use of predictive analytics in the operation of turbine generator sets;
- The use of video analytics to assess occupational safety and health performance and product quality;
- Making production sites more stable, improving product quality and reducing the share of manual work by implementing projects based on end-to-end technologies to enable a gradual transition to 'unmanned' production.

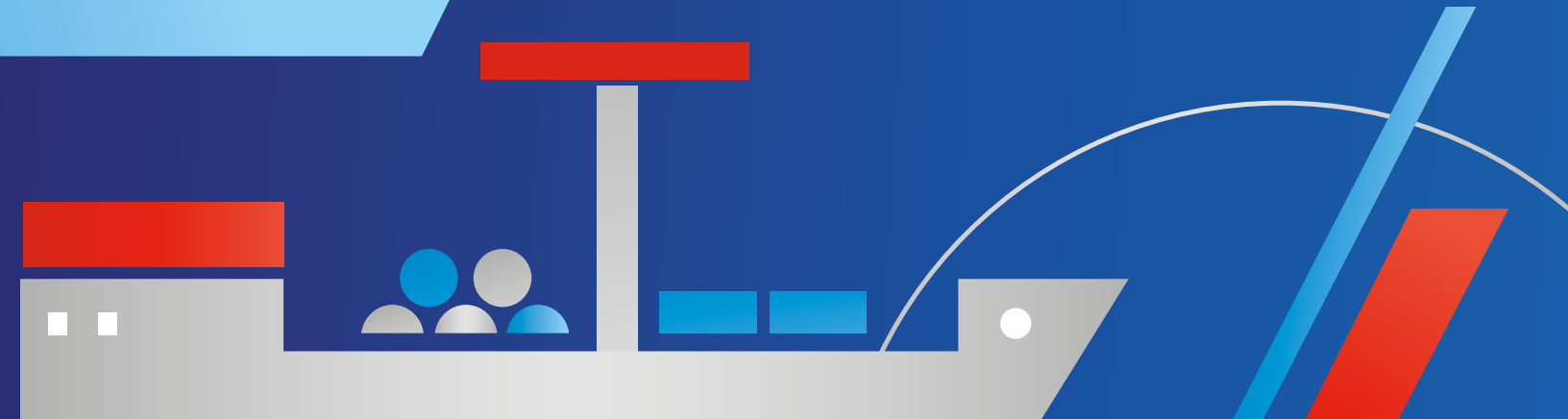


7

DEVELOPMENT OF THE NORTHERN SEA ROUTE

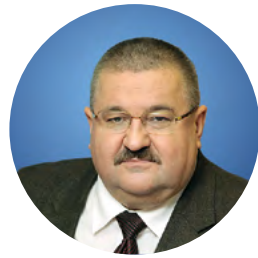


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Key results in 2019

- The targets set for the Northern Sea Route Federal Project were met. Cargo traffic totalled 31.5 million tonnes (against a target of 26 million tonnes).
- The Ural icebreaker was launched, and sea trials of the Arktika icebreaker began.
- The construction of the fleet of port vessels for the Yamal LNG project was completed.



VYACHESLAV RUKSHA
Deputy Director General,
Director for the Northern Sea Route
Directorate

– In 2019, ROSATOM managed to meet the targets set for the Northern Sea Route Federal Project ahead of schedule. How was this achieved?

– In 2019, cargo traffic along the Northern Sea Route (NSR) reached 31.5 million tonnes. Its growth was driven mainly by the Yamal LNG project launched at the Yuzhno-Tambeyskoye gas condensate deposit.

– What will be the target composition of the Russian nuclear-powered icebreaker fleet between 2024 and 2035?

– At the end of 2019, the Government of the Russian Federation approved the Northern Sea Route Infrastructure Development Plan until 2035, which had been developed by the Northern Sea Route Directorate of ROSATOM in cooperation with other ministries and departments.

The plan includes three stages. At the first stage (between 2020 and 2024), it is necessary to promote accelerated development of the western part of the NSR. At the second stage (between 2025 and 2030), measures will need to be taken to enable year-round navigation along the entire length of the NSR. Finally, the third stage (until 2035) will involve developing a competitive international and national transport corridor based on the NSR.

The plan includes building five Project 22220 (LK-60) icebreakers and three Lider-class Project 10510 (LK-120) icebreakers, as well as extending the service life of the three operating nuclear icebreakers. All contracts for Project 22220 (LK-60) icebreakers have already been concluded, and prices are firm. As early as in 2020, a contract was signed for the construction of the Lider-class Project 10510 flagship icebreaker. ROSATOM is developing a concession arrangement for financing the construction of follow-on icebreakers of this project. Thus, given the gradual retirement of existing vessels, icebreaking capacities have been secured for the first stage of the Plan. This is important, since all Arctic projects, which are expected to drive an increase in cargo traffic along the NSR to 80 million tonnes in 2024, involve year-round westbound navigation.

As for the target composition of the icebreaker fleet by 2030, this corresponds to the end of the second phase of the Plan, which will involve ensuring safe year-round navigation along the NSR not only westwards but also eastwards. According to various estimates, in 2030, cargo traffic may exceed 100 million tonnes. This increase in cargo traffic will also necessitate expansion of the cargo fleet, which is being sourced or built by our colleagues from companies implementing unique mining, oil and gas production projects in the Arctic.

ROSATOM has been assigned the functions of the infrastructure operator of the Northern Sea Route (NSR). Its responsibilities include escorting vessels, building infrastructure facilities, supporting navigation and ensuring its safety in the challenging Arctic environment.

The Corporation supervises the implementation of the Northern Sea Route Federal Project, which forms part of the Comprehensive Plan for Upgrading and Expanding Core Infrastructure until 2024 (developed in accordance with the President's 'May Decree' No. 204 dated May 7, 2018)

In December 2019, the Russian Government approved the NSR Infrastructure Development Plan until 2035. The Plan outlines a large scope of measures grouped into 11 sections, from the development of infrastructure for large-scale investment projects

The Northern Sea Route is a historically developed integrated national transport link in the Russian Arctic.

Cargo transportation along the Northern Sea Route provides logistical advantages: the distance between Northern Europe and East Asia is reduced by up to 39%, while the distance between the western coast of North America and Northern Europe is reduced by up to 28%. Russia's long-term strategic objectives include developing the Arctic and navigation along the Northern Sea Route.

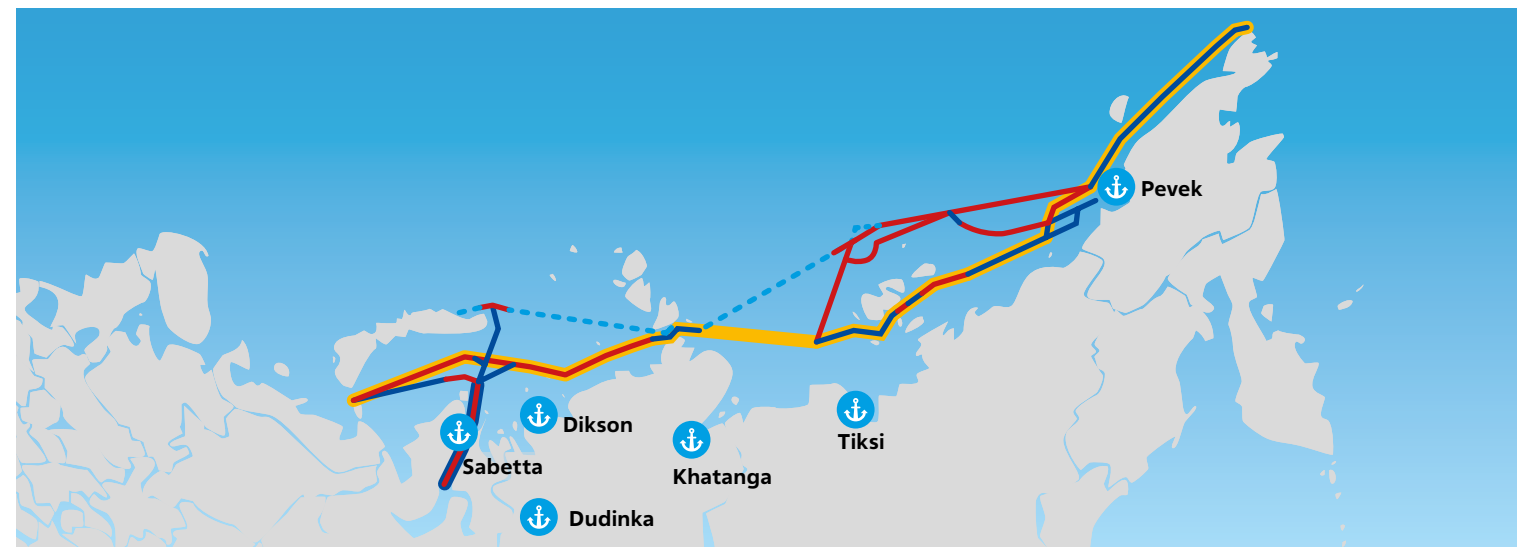
On December 3, 1959, the world's first nuclear icebreaker, Lenin, was put into operation. This date marked the emergence of Russia's nuclear-powered icebreaker fleet. The Lenin icebreaker remained in operation for almost three decades and escorted thousands of vessels through ice-bound Arctic seas, covering almost three times the distance between the Earth and the Moon.

2019 saw the 60th anniversary of the Russian nuclear-powered icebreaker fleet.

and preparations to enable transit navigation along the NSR to addressing healthcare issues and providing personnel for navigation in the Arctic.



- Port
- Hub port
- Boundary of the NSR area
- Duration of a voyage along the NSR: 7 to 15 days at an average speed of 5 to 13 knots, without calling at intermediate ports
- Duration of the navigation season: 2 to 4 months (longer for individual sections, with assistance from icebreakers)



- Main high-latitude route
- Alternative high-latitude route
- Sections of deep-water routes along the high-latitude route, in the Gulf of Ob, the Sannikov Strait and approaches to them surveyed during the 2011-2018 navigation seasons
- Sections scheduled to be surveyed during the 2019-2024 navigation seasons

7.1. ESCORTING VESSELS AND HANDLING CARGO TRAFFIC ALONG THE NORTHERN SEA ROUTE

Under the Northern Sea Route Federal Project, cargo traffic along the NSR is projected to reach 80 million tonnes per year by 2024. Between 2030 and 2035, cargo traffic may increase to 100-120 million tonnes per year.

Russia owns the world's only nuclear-powered icebreaker fleet and has a long track record in the construction and operation of nuclear icebreakers. The nuclear-powered icebreaker fleet owned by ROSATOM participates in projects in the Arctic that are strategically important for Russia's economic development.

As at December 31, 2019, the nuclear-powered icebreaker fleet included:

- Two nuclear icebreakers with 75,000 h.p. two-reactor nuclear power units: Yamal and 50 Let Pobedy;
- Two nuclear icebreakers with a 50,000 h.p. one-reactor nuclear power unit: Taymyr and Vaygach;
- Sevmorput, a nuclear-powered LASH carrier with a 40,000 h.p. one-reactor nuclear power unit;
- Imandra and Lotta floating maintenance bases;
- Serebryanka, a motor vessel intended for liquid RAW management and SNF transportation; Rossita, a motor vessel used for SNF and RAW transportation; and Rosta-1, a radiation monitoring vessel.

The icebreakers and onshore infrastructure are operated by the Corporation's enterprise FSUE Atomflot, which has the status of a federal nuclear organization.

In 2019, ROSATOM met the targets set for the Northern Sea Route Federal Project ahead of schedule. Cargo traffic totalled 31.5 million tonnes (against a target of 26 million tonnes). Both

In 2019, a special voyage to the North Pole was organized for children. On board the 50 Let Pobedy nuclear-powered ship, 124 participants travelled to the northernmost point of the planet; they included 70 children from various regions of Russia, from Ekaterinburg to Murmansk: representatives of the Russian Movement of Schoolchildren, students of the Sirius Educational Centre, children participating in the ROSATOM School project, and active participants of events held by the network of Nuclear Energy Information Centres. Members of the expedition learned about the history of the nuclear-powered icebreaker fleet, the professions needed on an icebreaker and the problems related to preserving the Arctic.

the number of escorted vessels and their gross tonnage increased significantly, mainly due to the ramp-up of the LNG plant in the seaport of Sabetta to rated capacity and the commissioning of large-capacity LNG carriers exporting liquefied natural gas as part of the Yamal LNG project.

In 2019, long-term cooperation agreements were signed with major operators of oil, gas and mineral deposits in the Russian Arctic. The new long-term contract format enables companies to secure logistic support provided by icebreakers with a planning horizon of 2025-2027 and the possibility of extending the terms of services provided under options amid growing cargo traffic along the Northern Sea Route.

7.2. CONSTRUCTION OF NEW ICEBREAKERS

To handle the growing cargo traffic along the Northern Sea Route, ROSATOM is upgrading its icebreaker fleet on a large scale. By the end of 2019, the construction of three Project 22220 multipurpose nuclear icebreakers was underway. In the reporting year, the Ural icebreaker was launched (the Sibir and Arktika icebreakers were launched in 2017 and 2016 respectively). In 2019, sea trials of the Arktika flagship icebreaker began. In the reporting year, ROSATOM concluded a contract for the construction of two more follow-on icebreakers of this type.

In 2020, the Corporation plans to sign the contract and to start the construction of a unique icebreaker, Lider, which will enable year-round operation in the High Arctic, mainly in its eastern sector, which is characterized by the most challenging ice conditions.

7.3. NEW PRODUCTS

In 2019, the construction of the fleet of port vessels for the Yamal LNG project was completed: the shipyard handed over the Ob port icebreaker to FSUE Atomflot. With its engine power totalling 12 MW, the vessel can successfully maintain a speed of 2 knots through ice that is 1.5 metres thick and reach a speed of 4 knots in broken ice. Previously, the Pur, Tambey, Nadym and Yuribey tugboats had been built as part of the project. The vessels

used in the project operate together with nuclear icebreakers and gas tankers, enabling FSUE Atomflot to provide a full range of services in the port of Sabetta.

In 2019, ROSATOM also launched a new project focused on technical management of non-nuclear icebreakers.

7.4. DIGITIZATION OF OPERATIONS

In 2019, a digitization programme was developed for FSUE Atomflot. The programme is aimed at integrating all information systems; it is designed to ensure information security and allows the possibility of creating a digital twin of a nuclear icebreaker. Development of digital culture is also an integral part of the programme.

In the reporting year, a project was launched to create an automated control system for the Marine Operations Headquarters. The main task of the system is to provide information support for managerial decision-making, including on operations in the ice-bound sea.

7.5. ACTIVITIES OF FSUE HYDROGRAPHIC ENTERPRISE

In 2019, FSUE Hydrographic Enterprise was transferred to ROSATOM from the Ministry of Transport of Russia. The enterprise manages a fleet of hydrographic survey vessels and performs the following functions:

- Navigational and hydrographic support of navigation along the NSR, including determining recommended navigation routes and operating the vessel positioning system;
- Construction and management of infrastructure facilities of the NSR, including sea and approach channels, hydraulic and ice protection structures.

FSUE Hydrographic Enterprise comprises:

- Eight hydrographic bases;
- A fleet comprising nine hydrographic survey vessels and three auxiliary vessels;
- An integrated Arctic hydrographic expedition;
- A cartographic unit;
- An integrated Arctic radio navigation unit;
- An Arctic service of aids to navigation;
- An information centre for safety at sea;
- An Arctic pilot service;
- A port infrastructure construction and operation department.

In 2019, a seafloor topography survey was carried out along the routes of large-tonnage vessels navigating the NSR in the Laptev and East Siberian Seas, in the Sannikov and Bering Straits, the Yenisei and Kolyma Rivers.

Measures were taken to maintain, operate and develop the infrastructure of GLONASS/GPS monitoring and correction stations in the Arctic. Support was provided for round-the-clock operation of radio equipment; equipment maintenance and repairs of power supply and life support systems were carried out.

FSUE Hydrographic Enterprise acting on behalf of ROSATOM provides support for the participation of the Russian Federation in the activities of the International Hydrographic Organization and the International Association of Marine Aids to Navigation and Lighthouse Authorities.

Construction of two Ice 3 class Project E35.G hydrographic survey boats was commenced. These vessels are designed to operate in ports along the Northern Sea Route, ensure safe navigation and support the development of port infrastructure. The vessels are scheduled to be commissioned in 2021.

Construction of two Ice 3 class Project BLV03 buoy tenders was commenced. These vessels are designed for the positioning, servicing and delivery of navigation and radio equipment and specialists to onshore facilities. The vessels are scheduled to be commissioned in 2021.

In 2019, departmental electronic navigational charts created in accordance with the requirements of the S-57 Standard of the International Hydrographic Organization continued to be updated. As at December 31, 2019, the collection of FSUE Hydrographic Enterprise included 253 maps and covered the entire length of the NSR.

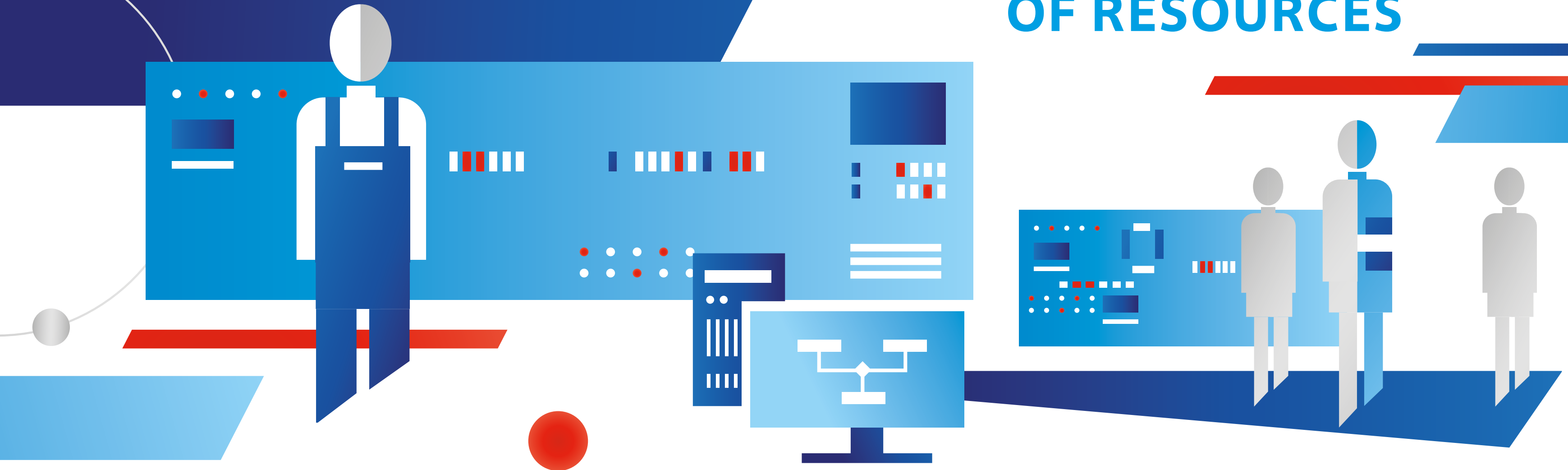
7.6. PLANS FOR 2020 AND FOR THE MEDIUM TERM

- To meet the target for cargo traffic under the Northern Sea Route Federal Project;
- To continue the construction of Project 22220 multipurpose nuclear icebreakers, commission the Arktika flagship icebreaker and carry out sea trials of the Sibir icebreaker;
- To extend the service life of reactor units of the Taymyr and Vaygach nuclear icebreakers;
- To lay the keel of the Lider icebreaker;
- To put the automated control system of the Marine Operations Headquarters into commercial operation;
- To organize a voyage of the Sevmorput nuclear-powered LASH carrier to the Antarctic to deliver cargo for the construction of an Antarctic station;
- To organize seafloor topography surveys along the NSR, in the Yenisei Gulf and the Yenisei and Kolyma Rivers;
- To organize maintenance, operation and infrastructure development of GLONASS/GPS monitoring and correction stations in the Arctic;
- To organize the construction of facilities forming part of the Global Maritime Distress and Safety System;
- To continue the construction of two hydrographic survey vessels and two buoy tenders;
- To develop the NSR port infrastructure, including the construction of the Utrenniy liquefied natural gas and gas condensate terminal in the seaport of Sabetta.

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8

EFFECTIVE MANAGEMENT OF RESOURCES





8.1. CORPORATE GOVERNANCE

8.1.1. GOVERNING BODIES

SUPERVISORY BOARD

In accordance with Article 23 of Federal Law No. 317-FZ of December 1, 2007 on State Atomic Energy Corporation Rosatom, the Supervisory Board³⁶ is ROSATOM's supreme governing body. The powers of the Supervisory Board are stipulated by Federal Law No. 317-FZ of December 1, 2007.

The Supervisory Board comprises nine members, including eight representatives of the President of the Russian Federation and the Government of the Russian Federation, as well as ROSATOM's Director General, who is a member of the Supervisory Board by virtue of his position.

The Supervisory Board members and chairman are appointed by the President of the Russian Federation.

The Supervisory Board members, except for ROSATOM's Director General, are not executives of ROSATOM.

The Supervisory Board members receive no remuneration for their participation in the work of the Supervisory Board.

COMPOSITION OF ROSATOM'S SUPERVISORY BOARD AS AT DECEMBER 31, 2019

Sergey Kirienko	First Deputy Chief of the Presidential Executive Office, Chairman of the Supervisory Board
Igor Borovkov	Chief of Staff of the Military Industrial Commission under the Government of the Russian Federation, Deputy Chief of Staff of the Russian Government
Larissa Brychyova	Assistant to the President of the Russian Federation, Head of the Legal Department of the Presidential Administration
Andrey Klepach	Deputy Chairman (Chief Economist) of State Development Corporation VEB.RF
Sergey Korolev	Head of the Economic Security Service of the Federal Security Service of Russia
Alexey Likhachev	Director General of State Atomic Energy Corporation Rosatom
Alexander Novak	Minister of Energy of the Russian Federation
Yury Trutnev	Deputy Chairman of the Government of the Russian Federation, Plenipotentiary Representative of the President of the Russian Federation in the Far Eastern Federal District
Yury Ushakov	Assistant to the President of the Russian Federation

³⁶ <https://rosatom.ru/en/about-us/governance/supervisory-board/>.

In 2019, there were no changes in the composition of ROSATOM's Supervisory Board.

In the reporting year, the Supervisory Board held 12 meetings, including three face-to-face meetings, and considered 34 issues.

The Supervisory Board approved the following:

- The report on the achievement of key performance targets by ROSATOM in 2018;
- ROSATOM's key performance targets for 2019;
- Key performance targets of federal nuclear organizations for 2019;
- ROSATOM's annual report for 2018.

On June 26, 1953, the First Main Directorate of the Council of Ministers of the USSR overseeing the country's nuclear industry was reorganized into the Ministry of Medium Machine-Building of the USSR (Minsredmash). This marked the end of the first stage of development of the Soviet nuclear industry and the beginning of the era of the Minsredmash.

The Ministry was faced with an ambitious task of developing the country's nuclear shield, the peaceful use of nuclear energy and nuclear technologies for other applications by leveraging the research and technical capabilities, human and organizational resources accumulated during the post-war years under the supervision of the First Main Directorate.

During the era of the Minsredmash, the country was developing its defensive nuclear arsenal; nuclear power plants and various other facilities were commissioned; the production of raw materials for the nuclear industry was started within a very short time; major mining and processing plants were built, and unique technological solutions were developed and adopted in a wide range of areas, including uranium and gold mining, production of mineral fertilizers, the use of isotopes in healthcare, agriculture and other sectors of the national economy.

In 1957, the Ministry of Medium Machine-Building was headed by Efim Slavsky, the legendary minister who managed the industry for almost 30 years and one of the most distinguished of its founding fathers. He was one of the only three people in the country to be awarded the Order of Lenin 10 times. He was also awarded the title of Hero of Socialist Labour three times. It was under Efim Slavsky that the Ministry of Medium Machine-Building expanded its manufacturing, research and technical capabilities on an unprecedented scale.

ROSATOM'S DIRECTOR GENERAL

The functions and powers of the Director General are stipulated in the Federal Law on State Atomic Energy Corporation Rosatom. ROSATOM's Director General is the Corporation's sole executive body and manages its day-to-day operations.

Alexey Likhachev is ROSATOM's Director General (appointed by Decree No. 527 of the President of Russia dated October 5, 2016). Information on the background of the Director General is available on ROSATOM's official website³⁷.

ROSATOM'S MANAGEMENT BOARD

The Management Board is ROSATOM's collective executive body. The Management Board includes ROSATOM's Director General, who is a member of the Board by virtue of his position, and other members of the Board. The Director General manages the work of ROSATOM's Management Board.

The powers of the Management Board are stipulated in the Federal Law on State Atomic Energy Corporation ROSATOM. Information on the background of the Board members is available on ROSATOM's website³⁸.

³⁷ <https://rosatom.ru/en/about-us/governance/management-board/likhachev/>.

³⁸ <https://www.rosatom.ru/en/about-us/governance/management-board/>.

Members of ROSATOM's Management Board are appointed and dismissed under the resolution of ROSATOM's Supervisory Board on the recommendation of the Director General. The Board members work full-time for ROSATOM or are employees of ROSATOM's organizations, joint-stock companies and their subsidiaries, as well as enterprises controlled by ROSATOM.

Information about income, expenses, property and liabilities of the Management Board members and their relatives is available on ROSATOM's official website³⁹.

COMPOSITION OF THE MANAGEMENT BOARD AS AT DECEMBER 31, 2019

Alexey Likhachev	ROSATOM's Director General, Chairman of the Management Board
Ivan Kamenskikh	First Deputy Director General for Nuclear Weapons
Kirill Komarov	First Deputy Director General for Corporate Development and International Business
Alexander Lokshin	First Deputy Director General for Operations Management
Konstantin Denisov	Deputy Director General for Security
Oleg Kryukov	Director for Public Policy on Radioactive Waste, Spent Nuclear Fuel and Nuclear Decommissioning
Andrey Nikipelov	Chief Executive Officer of JSC Atomenergomash
Sergey Novikov	State Secretary, Deputy Director General for Execution of State Powers and Budgeting
Sergey Obozov	Director for ROSATOM Production System
Yury Olenin	Deputy Director General for Science and Strategy
Andrey Petrov	Director General of JSC Rosenergoatom
Ilya Rebrov	Financial Director
Vyacheslav Ruksha	Deputy Director General, Director for the Northern Sea Route Directorate
Nikolay Spasskiy	Deputy Director General for International Relations
Yury Yakovlev	Deputy Director General for the State Safety Policy in the Defence Uses of Atomic Energy

In 2019, there were no changes in the composition of the Corporation's Management Board.

In 2019, the Management Board held 37 meetings (all by absentee voting). The Board considered 357 issues, including the following key issues:

- The achievement of key performance targets by ROSATOM in 2018;
- Approval of ROSATOM's key performance targets for 2019.

³⁹ <http://www.rosatom.ru/about/protivodeystvie-korrupsii/svedeniya-o-doxodax-rabotnicov/>.

AUDITING COMMISSION

ROSATOM's Auditing Commission monitors ROSATOM's financial and business operations.

COMPOSITION OF THE AUDITING COMMISSION

Roman Artyukhin	Head of the Federal Treasury, Chairman of the Auditing Commission
Olga Allilueva	Administrative Aide in the Presidential Domestic Policy Directorate of the Presidential Executive Office
Alexey Lipaev	Deputy Department Director, Head of the Office for Budgetary Policy in the Sphere of the State Defence Order and Material Reserves of the Department for Budgetary Policy in the Sphere of State Military and Law Enforcement Services and the State Defence Order of the Ministry of Finance of the Russian Federation
Andrey Pogodin	Chief Engineer of the 12 th Main Department of the Ministry of Defence of the Russian Federation
Vasily Utkin	Office Head of the Department for the Defence Industry of the Government of the Russian Federation

COMMISSIONS, BOARDS AND COMMITTEES UNDER THE GOVERNING BODIES

In 2019, ROSATOM had about 30 permanent committees, boards and commissions under the governing bodies.

Committee/Board/Commission	Chairman
KEY COLLECTIVE AND ADVISORY BODIES AS AT DECEMBER 31, 2019	
Strategic Council	Alexey Likhachev, Director General
Operations Committee	
Staff and Incentives Committee	
Steering Board of the Proryv (Breakthrough) Project	
Unified Commission for the Procurement of Goods, Work and Services for Government Needs under a Closed Procedure	Ivan Kamenskikh, First Deputy Director General for Nuclear Weapons
Investment Committee	Alexander Lokshin, First Deputy Director General for Operations Management
Ethics Board	
Committee on the Standardization of Technical Specifications	Kirill Komarov, First Deputy Director General for Corporate Development and International Business
Committee on the Restructuring of Non-Core Assets, Real Property and Equity	
Committee on Cost within International Sales	
Committee on Strategic Partnerships, Mergers and Acquisitions	
Committee on Venture Capital Financing	
Charity Committee	

Risk Committee

Science Committee

Technical Committee of the Proryv Project

Central Procurement Commission

Committee on Procurement Strategies

Central Arbitration Committee (in procurement)

Committee on Pricing in the Construction of Nuclear Facilities

Sergey Novikov, State Secretary, Deputy Director General for Execution of State Powers and Budgeting

Yury Olenin, Deputy Director General for Science and Strategy

Evgeny Adamov, Scientific Leader of the Proryv Project

Roman Zimonas, Director for Procurement, Logistics and Quality Management

Herman Gonso, Chairman of the Central Arbitration Committee

Gennady Sakharov, Director for Capital Investments, State Construction Supervision and Government Expert Review

8.1.2. IMPROVEMENT OF THE CORPORATE GOVERNANCE SYSTEM

In the reporting year, the Corporation continued to adopt new regulations governing the cooperation between ROSATOM and the holding companies of its Divisions, business incubators and industry complexes.

An industry-wide mechanism for the conclusion of corporate integration and cooperation deals by ROSATOM and its organizations was improved.

The Litigation industry-wide centre for claims administration and litigation management started pilot operation. The Centre will:

- Provide a shared industry-wide information space for claims administration;
- Help to centralize the system for the monitoring of enforcement of cases and compliance with deadlines as part of claims administration and the relevant reporting.

ROSATOM and joint-stock companies in the nuclear industry adhere to the key corporate governance principles stipulated by Russian legislation and the Corporate Governance Code (including respect for shareholder rights, determination of the procedure, format and scope of information disclosure), with some exceptions stemming from special characteristics of ROSATOM's business and its legal status as the authorized body responsible for nuclear power management (restricted civilian circulation of shares of joint-stock companies on the lists approved by the Russian President and comprising Russian legal entities that may own nuclear materials or nuclear facilities).

8.1.3. KEY CHANGES IN THE CORPORATE STRUCTURE IN 2019

To promote its digital product portfolio on the market and to manage internal digitization programmes and projects, ROSATOM established LLC Rusatom Digital Solutions and Private Institution for Digitization of the Nuclear Industry Cifrum.

To improve digital development processes in the electric power industry, JSC Rosenergoatom together with JSC Inter RAO – Electric Power Plants, JSC SO UPS and JSC UPS EC Real Estate established the Association of Digital Industry Development Organizations Digital Energy.

To create an industry integrator of logistical services and develop a new international business, JSC Atomenergoprom established a wholly owned subsidiary, LLC Rusatom Cargo.

To develop the logistics business in the industry, JSC Atomenergoprom acquired a 30% shareholding in Delo Group, a major Russian intermodal container terminal operator.

To ensure effective implementation of the Akkuyu NPP construction project in Turkey, JSC CONCERN TITAN-2 and a Turkish company IC İçtaş İnşaat Sanayi ve Ticaret A.Ş. established a joint venture operating on the site of Akkuyu NPP as a contractor.

To launch the production of sports goods made of composite materials at an existing enterprise, JSC RPC Khimpromengineering acquired a shareholding in LLC ZARYAD.

In 2019, ROSATOM's trademark was registered in Bangladesh and Indonesia. The Corporation submitted applications for trademark registration in another 15 countries where it has strategic interests.

To promote services provided by the data centre in Udomlya, JSC Rosenergoatom and LLC LinKey, an international data centre operator, established a joint venture, JSC ATOMDATA, on a parity basis.

To implement the project to build the Multipurpose Fast Neutron Research Reactor (MBIR) in cooperation with its foreign partners, JSC Atomenergoprom established a wholly owned subsidiary, LLC IRC MBIR Consortium Leader.

Shares of six joint-stock companies under federal ownership were transferred to ROSATOM pursuant to Decree No. 1241 of the Russian Government dated October 12, 2017 and Order No. 328 of the President of the Russian Government dated July 20, 2017 as an asset contribution of the Russian Federation (as part of the completion of privatization of FSUEs).

Shares of seven joint-stock companies under federal ownership were transferred to ROSATOM pursuant to Order No. 1066-r of the Russian Government dated May 25, 2019 as an asset contribution of the Russian Federation.

8.1.4. NON-ARM'S LENGTH TRANSACTIONS

In accordance with Federal Law No. 317-FZ of December 1, 2007, the Supervisory Board approves non-arm's length transactions. In 2019, five non-arm's length transactions were approved with the following organizations:

- The Government of the Nizhny Novgorod Region and the National Research Centre Kurchatov Institute;

- NRNU MEPhI;
- The Government of the Kaluga Region and NRNU MEPhI;
- The Foundation for Advanced Research Projects.

8.2. RISK MANAGEMENT

8.2.1. RISK MANAGEMENT SYSTEM

The industry-wide risk management system (RMS) is integrated into ROSATOM's planning and management processes. The RMS is based on a continuous cyclical process of identifying, assessing and managing the risks that can affect the Corporation's short- and long-term performance and the implementation of its strategy.

The RMS is being developed in accordance with the approved Risk Management Development Programme for the period from 2019 through 2024.

In 2019:

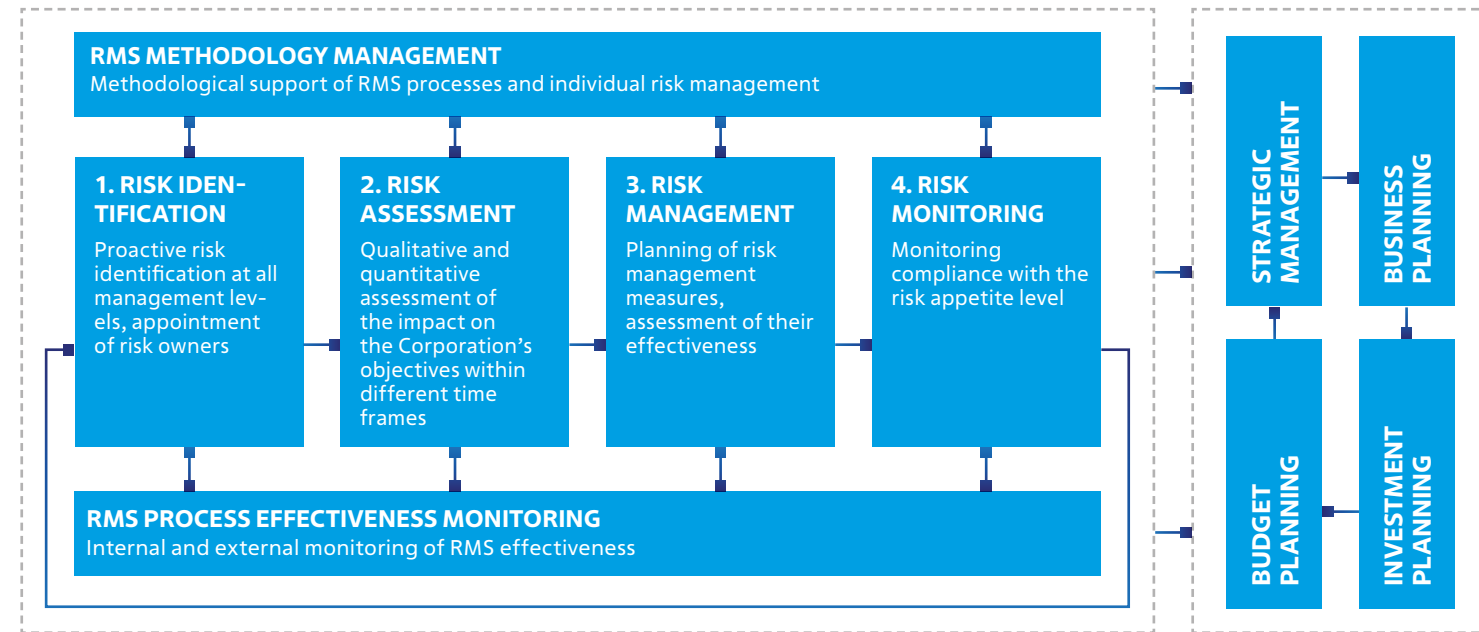
- Approaches to risk monitoring and the prevention of risk recurrence were developed: a database of the relevant indicative external and internal case studies and NPP construction benchmarks (systemic risks) was created; an expert assessment of the impact of systemic risks on project cost, time frame and likelihood of abandonment was carried out;
- A quantitative risk assessment was carried out for ROSATOM's NPP construction projects⁴⁰;

- A list of key risks of ROSATOM and its organizations and a matrix of responsibility for the management of key risks were approved;
- An approach to early response to risks was developed and approved: a list of key risk indicators was compiled, including a description, sources of information, the calculation algorithm and frequency, thresholds (warning and response thresholds); an expert assessment of key risk indicators was carried out, and data on changes in their levels was collected;
- Risk management practices forming part of maintenance processes in NPP construction projects in Russia and abroad were gathered;
- Risk management measures were implemented in accordance with recommendations based on the findings of a comprehensive thematic audit of efficiency of cross-divisional cooperation on the Akkuyu and Hanhikivi NPP construction projects.

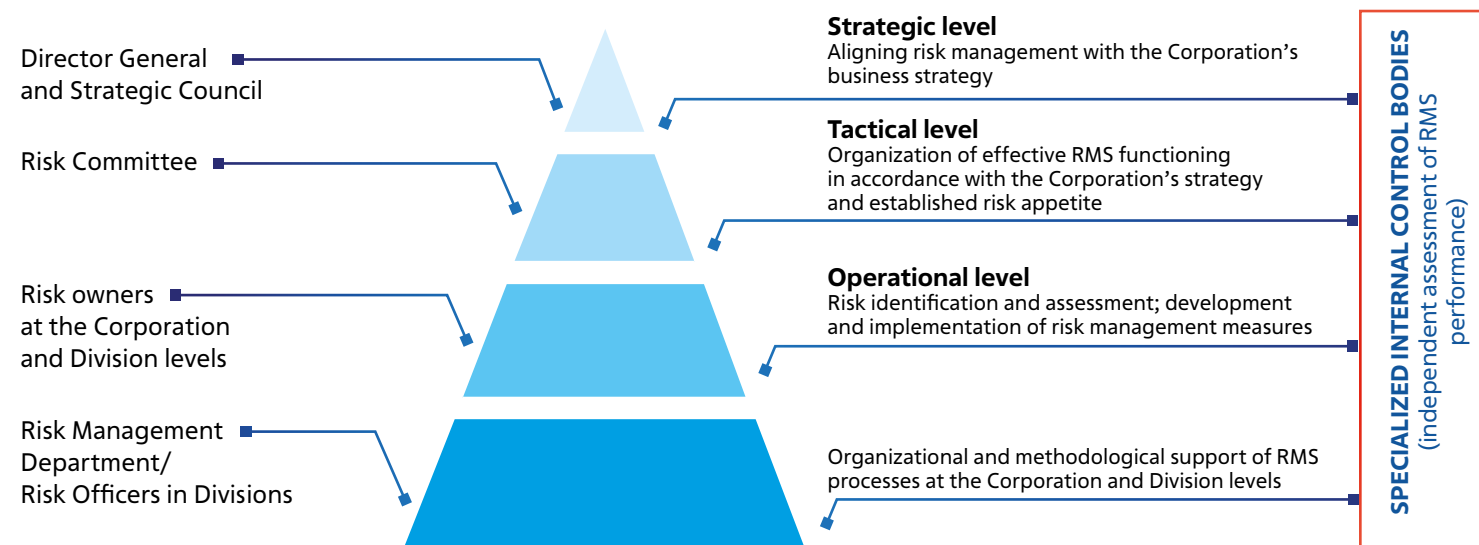
⁴⁰ An assessment using the Monte Carlo method was carried out for Hanhikivi NPP (Finland), Akkuyu NPP (Turkey) and Rooppur NPP (Bangladesh). A parametric assessment was carried out for Kudankulam NPP (India, power units No. 3-6), El Dabaa NPP (Egypt), Akkuyu NPP (Turkey), Rooppur NPP (Bangladesh), Paks NPP (Hungary), Kursk NPP-2 and the Uzbek NPP (Uzbekistan).

RISK MANAGEMENT PROCESS AT ROSATOM

RMS processes



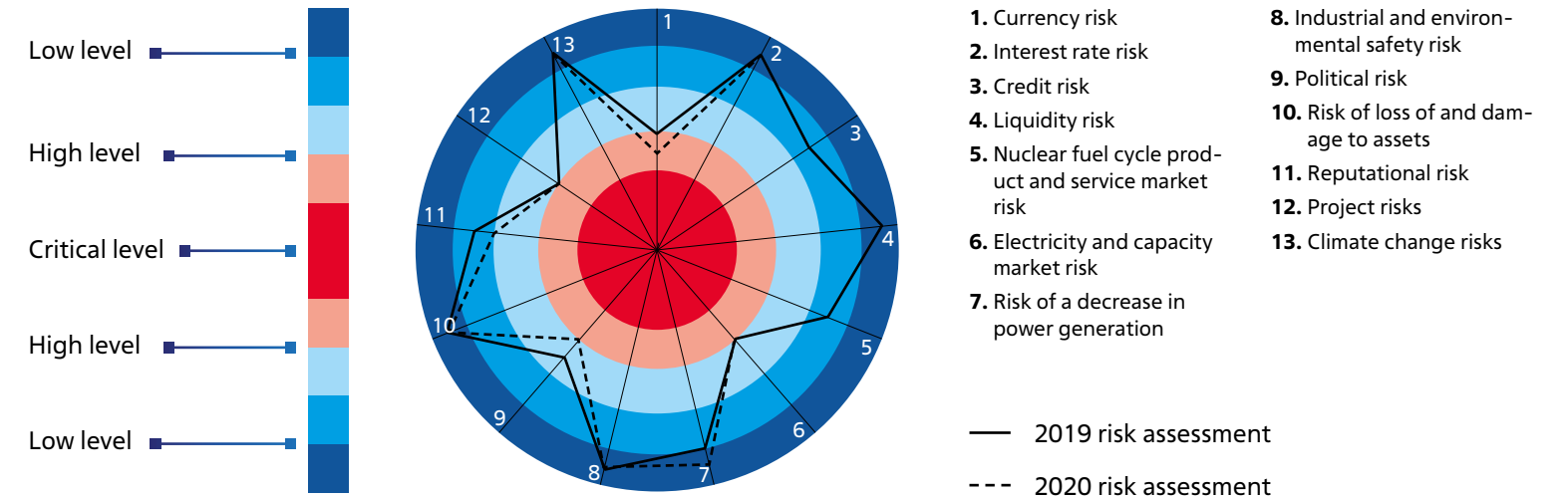
ORGANIZATIONAL MODEL OF THE RISK MANAGEMENT SYSTEM AT ROSATOM



8.2.2. KEY BUSINESS RISKS OF ROSATOM⁴¹

As part of the functioning of the RMS, a list of critical risks was compiled; risk owners were appointed; risks were assessed, and risk management measures were developed and implemented.

RISK RADAR



Comprehensive risk management measures largely offset the negative impact of external factors on the implementation of the Corporation's strategy. The connection between critical risks and the Corporation's strategic goals is shown in section 8.2.3.

⁴¹ The annual report does not contain an exhaustive description of all risks that may affect the Corporation's operations; it only provides information on key risks.

8.2.3. RISK MANAGEMENT OUTCOMES IN 2019

Change in estimated risk levels for 2020:

- ↑ increase
- ↓ decrease
- no significant changes

ROSATOM's strategic goals:

- 1 To increase the international market share
- 2 To reduce production costs and the lead time
- 3 To develop new products for the Russian and international markets
- 4 To achieve global leadership in state-of-the-art technology

Risks and changes in risk levels (risk owners)	Risk description	Risk management practices	Connection with strategic goals
CHANGE IN ESTIMATED RISK LEVELS FOR 2020			
FINANCIAL RISKS			
1. Currency risk ↑ (Executives of ROSATOM's Divisions)	Adverse changes in exchange rates	Management approaches: <ul style="list-style-type: none"> ■ Setting the highest possible conversion rates when negotiating the terms of expense contracts; ■ Monitoring the terms of foreign currency payments under revenue contracts and expense contracts concluded as part of performance of revenue contracts; ■ Maintaining a balance of claims and liabilities denominated in foreign currencies (natural hedging); ■ Use of financial hedging instruments. Results: Foreign currency liabilities were met without raising additional funds to compensate for exchange rate fluctuations. Divergent trends in the exchange rates of currencies in which project financing, key items of capital expenditure and operating cash flows are denominated were taken into account. An optimal ratio of assets and liabilities denominated in the same currency was maintained.	<ol style="list-style-type: none"> 1 2 3
		Changes: Due to high exchange rate volatility as at the beginning of 2020, the risk tends to increase.	

Risks and changes in risk levels (risk owners)	Risk description	Risk management practices	Connection with strategic goals
2. Interest rate risk ○ (ROSATOM's Treasury Department)	Adverse changes in interest rates, different timing of interest income and interest expenses	Management approaches: <ul style="list-style-type: none"> ■ Maintaining a balance of interest income and interest expenses in terms of timing and amounts; ■ Reasonable selection of interest rates (fixed or floating) for the expected maturity period. All things being equal, the Corporation prefers long-term fixed-rate loans with the option of penalty-free early repayment. It has not raised any loans with interest rates linked to the refinancing rate/key rate of the Bank of Russia; ■ Floating-rate loans on which interest rates may be increased are refinanced using the intra-group liquidity pool. Results: ROSATOM maintains a stable long-term credit portfolio. The average interest rate on the total debt portfolio of ROSATOM and its organizations was reduced to below 5% per annum, partly due to the refinancing of both the rouble-denominated and foreign-currency-denominated portions of the credit portfolio. The reduction in the risk level in 2019 was due to the effective use of the risk management approaches described above, as well as a decrease in the key rate of the Bank of Russia and lower volatility on the Russian credit market.	<ol style="list-style-type: none"> 1 2 3
		Changes: The likelihood of an increase in the risk level due to an interest rate hike is assessed as low. <i>For details, see the section 'Financial Management'.</i>	
3. Credit risk ○ (ROSATOM's Treasury Department for banks; executives of the Corporation's organizations for other counterparties)	Failure by counterparties to fulfil their obligations in full and on time	Management approaches: <ul style="list-style-type: none"> ■ Setting and monitoring limits for counterparty banks; ■ Using suretyship, guarantees, restrictions on advance payments in favour of external counterparties; ■ Improving the legal framework for the wholesale electricity and capacity market (including increasing fines and improving the system of financial guarantees); ■ Monitoring the status of accounts receivable and the financial position of counterparties; ■ An internal counterparty solvency rating system. 	<ol style="list-style-type: none"> 1 2

Risks and changes in risk levels (risk owners)	Risk description	Risk management practices	Connection with strategic goals
<p>4. Liquidity risk</p> <p>○</p> <p>(ROSATOM's Treasury Department for ROSATOM and JSC Atomenergoprom/Executives of Divisions)</p>	Lack of funds for the fulfilment of obligations by ROSATOM and its organizations	<p>Results:</p> <p>Losses through the fault of counterparties were minimized. Bank guarantees were not called upon under revenue contracts.</p> <p>Management approaches:</p> <ul style="list-style-type: none"> ■ Centralized cash management (cash pooling); ■ Rolling liquidity forecasts and cash flow budget; ■ Maintaining required amounts of open lines of credit with banks; ■ Reducing the period of keeping spare cash on bank deposits when this is advisable from an economic perspective; ■ Discussing matters related to state support with Russian federal executive authorities; ■ Active use of project financing instruments as part of implementation of projects and programmes by the Corporation and its organizations; ■ Maintaining credit ratings assigned to JSC Atomenergoprom by the 'Big Three' international rating agencies (S&P, Moody's and Fitch), by JSC Expert RA and other rating agencies at the level of Russia's sovereign credit rating. <p>In 2019, the Analytical Credit Rating Agency (ACRA) assigned ROSATOM a credit rating at the highest possible sovereign credit rating level, AAA (RU), with a stable outlook.</p> <p>Results:</p> <p>The Corporation maintained sufficient liquidity to repay liabilities on time, preventing unacceptable losses and reputational risk.</p> <p><i>For details, see the section 'Financial Management'.</i></p>	<p>1</p> <p>3</p>
COMMERCIAL RISKS			
<p>5. Nuclear fuel cycle (NFC) product and service market risk</p> <p>○</p> <p>(Executives of the relevant Divisions of the Corporation)</p>	Adverse change in the pricing environment and demand on markets for natural uranium and uranium conversion and enrichment services	<p>Management approaches:</p> <ul style="list-style-type: none"> ■ Maintaining an optimal balance between market-focused and escalation pricing mechanisms (based on benchmark price inflation) in contracts; ■ Aligning pricing mechanisms used for procurement and those used in contracts with a high level of commodity risk; ■ Discussing the volume of future orders with customers in advance; ■ Embedding quantitative flexibility and options in contracts with suppliers to align purchase and sales volumes; 	<p>1</p> <p>2</p> <p>4</p>

Risks and changes in risk levels (risk owners)	Risk description	Risk management practices	Connection with strategic goals
<p>6. Electricity and capacity market risks</p> <p>○</p> <p>(Director General of JSC Rosenergoatom)</p>	Adverse changes in electricity and capacity prices	<ul style="list-style-type: none"> ■ Providing supply guarantee mechanisms; ■ Improving the technical and economic characteristics of nuclear fuel; developing new types of fuel; ■ Promoting products in new market segments. <p>Results:</p> <p>Despite continuing price and demand stagnation on nuclear fuel cycle product and service markets, in 2019, the revenue target was exceeded.</p> <p>The risk level remains unchanged, as the fact that natural uranium prices and separative work unit prices are currently low limits their further reduction and at the same time creates growth opportunities if the market environment is favourable.</p> <p><i>For details, see the section 'International Business'.</i></p> <p>Management approaches:</p> <p>The risk depends exclusively on external factors. The risk cannot be hedged using financial instruments due to the low liquidity of the market. To reduce the risk, power supply divisions of JSC Rosenergoatom are negotiating with PJSC FGC UES and JSC SO UEC in order to align the schedule of power grid equipment maintenance.</p> <p>Results:</p> <p>In 2019 (like in previous periods), key drivers included electricity consumption in the first pricing zone, indexation of gas prices (with gas being the main type of fuel used by thermal power plants in the first pricing zone) and competition between power generation companies. There were no significant changes in the impact of these factors on electricity and capacity prices in 2019 compared to 2018.</p>	<p>1</p>
OPERATIONAL RISKS			
<p>7. Risk of a decrease in power generation</p> <p>↓</p> <p>(Director General of JSC Rosenergoatom)</p>	Decrease in power generation due to equipment shutdowns and unavailability	<p>Management approaches:</p> <ul style="list-style-type: none"> ■ Scheduled preventive maintenance and repairs at NPPs; ■ Implementation of the NPP life extension programme and equipment upgrades to increase installed capacity and power generation at operating power units (including the possibility of power units operating at above nameplate capacity). 	<p>1</p>

Risks and changes in risk levels (risk owners)	Risk description	Risk management practices	Connection with strategic goals
<p>8. Industrial and environmental safety risk</p> <p>○</p> <p>(Executives of ROSATOM's Divisions)</p>	Major accidents/incidents in nuclear enterprises	<p>Results:</p> <p>All incidents and equipment failures have been properly investigated. Corrective and preventive measures have been developed in order to address the root causes of the incidents and prevent their recurrence.</p> <p>Changes:</p> <p>The risk level has decreased. Implementation of a set of risk management measures and the use of tools forming part of the ROSATOM Production System has made it possible to offset the impact of negative factors.</p> <p><i>For more details, see the appendix to the Report of ROSATOM on the performance of the Power Engineering Division in 2019 (www.report.rosatom.ru/en/rea).</i></p> <p>Management approaches:</p> <ul style="list-style-type: none"> ■ Comprehensive risk surveys in key manufacturing enterprises, followed by the development and implementation of risk mitigation plans; ■ Developing and implementing business insurance programmes based on the findings of risk surveys; ■ Implementing measures to improve occupational safety and health performance in enterprises, including measures to improve the safety of employees and local communities in ROSATOM's regions of operation and to maintain the balance of local ecosystems; ■ Upgrading process equipment in enterprises; ■ Ensuring compliance of production processes with applicable standards; ■ Arranging civil liability insurance for enterprises; ■ Provision of an up-to-date legal framework; ■ Engineering measures to ensure the safety of nuclear facilities; ■ Maintaining a high level of professionalism and safety culture among employees. <p>Results:</p> <p>Safe operation of nuclear facilities and hazardous industrial facilities.</p> <p><i>For details, see the section 'Nuclear and Radiation Safety; Occupational Safety and Health'.</i></p>	<p>1</p> <p>3</p>

Risks and changes in risk levels (risk owners)	Risk description	Risk management practices	Connection with strategic goals
<p>9. Political risk</p> <p>↑</p> <p>(International Cooperation Department of ROSATOM)</p>	Changes in the regulatory and political climate in foreign countries imposing restrictions on the operations of ROSATOM and its organizations	<p>Management approaches:</p> <ul style="list-style-type: none"> ■ Coordination with the Russian Ministry of Foreign Affairs and other authorities; using the relevant intergovernmental mechanisms; ■ Providing political support for global operations of nuclear organizations; ■ Using the platform of specialized international organizations for communication and awareness campaigns; ■ Establishing partnerships with local and foreign regional companies and searching for alternative partners; ■ Examining alternative options for the supply of equipment that has been produced by the Corporation or is in production; ■ Obtaining general export licences; ■ Taking into account political interests of governments in the Corporation's end markets. <p>Results:</p> <p>The Corporation concluded 7 intergovernmental agreements and 23 major interdepartmental agreements, which is a positive trend.</p> <p>Changes:</p> <p>The risk tends to increase, as persisting sanctions pressure on Russian individuals and legal entities generally increases uncertainty over the possibility of implementation of specific economic projects.</p> <p><i>For details, see the sections 'International Cooperation' and 'International Business'.</i></p>	<p>1</p> <p>2</p> <p>3</p>
<p>10. Risk of loss of and damage to assets</p> <p>○</p> <p>(Asset Protection Department of ROSATOM)</p>	Corruption and other offences leading to a damage to/loss of assets	<p>Management approaches:</p> <p>ROSATOM has in place an integrated industry-wide system for the prevention of corruption and other offences:</p> <ul style="list-style-type: none"> ■ ROSATOM has issued local regulations specified in the recommended list of anti-corruption documents for ROSATOM's organizations. Employees have been familiarized with the local regulations; ■ Candidates nominated to various positions are screened, including in order to prevent conflicts of interest; ■ Terms of reference are reviewed, and counterparties undergo due diligence checks in order to minimize the risk of corruption in the course of procurement procedures; ■ ROSATOM operates a hotline. 	<p>1</p> <p>2</p>

Risks and changes in risk levels (risk owners)	Risk description	Risk management practices	Connection with strategic goals
		<p>Results:</p> <p>In accordance with ROSATOM's Anti-Corruption Plan for the period from 2018 through 2020, the Corporation implemented anti-corruption measures stipulated in the National Anti-Corruption Plan for the relevant period approved pursuant to Decree No. 378 of the President of the Russian Federation dated June 29, 2018.</p> <p>The Corporation continued to develop the legal and organizational anti-corruption framework and to ensure compliance with anti-corruption laws and managerial decisions. Systematic measures have been taken to prevent and resolve conflicts of interest.</p> <p>Executives of new businesses established in the nuclear industry were informed about prioritized anti-corruption measures, including the industry-wide anti-corruption regulations to be implemented in the organizations. These measures covered executives in more than 80 innovative areas of business of more than 20 organizations in the nuclear industry.</p> <p><i>For details, see the section 'Prevention of Corruption and Other Offences'.</i></p>	
<p>11. Reputational risk</p> <p>↑</p> <p>(Communications Department of ROSATOM and executives of Divisions)</p>	Changes in stakeholder perception of the trustworthiness and appeal of the Corporation and its organizations	<p>Management approaches:</p> <ul style="list-style-type: none"> Measures are taken to shape a positive public opinion on the development of ROSATOM's technologies (both nuclear and non-nuclear) through improved information transparency and open stakeholder engagement (including the functioning of an industry-wide public reporting system); The Corporation works continuously to improve the recognition and appeal of its HR brand (both in the industry and among prospective employees and within the expert community); ROSATOM continuously monitors public opinion on NPP construction and information on the decisions of government and regulatory bodies on curtailment of the nuclear industry in the countries where the Corporation is implementing projects. It continuously monitors and analyses news reports in the national and international media and information obtained during business meetings, industry conferences and workshops. Industry executives are promptly informed about key developments in the media space in Russia and abroad; 	<p>1</p> <p>3</p>

Risks and changes in risk levels (risk owners)	Risk description	Risk management practices	Connection with strategic goals
		<ul style="list-style-type: none"> If it is reasonable to make changes to the schedule of NPP construction projects in Russia and abroad, the relevant decisions are agreed with all parties involved in the projects and are reflected transparently in communications with partners and other stakeholders (including the general public and local communities); Technical tours and media tours of Russian nuclear facilities are arranged for foreign media representatives; The Corporation maintains a presence on social media; ROSATOM's representatives participate in international industry exhibitions (including ATOMEXPO) as speakers/delegates; The Corporation publishes printed materials (brochures, leaflets) to raise public awareness about the nuclear power industry. <p>Results:</p> <p>Overseas projects are supported by government bodies. The main Russian nuclear industry exhibition, ATOMEXPO 2019, titled 'Nuclear for Better Life' was attended by over 4,000 specialists and experts from 74 countries worldwide. The findings of an opinion poll conducted in local communities near the construction site of Hanhikivi 1 NPP in Finland show that the level of public acceptance of the project increased from 73% to 75% in 2019 (the opinion poll was commissioned by Fennovoima and conducted by a Finnish company Norstat in November and December 2019). Between September and December, more than 10 scheduled public events were held in Turkey and received widespread positive coverage in the Turkish media (in Turkey, the Corporation is building Akkuyu NPP). According to an opinion poll by Levada-Centre, in 2019, 73.7% of the Russian population supported the use of nuclear power. Over the past few years, this figure remains persistently high. According to data in the Medialogia automated media monitoring and analysis system, in 2019, 95.4% of publications about the Corporation were positive or neutral. The Corporation received a number of prizes and awards in the sphere of personnel management. In March 2019, ROSATOM topped the Ranking of the Best Russian Employers compiled by HeadHunter.</p>	
<p>11. Reputational risk</p> <p>↑</p> <p>(Communications Department of ROSATOM and executives of Divisions)</p>			

Risks and changes in risk levels (risk owners)	Risk description	Risk management practices	Connection with strategic goals
		<p>A high level of transparency in ROSATOM is confirmed by the fact that it was included in the top groups in the sustainable development, corporate responsibility and reporting indices compiled by the Russian Union of Industrialists and Entrepreneurs (RSPP) for 2019 and that the quality of ROSATOM's public annual report was assessed as high (the report for 2018 was awarded 5 stars (the highest rating) in the annual competition held by the RAEX-Analytics agency).</p> <p>Systematic work initiated by ROSATOM to incorporate international sustainability principles and approaches into its operations and establish the relevant communication with stakeholders (via the corporate website, public reports, messages from senior executives, participation in specialized conferences, etc.) made an important contribution to strengthening ROSATOM's reputation.</p> <p>Changes: An increase in the risk level was due to its strong correlation with political risk. <i>For details, see the sections 'Stakeholder Engagement', 'Implementation of the HR Policy' and 'Public Reporting System'.</i></p>	
<p>12. Project risk</p> <p>○ (Executives of ROSATOM's Divisions)</p>	Changes in the macroeconomic indicators of countries participating in the projects; contractors' failure to fulfil their commitments with regard to the schedule and quality of work to be performed	<p>Management approaches:</p> <ul style="list-style-type: none"> ■ Improving project management practices; ■ Developing action plans for the interaction with foreign customers; ■ Concluding long-term contracts stipulating fixed electricity prices; ■ Developing standardized design solutions; ■ Implementing a programme to reduce the cost and duration of NPP construction; ■ Implementing measures forming part of the industry-wide approach to managing risks associated with NPP construction projects; ■ Reallocating available credit resources between projects, when possible; ■ Developing additive manufacturing, including a system of printing services and infrastructure for new digital production facilities; integrating the capabilities of ROSATOM's enterprises in the sphere of development and operation of digital production facilities (including based on the Virtual Printer digital platform), supply of 3D printers and the relevant materials, and construction and operation of additive manufacturing centres in Russia and abroad. 	<p>1</p> <p>3</p> <p>4</p>

Risks and changes in risk levels (risk owners)	Risk description	Risk management practices	Connection with strategic goals
		<p>Results: ROSTATOM continuously improves the system for managing all stages of NPP construction, from front-end engineering design to the commissioning of power units. The Corporation carries out quantitative risk assessment for NPP construction projects (using the Monte Carlo method). A pilot facility assembling 3D printers and producing components was put into operation.</p>	
<p>13. Climate risk</p> <p>○ (Executives of ROSATOM's Divisions)</p>	Adverse climate change/impacts of natural disasters on the operations of the Corporation and its organizations	<p>Management approaches:</p> <ul style="list-style-type: none"> ■ At the stage of NPP design, ROSATOM carries out a comprehensive assessment of risks associated with the climatic characteristics of the region where the proposed NPP construction site is situated; ■ Calculations performed as part of an assessment of external impacts take into account the climatic characteristics of the customer country and form part of a probabilistic safety assessment; ■ Industrial environmental control is performed to ensure that the operations of enterprises that make an impact on the environment comply with statutory limits and applicable environmental laws and regulations. <p>Results: Following the completion of engineering surveys, appropriate design solutions are adopted for each NPP construction project taking into account the climatic characteristics of the region where the NPP will be built. ROSTATOM makes sure that all its operations are environmentally safe; nuclear power generation facilities produce virtually no CO or CO₂ emissions, helping to maintain the natural ecological balance and reduce the likelihood of adverse climate changes or natural disasters.</p>	<p>1</p> <p>4</p>

OTHER RISKS

Social and regional risks (including the risk of epidemic outbreaks, etc.)

ROSATOM operates in a socially important sector of the economy. The Government of the Russian Federation makes a direct impact on ROSATOM's operations by financing individual federal projects and federal target programmes. As a result, ROSATOM and its organizations are characterized by a high level of financial stability sufficient to withstand the negative economic consequences of social and regional risks.

Licensing risks

ROSATOM has all necessary licences. Where necessary, the Corporation can promptly obtain licences for new businesses and renew existing licences.

Logistical risks

Regions in which the core operations of ROSATOM and its organizations are situated have well-developed infrastructure and transport links. ROSATOM's organizations implement preventive measures to ensure reliable supplies: they maintain emergency stocks of materials and equipment, organize exercises for emergency response and recovery teams and implement other measures to ensure the continuity of production and logistical processes.



8.2.4. RISK INSURANCE

Risk insurance is one of the main risk management approaches used by ROSATOM. To improve the reliability of insurance coverage, in 2019, the Corporation continued to cooperate with the insurance community on the reinsurance of Russian operators against property risks. A significant share of liability of Russian NPPs for potential nuclear damage was transferred for reinsurance to the international pooling system. This proves that the international nuclear insurance community acknowledges the

safety and reliability of Russian NPPs to be adequate. In-house insurance audits were conducted with assistance from experts of the Russian Nuclear Insurance Pool.

Key enterprises in the industry will continue to be audited for insurance purposes in 2020.



8.2.5. OBJECTIVES FOR 2020 AND FOR THE MEDIUM TERM

The Corporation has developed an action plan for 2020 covering the key areas of the Risk Management Development Programme for the period from 2019 through 2024. This plan takes into account both external factors related to the requirements of foreign customers (NPP construction on time and on budget) and Russian government bodies and internal factors (the need to build an efficient risk management system at ROSATOM that is aligned with global best practices).

The plan sets three key objectives for the development of risk management in the Corporation:

- To develop an automated risk assessment and management system, which will, among other things, enable the Corporation to maintain and update a knowledge base of typical risks and risk management measures;
- To develop the risk management expert community in the industry;
- To adopt procedures (including initial assessment) for managing risks associated with projects and programmes in the sphere of new business development.

8.3. PERFORMANCE OF GOVERNMENT FUNCTIONS

Key results in 2019

- The state defence order was 100% fulfilled.
- ROSATOM participated in the consideration of more than 400 bills.
- The government programme of the Russian Federation 'Development of the Nuclear Power and Industry Complex' was updated for the period until 2027.
- Overall performance against the targets set in the government programme of the Russian Federation 'Development of the Nuclear Power and Industry Complex' in 2019 was assessed at 99.73%.

8.3.1. PERFORMANCE OF THE NUCLEAR WEAPONS DIVISION (NWD)

In 2019, all targets set as part of the state defence order were achieved. ROSATOM's enterprises conducted research and development.

A digitization strategy was developed for the NWD; it is aligned with ROSATOM's Uniform Digital Strategy.

In order to improve the performance of the NWD, a financial and economic planning section was developed as part of the KAM-IZ-GAMMA information system, making it possible to gather information from NWD organizations and update it in real time to enable prompt managerial decision-making.

OPERATIONS IN THE CIVILIAN SECTOR

In 2019, the Division continued to expand the production of high-technology civilian products. Projects to diversify manufacturing operations of the NWD are focused on prioritized areas of development of the Russian economy and are implemented in those segments where ROSATOM's organizations have the relevant competences, technological capabilities and access to markets.

The construction of Russia's largest centre for irradiation technology was completed; it is now being prepared for commissioning. Its capacities will be used for polymer modification, sterilization of single-use medical supplies, food products, etc.

Preclinical trials of a 40 W medical thulium laser were successfully completed. A mock-up of a 100 W laser for fragmenting kidney stones was designed and successfully tested.

In 2019, consolidated revenue from other products of the NWD totalled RUB 81.9 billion.

See also the section 'Business Diversification'.

8.3.2. LAW DRAFTING

A landmark event in 2019 was the adoption of Federal Law No. 225-FZ of July 26, 2019 on Amendments to the Federal Law on Industrial and Consumer Waste and the Federal Law on State Atomic Energy Corporation Rosatom. The new law expanded the scope of ROSATOM's jurisdiction and assigned it additional powers and functions in the sphere of hazard class 1 and 2 waste management.

Another important milestone in the reporting year was the adoption of Federal Law No. 81-FZ of May 1, 2019 on Amendments to Article 7 of the Federal Law on State Atomic Energy Corporation Rosatom Regarding Its Authority to Inspect Design Documentation of Nuclear Facilities under Construction Outside the Russian Federation and the Outcomes of Engineering Surveys Conducted for the Preparation of Such Design Documentation. This federal law granted ROSATOM additional powers, thus closing a gap in the sphere of regulation of construction of nuclear facilities abroad and enhancing control over construction projects involving the use of funds allocated from the budgetary system of the Russian Federation.

As in previous years, the Corporation took an active part in the drafting and legal support of federal bills affecting its operations and the operations of its organizations in various areas (the use of nuclear energy, industrial safety, standardization, metrology, government support for business operations in the Russian Arctic, government regulation of prices (tariffs) and transformation of the legal framework regulating natural monopolies, addressing issues related to the location of wind turbines, etc.).

Overall, in 2019, the Corporation reviewed over 400 bills.

ROSATOM took an active part in the reform in the sphere of supervision and control (the so-called 'regulatory guillotine'), which is designed to improve security and remove excessive administrative burden on businesses. The Corporation also contributed to the codification of legislation on administrative offences by participating in the drafting of a new version of the Code of Administrative Offences of the Russian Federation.

8.3.3. GOVERNMENT PROGRAMME 'DEVELOPMENT OF THE NUCLEAR POWER AND INDUSTRY COMPLEX'

In 2019, the government programme of the Russian Federation 'Development of the Nuclear Power and Industry Complex' was being implemented. In the reporting year, the government programme was updated for the period until 2027⁴². Amendments to the programme include the parameters of a comprehensive programme titled 'Development of Technical Capabilities, Technology and Scientific Research in the Use of Nuclear Energy in the Russian Federation until 2024', which is being developed by ROSATOM. The measures and deliverables of this programme are aligned with the national goals and strategic development objectives of Russia stipulated in Decree No. 204 of the President of the Russian Federation dated May 7, 2018.

Overall performance under the government programme 'Development of the Nuclear Power and Industry Complex' was assessed at 99.73%. This assessment takes into account progress on measures scheduled for 2019 and the amount of budgetary and extra-budgetary financing used for implementing the measures stipulated in the government programme.

8.3.4. IMPLEMENTATION OF FEDERAL TARGET PROGRAMMES

In 2019, ROSATOM's enterprises and organizations implemented measures forming part of three federal target programmes (FTPs).

To implement the FTPs (included in the part of the federal budget on which information is publicly available), ROSATOM raised financing totalling RUB 34,414.2 million, including RUB 16,567.6 million from the federal budget and RUB 17,846.6 million from extra-budgetary sources.

8.3.5. STATE PROPERTY MANAGEMENT AND RESTRUCTURING OF NON-CORE ASSETS

In 2019, the Russian Federation registered its title to 50 items of real property (buildings and structures).

99 non-core items of real property owned by joint-stock companies in which ROSATOM has a shareholding exceeding 25% were restructured (sold or liquidated). The relevant economic benefits totalled RUB 1.4 billion.

275 non-core assets owned by joint-stock companies in which ROSATOM has a shareholding totalling less than 25% and by companies whose shares are held by ROSATOM on behalf of the Russian Federation were restructured (sold, liquidated or transferred free of charge to the government and municipalities). The relevant economic benefits totalled RUB 4 billion.

⁴² <https://www.rosatom.ru/upload/iblock/fff/fffa4ecb6c37863edd2b510d2bbfd62f.pdf>.

8.4. FINANCIAL AND INVESTMENT MANAGEMENT

Key results in 2019

- The investment programme was 75% completed.
- Return on the investment portfolio stood at 11.3%.
- A total of RUB 37.1 billion was saved through intra-group financing between 2010 and 2019.

8.4.1. FINANCIAL MANAGEMENT

IMPLEMENTATION OF ROSATOM'S FINANCIAL STRATEGY

Given the scale of ROSATOM's business in Russia and abroad, the Corporation's management attaches special importance to the financial sustainability of nuclear organizations in a changing environment. The financial strategy is an integral part of ROSATOM's overall business strategy. Its main goal is to ensure the financial sustainability of ROSATOM and its organizations and to maximize the efficiency of financing and financial risk management.

ROSATOM's key financial transactions have been centralized. Cash flow management is centralized through:

- A single industry-wide legal framework regulating financial management (including the Uniform Industry-Wide Financial Policy);
- Vertical integration of treasury departments in subsidiaries and affiliates, which are functionally accountable to the Treasury Department of ROSATOM. The established treasury structure enables 100% control of funds in the industry;
- Concentration of principal treasury functions of nuclear organizations in the Treasury Department of ROSATOM, which communicates with nuclear organizations in a shared information space and is essentially a liquidity management centre;
- An industry-wide automated system for recording treasury transactions (the Corporate Settlement Centre Information System), which enables the recording of all treasury transactions across the Corporation on a daily basis.

Targets for 2019 in the sphere of cooperation with banks, development of the cash pool and debt management set out in the financial strategy have been achieved.

In order to improve the performance of the treasury functions, in 2019, the Corporation continued to work towards:

- Accumulating spare cash in the accounts of pool leaders⁴³;
- Improving the accuracy of payment scheduling (a rolling liquidity forecast);
- Maintaining a competitive cost of servicing of the consolidated debt portfolio;
- Centralizing treasury transactions (complying with the financial policy);
- Using project financing instruments as part of project implementation by the Corporation and its organizations.

In 2019, ROSATOM continued to work towards further centralization of the treasury function, including the development of a Payment Factory at JSC Atomenergoprom. This project is aimed at improving the performance of the treasury function in the industry.

⁴³ A pool leader is an organization of the Corporation on whose accounts spare cash is accumulated and subsequently redistributed between ROSATOM's organizations through loan agreements. The organization performing the functions of a pool leader is appointed under the resolution of ROSATOM's executive bodies.

RECEIVING AND MAINTAINING CREDIT RATINGS

In the reporting year, JSC Atomenergoprom continued to take measures to maintain credit ratings assigned by the 'Big Three' international rating agencies (S&P, Moody's Investors Service and Fitch Ratings) and the national rating agency, JSC Expert RA.

As at December 31, 2019, JSC Atomenergoprom was rated at the level of Russia's sovereign credit ratings:

- BBB-/A-3 with a stable outlook by S&P;
- BBB with a stable outlook by Fitch Ratings;

- Baa3 with a stable outlook by the Moody's Investors Service international rating agency;
- ruAAA with a stable outlook by the national rating agency, JSC Expert RA.

In addition, in the reporting year, the Analytical Credit Rating Agency (ACRA) assigned the Corporation the highest credit rating, AAA (RU), with a stable outlook.

RAISING FINANCING FOR DAY-TO-DAY OPERATIONS AND FOR PROJECTS

In 2019, the average interest rate on ROSATOM's total debt portfolio denominated in Russian roubles was maintained below 8.4%. Throughout 2019, the Corporation maintained sufficient liquidity or sources of liquidity (credit facilities, etc.) to repay liabilities on time, preventing unacceptable losses and reputational risk.

The Corporation continued to use suretyship to secure obligations of organizations in the industry to their counterparties. This measure helps to reduce both the cost of bank guarantees and the cost of financing raised by ROSATOM (including interest expenses).

JSC AtomCapital (a wholly owned subsidiary of the Corporation acting as a pool leader in intra-group financing of FSUEs) enabled an optimal debt burden distribution between JSC Atomenergoprom and organizations and enterprises outside its scope.

In the reporting year, the Corporation continued to search for sources of financing for projects in traditional and new business areas.

Wind power

The limit under a credit facility agreement with JSC Gazprombank was increased by RUB 5.5 billion to RUB 69.7 billion as part of a project finance arrangement for the construction of a wind farm with installed capacity totalling 660 MW.

BOO projects

Independent advisors were engaged to conduct comprehensive due diligence for the Hanhikivi 1 NPP construction project.

Loan and collateral documents worth a total of USD 400 million were signed with PJSC Sberbank as part of the Akkuyu NPP construction project. The Corporation continued to take steps to obtain guarantee support for the project: agreement with Bpifrance on export credit support was formalized in the outcome document of the 25th session of the Franco-Russian Economic, Financial, Industrial and Trade Council (CEFIC) held in December 2019.

Concession projects in the utilities sector

A project finance arrangement was implemented as part of a project to renovate water supply and sewerage systems in the town of Lesnoy (Sverdlovsk Region). The acquisition of a shareholding in LLC RIR-Lesnoy by PJSC Sovcombank was closed; the bank also acts as the lender under the deal.

Multipurpose fast neutron reactor

A target scenario for sources of financing was prepared using the tools of the VEB.RF Project Finance Factory. A syndicate comprising VEB.RF and JSC Gazprombank was selected as the financial partner of the project; their participation was approved by the VEB.RF Supervisory Board.

Industrial waste

A target financing structure was developed for the Infrastructure for the Management of Hazard Class 1 and 2 Waste Federal Project and commercial projects forming part of ROSATOM's strategic programme for industrial and consumer waste management.

Northern Sea Route

The Government of the Russian Federation issued decrees on providing subsidies from the federal budget for the construction of the third and fourth follow-on icebreakers and budget investment in the construction of the flagship icebreaker, Lider. An interdepartmental group on the financing of the nuclear-powered icebreaker fleet approved an approach to the financing of Lider-class follow-on nuclear icebreakers under a federal concession model.

Nuclear medicine

A provisional financing structure was developed jointly with VEB.RF for the construction of a nuclear medicine centre on Rusky Island (Primorsky Territory) and a radiology department building including a positron emission tomography centre in Irkutsk.

In 2019, the Ministry of Industry and Trade of Russia approved corporate competitiveness improvement programmes (CCIPs) for a number of ROSATOM's organizations (JSC AECF, PJSC ZiO-Podolsk, JSC NovaWind). Organizations implementing CCIPs are granted access to preferential government loans.

MAKING THE RUSSIAN NUCLEAR INDUSTRY MORE ATTRACTIVE TO INVESTORS

In 2019, ROSATOM continued to take steps towards making the Russian nuclear industry more attractive to investors, engaging strategic investors in NPP construction projects in Russia and abroad, maintaining relationships with existing investors and lenders, and establishing relationships with and setting limits on credit facilities in new banks.

Cooperation agreements were signed with financial institutions on the sidelines of business forums (the 2019 Saint Petersburg International Economic Forum, the Sochi Investment Forum, etc.); the agreements covered projects and digitization initiatives being implemented by ROSATOM and its organizations.

During the year, ROSATOM organized visits to Leningrad NPP-2, which is currently under construction, and the construction site of the Adygea Wind Power Plant for representatives of Russian and foreign banks.

A round-table session titled 'Investment in Sustainable Development: Opportunities and Challenges' was held as part of the ATOMEXPO 2019 International Forum.

The Corporation continued to promote financial and non-financial support instruments offered by JSC Russian Export Centre in the industry (including holding regular working group meetings attended by representatives of JSC Russian Export Centre and ROSATOM's organizations).

PLANS FOR 2020 AND FOR THE MEDIUM TERM

- To roll out the Payment Factory project;
- To ensure a consistent payment discipline for intra-group financing;
- To improve the accuracy of medium-term cash flow planning;
- To prevent internal competition for credit resources between organizations;
- To continue to centralize cash management;
- To focus on maintaining relations with supporting banks as the most reliable partners providing accessible funds in terms of both volumes and cost;
- To fulfil all obligations (including covenants) to lenders and rating agencies;
- To discuss project financing arrangements to reduce recourse on ROSATOM and minimize the use of the Corporation's consolidated investment resources (including through the use of project financing instruments);
- To expand the use of financing instruments in order to reduce the cost of debt service and ensure timely and full financing of the investment programme of organizations in the industry (provided it is economically feasible to do so);
- To discuss potential areas of cooperation in the sphere of digitization with credit institutions.

8.4.2. INVESTMENT MANAGEMENT

APPROACHES TO INVESTMENT MANAGEMENT

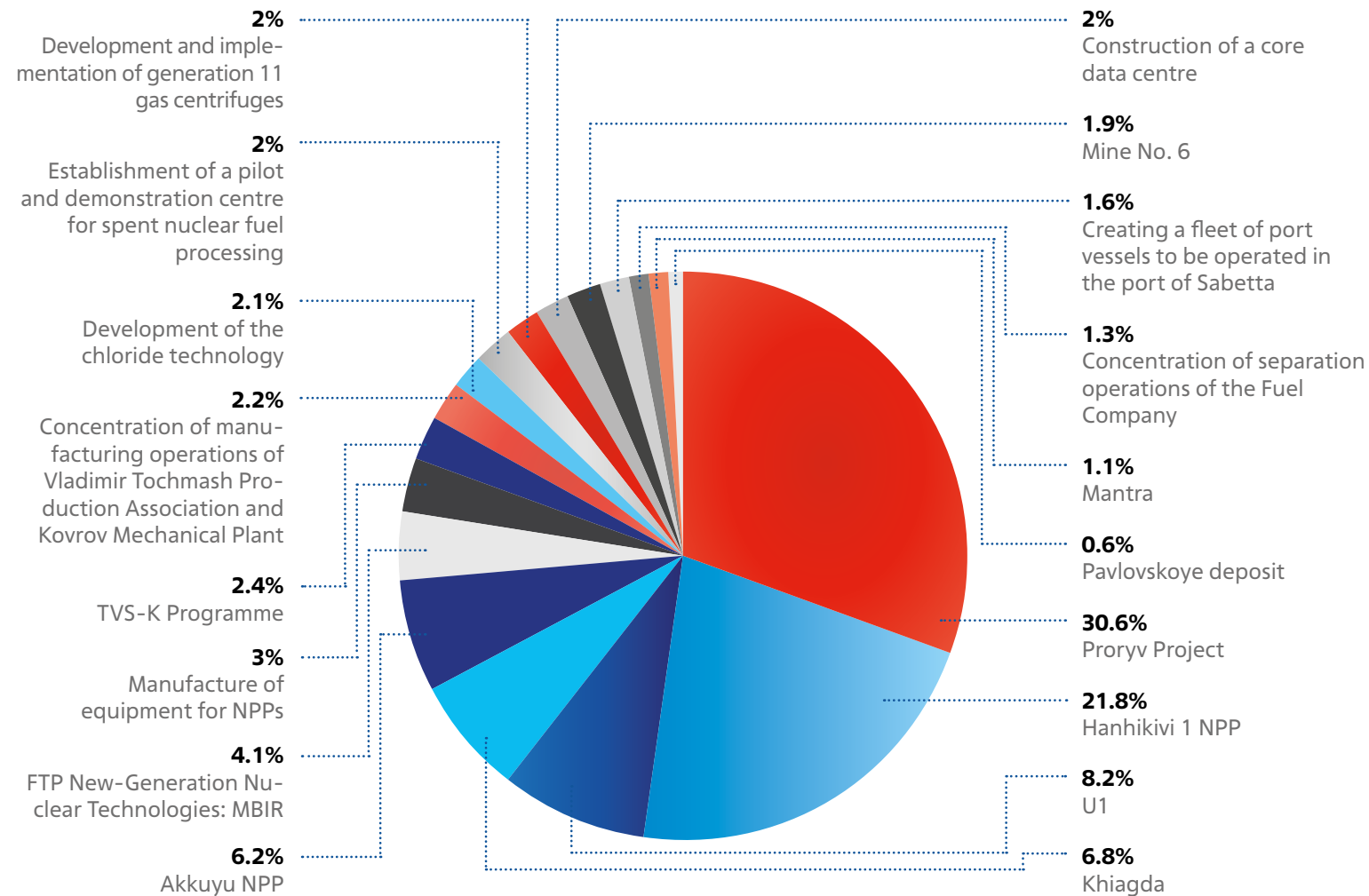
- A distributed system has been built for investment decision-making by the governing bodies of ROSATOM and its organizations; it is aligned with the distribution of competence centres in the industry;
- Decisions on key milestones of important projects are made and the projects are monitored at the level of the Corporation;
- Investment decisions related to day-to-day operations of assets are delegated to ROSATOM's organizations;
- To improve the quality of investment decision-making, opinions of experts independent from the project initiator are taken into account;
- Investment infrastructure is based on an 'open innovation' model, which involves searching for ideas and projects outside the industry (through a business accelerator and a venture capital fund);
- ROSATOM's project portfolio is built as a set of projects of organizations in the industry for a year and for the medium term based on available investment resources and the required rate of return;
- Investments in new businesses (including through investment infrastructure based on the 'open innovation' model) are managed using the same approach as for venture capital management;
- A phase-gate approach is used in the course of project implementation;
- Experts are engaged to perform an in-depth probabilistic risk analysis for significant projects; the findings of analysis are incorporated in the decision-making system;
- A comprehensive audit is conducted, which helps to formulate recommendations on how to improve project planning and implementation;
- ROSATOM is developing approaches to raising financing as an alternative to using its own funds.

RESULTS IN 2019

In 2019, ROSATOM's investment programme was 75% completed⁴⁴. The investment programme was not implemented in full (including in ROSATOM's Divisions) due to the deferral of financing for certain projects to subsequent reporting periods.

Return on ROSATOM's investment portfolio as a whole stood at 11.3%, while return on the portfolio excluding unprofitable projects (projects that do not produce economic benefits) reached 29%.

BREAKDOWN OF INVESTMENTS IN SIGNIFICANT PROJECTS⁴⁵



⁴⁴ Including the investment programme of JSC Rosenergoatom.

⁴⁵ Apart from NPP construction in Russia. For details on the projects, see the sections 'Mining Division', 'Fuel Division', 'Power Engineering Division', 'Business Diversification', 'Research and Innovations', 'International Business', 'RAW and SNF Management and Decommissioning of Facilities Posing Nuclear and Radiation Hazards', the chapter 'Development of the Northern Sea Route' and appendices to the Report on the performance of the Divisions.

OPERATIONS OF THE INDUSTRY VENTURE CAPITAL FUND

ROSATOM operates a venture fund, Digital Evolution Ventures, founded by JSC Atomenergoprom and LLC Orbita Capital Partners. The fund focuses on developing new businesses in promising sectors of the Russian and global economy.

Since the establishment of the fund, ROSATOM's Investment Committee has reviewed 18 high-technology projects, 5 of which (in such areas as Energy Storage Systems, the Smart City, Digital Medicine and Artificial Intelligence) have been provided with funding. A list of about 150 promising projects worth a total of more than RUB 4 billion has been compiled.

MEASURES TO IMPROVE INVESTMENT EFFICIENCY

In the reporting year, the Corporation updated the Comprehensive Programme of Measures to Improve the Maturity of Project Management in ROSATOM and Its Organizations.

Employees in the industry continued to develop their competences at the Project Management School. 577 people underwent assessment and subsequent training in 2019.

Challenges	Mitigation measures
<p>CHALLENGES IN THE REPORTING PERIOD AND MITIGATION MEASURES</p> <p>Slow processes in the sphere of new business development</p> <p>Organizational environment that is not conducive to the implementation of digitization projects</p> <p>Lack of R&D integration with business initiatives</p>	<ul style="list-style-type: none"> Decentralization of the decision-making system through an expansion of the divisions' powers Reducing the number of approvals and decision-making bodies, which will make it possible to speed up the launch of new businesses and reduce the load on the management Simplifying project formats; gathering best practices for the preparation of materials for investment decision-making bodies and communicating these practices to project teams Adapting the decision-making system for digitization projects; establishing the Quick Start Committee for investing in ideas with a budget totalling less than RUB 10 million Adopting a 'one-stop-shop' approach to all investment decisions concerning the Corporation's scientific research efforts (a Council for Investing in Scientific Projects has been formed; its powers were delineated from those of other collective bodies responsible for innovation management) Increasing the level of maturity of investment and project management in the industry Preparing methodological guidelines for expert assessment of technological maturity of projects <p>See also the section 'Research and Innovations'.</p>

PLANS FOR 2020 AND FOR THE MEDIUM TERM

- To develop project methodology on a systematic basis;
- To implement the Comprehensive Long-Term Programme of Measures to Improve the Maturity of Project Management in ROSATOM and Its Organizations;
- To form business partnerships in order to develop technologies, research and technological capabilities in ROSATOM and its organizations;
- To digitize projects and investment activities.

8.5. ROSATOM PRODUCTION SYSTEM

Key results in 2019

- The status of an RPS Leader was given to 33 enterprises in the industry.
- 45 RPS benchmarks were created across various types of manufacturing operations.
- ROSATOM developed a new product, Lean Smart City.
- The Lean Polyclinic project was included in the Development of the Primary Healthcare System Federal Project.
- The Governors' Club and the Russian Production Systems Partnership were established.

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 are instrumental in achieving one of the Corporation's strategic

goals: to reduce the production cost and the lead time by identifying and eliminating all types of losses in manufacturing enterprises and in offices and by improving the performance of each employee.

8.5.1. RESULTS IN 2019

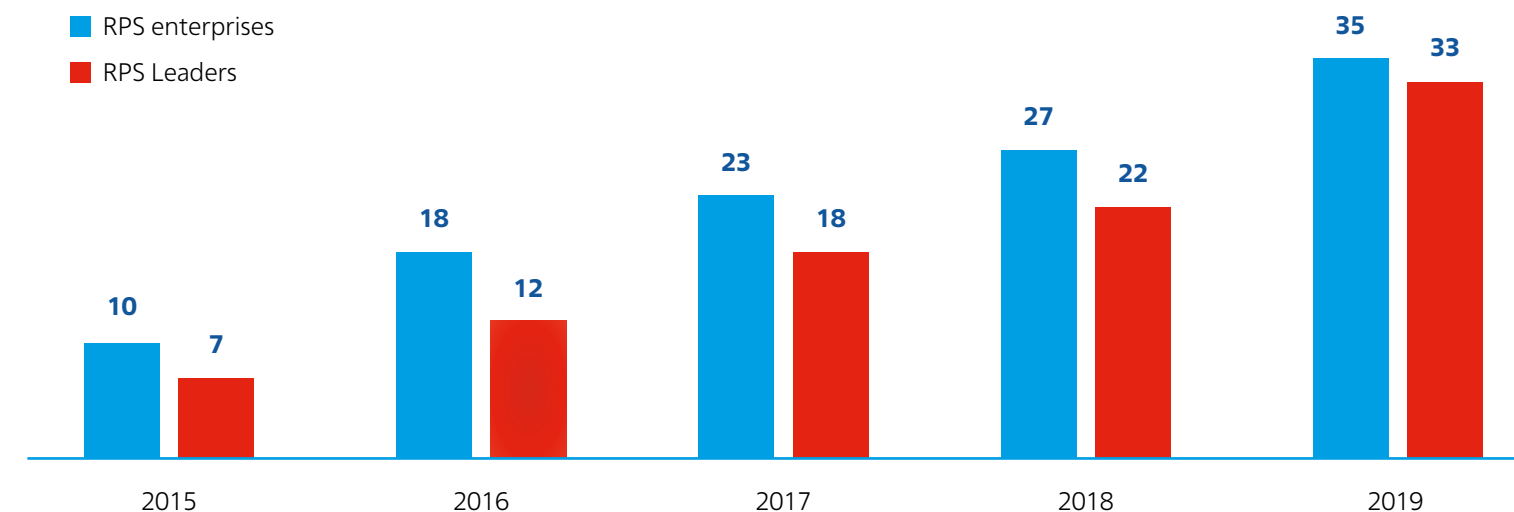
RPS ENTERPRISES

Since 2015, RPS has been rolled out systematically across enterprises in the industry: goals are decomposed to the level of area supervisors; the manufacture of an enterprise's core products (production flows) is optimized; RPS projects are implemented; training is provided for employees, and incentive systems are being developed.

In 2019, 35 enterprises were included in the scope of RPS roll-out, with 33 enterprises given the status of an RPS Leader. In order to obtain or confirm the status of an RPS Leader, in 2019, enterprises needed to achieve business goals set by ROSATOM and successfully undergo a peer quality review aimed at promoting development, which involved assessing the RPS benchmark created by an enterprise, its supplier development project and progress in the introduction of RPS engineering.

According to the RPS development concept, all enterprises participating in the systematic roll-out of the system are divided into three levels: RPS Leaders, RPS Candidates and RPS Reserve. RPS Leaders are provided with a package of privileges: a business coach makes on-site visits; employees are offered an opportunity to take business trips to leading foreign and Russian enterprises to share their experience; holiday packages are offered to employees' families; employees receive vouchers for training at ROSATOM's Corporate Academy, participate in the Workspace Design project, etc.

CHANGES IN THE NUMBER OF RPS ENTERPRISES IN THE INDUSTRY



RPS BENCHMARKS

An RPS benchmark is a processing stage or a process in the process flow for a key product of ROSATOM's organization that has achieved the level of global best practices in production engineering. The Corporation tasks its enterprises with creating RPS benchmarks that could be used as a basis for training in the ROSATOM Production System for both employees in the industry and the country as a whole.

In 2018 and 2019, 45 RPS benchmarks were created by ROSATOM's RPS enterprises across 16 types of manufacturing operations. The creation of each benchmark was preceded by at least five to seven years of preparatory work. In 2019, the main focus was on improving the benchmarks to make sure that they reach a 'perfect' state. At the next stage, the main task will be to create a benchmark product flow.

RPS ENGINEERING

In 2019, RPS engineering standards were being introduced at construction sites of 22 enterprises in the industry. Highlights

In order to reduce the cost and duration of NPP construction, in 2019, 34 RPS enterprises were taking active steps to assist the development of their suppliers. In addition, ROSATOM is implementing a supplier development programme as part of participation in the National Project to Improve Labour Productivity and Support Employment.

of the year included the creation of a benchmark titled 'Operational Management of the Kursk NPP-2 Construction Schedule'.

INTRODUCTION OF LEAN TECHNIQUES IN RUSSIA'S SOCIAL SECTOR AND INDUSTRY

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

National Project to Improve Labour Productivity and Support Employment

As part of the national project, in 2019, labour productivity improvement tools were introduced in 40 Russian enterprises. In 2020, ROSATOM will continue to collaborate with 20 enterprises and will start to cooperate with 10 new enterprises.

Efficient Region


The project was underway in 19 regions, including six regions where ROSATOM's enterprises are located. Active work was underway at more than 1,200 facilities: 140 adult outpatient clinics, 155 children's outpatient clinics, 25 inpatient clinics, 3 healthcare centres, 100 multi-service centres, 28 employment agencies, 140 regional ministries and more than 500 facilities in other sectors. More than 6,500 projects were implemented as part of 22 social and economic initiatives. 14 projects were presented by the regions as ready-made RPS benchmarks. One of them, the Employment Agency of the Belgorod Region, was recognized as a federal-level benchmark and became the first national centre for sharing best lean production practices.

Lean Smart City

In 2019, ROSATOM developed a new product, Lean Smart City, which integrates the principles and tools of the ROSATOM Production System and the Smart City platform to support the development of municipal and regional administration systems. Letters of intent with regard to the implementation of the Lean Smart City project were signed with 18 'nuclear' towns and cities. A standardized methodology was developed for the implementation of the Lean Smart City project, with the pilot initiative im-

In 2019, a project was implemented in the Nizhny Novgorod Region to optimize the process of providing proper nutrition for babies aged under three years through special facilities dispensing baby formula. The aim of the project was to promote effective cooperation between the Ministry of Health, the Ministry of Social Policy and the administration of Nizhny Novgorod. As a result of the project, the amount of time required to complete the paperwork necessary for receiving subsidies was reduced from 23 to 9 days, while the number of visits to the relevant institutions was reduced from nine to two.

Another project, which was implemented by the Ministry of Sports of the Nizhny Novgorod Region and was aimed at optimizing individual rehabilitation programmes, enabled a 20% increase in the number of people who completed the rehabilitation process, while the amount of time spent on paperwork was reduced from two months to two weeks.



plemented in Sarov serving as a benchmark; under this methodology, project teams in 11 towns and cities underwent training, and more than 60 RPS projects were launched.

See also the section 'Developing the Regions of Operation'.

Lean Polyclinic

In 2019, the project was included in the scope of the Development of the Primary Healthcare System Federal Project, which forms part of the Healthcare National Project. The Federal Project is aimed at optimizing the work of primary healthcare institutions and ensuring their optimal availability to the population.

In the reporting year, Russian healthcare institutions implemented more than 18,500 improvement projects, with methodological support provided by ROSATOM. Criteria were developed for a new model of primary healthcare institutions, and a system for verifying conformity with these criteria was being developed in cooperation with the Ministry of Health.

See also the section 'Developing the Regions of Operation'.

Russian Production Systems

In 2019, the Russian Production Systems Partnership was formed. It was joined by ROSATOM, JSC Russian Railways, State Space Corporation ROSCOSMOS, PJSC Rostelecom and other leading Russian industrial and technology companies. The aim of the partnership is to promote cooperation and the development

of production systems. In the reporting year, joint projects were launched, and peer audits were conducted, followed up with recommendations for development. A shared knowledge base on projects and techniques was put into operation, and members of the Partnership started to share experience in the development of suppliers and regions of operation.

8.5.2. PLANS FOR 2020

In 2020, 36 enterprises will be included in the scope of RPS roll-out. The key task will be to replicate the experience of RPS benchmarks and share best practices through Shop Floor Clubs.

As part of the Efficient Region project, work will be continued to create benchmarks across all aspects of the economy and the social sphere in the regions. The level of development of the benchmarks will be assessed, and methodological guidelines will be developed for the roll-out of best practices. It is intended that horizontal 'ministers' clubs' will be formed in the regions in various industries in order to consolidate resources and accumulated experience in the sphere of performance improvement.

In the sphere of healthcare, the main task will be to provide support and methodological guidance to the project office of the Russian Ministry of Health. Work on the new model of primary healthcare institutions will be focused primarily on cooperation with the Federal Biomedical Agency of Russia in 'nuclear' towns and cities.

In addition, ROSATOM plans to assist the Ministry of Labour and Social Protection and the Pension Fund of the Russian Federation in the adoption of lean practices.

8.6. PROCUREMENT MANAGEMENT

Key results in 2019

- Overall savings from competitive procurement procedures (using ROSATOM's own funds and federal budget funds) totalled RUB 36.45 billion.
- The share of electronic procurement (excluding procurement for foreign projects) totalled 99%.
- 40,196 contracts worth a total of RUB 128 billion were concluded with small and medium-sized enterprises, with the value of contracts concluded based on the results of procurement procedures held exclusively among small and medium-sized enterprises totalling RUB 56.1 billion.
- Pursuant to the order of the Prime Minister of Russia to disclose information on counterparties, ROSATOM disclosed information on 17,585 counterparties (100%).

The Uniform Industrial Procurement Standard (UIPS) (the Regulations on Procurement) is the main document that regulates the procurement activities of ROSATOM and organizations in the industry.

Governing and supervisory bodies in the sphere of procurement:

- Central Procurement Commission;
- Permanent procurement commissions of the Divisions;
- Contract management function (for procurement using federal budget funds in accordance with the Federal Law on the Contract System of the Federal and Municipal Procurement of Goods, Work and Services (Law No. 44-FZ));
- Central Arbitration Committee of ROSATOM and arbitration committees of the Divisions;
- Chief Controller.

Official procurement website: <http://www.zakupki.rosatom.ru/en/>.

ROSATOM ranks high in professional procurement rankings every year. For instance, in 2019, the Corporation:

- Topped the National Transparency Ranking in the Guaranteed Transparency Category;
- Topped the first Russian ranking of procurement professionals (procurement officers) compiled by the AK&M Information Agency;
- Was included in the top 5 in the ranking of procurement officers in the Best Chief Procurement Officer category by RAEX Analytics;
- Topped the ranking of loyalty of major customers to small and medium-sized enterprises compiled by JSC Russian Small and Medium Business Corporation and the Agency for Strategic Initiatives in a special category.

8.6.1. IMPLEMENTATION OF THE ANNUAL PROCUREMENT PROGRAMME⁴⁶

In 2019, the demand of nuclear organizations for products with the required price and quality was met in full.

ROSATOM and its organizations made 36,458 competitive purchases worth a total of RUB 701.9 billion using their own funds. The Corporation achieved savings totalling RUB 36.1 billion (7.6%

⁴⁶ The annual procurement programme is publicly available at <https://zakupki.rosatom.ru/en/Web.aspx?node=gpzz>.

of the value of completed purchases); overall, over the past ten years, savings totalled RUB 281 billion.

495 competitive purchases worth a total of RUB 121 billion were made by ROSATOM using federal budget funds. Savings on procurement activities totalled RUB 0.35 billion (0.29% of the value of completed purchases)⁴⁷.

As a result of the implementation of the annual procurement programme, contracts were concluded with 20,992 counterparties. The share of electronic procurement (excluding procurement for foreign projects) totalled 99%.

Indicator	2017	2018	2019
VALUE OF COMPETITIVE PURCHASES AND ACHIEVED SAVINGS⁴⁸, RUB BILLION			
Total value of procurement orders placed under an open competitive procedure	544.51	683.48	822.9
Using ROSATOM's own funds	523.50	663.16	701.9
Using federal budget funds	21.01	20.32	121
Total savings, including:	38.37 (8.71%)	28.86 (6.2%)	36.45 (6.1%)
Savings from competitive procurement procedures using ROSATOM's own funds	36.69 (8.7%)	28.5 (6.4%)	36.1 (7.6%)
Savings from competitive procurement procedures using federal budget funds	1.68 (9%)	0.36 (1.9%)	0.35 (0.29%)

8.6.2. EXPANSION OF ACCESS TO PROCUREMENT PROCEDURES FOR SMALL AND MEDIUM-SIZED ENTERPRISES (SMES)

In 2019, ROSATOM's organizations concluded 40,196 contracts with SMEs worth a total of RUB 128 billion, with the value of contracts concluded following tendering exclusively among SMEs totalling RUB 56.1 billion. The target share of procurement from SMEs stipulated for state-owned corporations by law (no less than 18%) was achieved.

In 2019, 20 workshops were held for SMEs in 20 Russian cities in cooperation with JSC Russian Small and Medium Business Corporation. They were attended by representatives of 1,701 SMEs. Overall, between 2016 and 2019, 43 workshops were held and were attended by representatives of 4,048 SMEs.

Pursuant to an order of the Russian Government, in the reporting year, three operators of electronic trading platforms were selected for procurement from SMEs: JSC United Electronic Trading Platform (Roseltorg), JSC ETS (NEP) and CJSC Sberbank ATS.

⁴⁷ Taking into account open competitive procurement procedures conducted and orders placed using the funds allocated through the Russian Ministry of Industry and Trade pursuant to Law No. 44-FZ.

⁴⁸ Savings from competitive purchases are the difference between the set initial maximum purchase price and the purchase price obtained as a result of competitive tendering. Only completed procurement procedures were taken into account.

8.6.3. DATA RELIABILITY AUDITS

In 2019, 328 data reliability audits were conducted among manufacturers, contractors and service companies:

- 288 enterprises successfully passed the audit;
- 22 enterprises failed the audit;
- 18 enterprises refused to undergo an audit.

Data reliability audits help to increase the share of contracts performed on schedule.

In 2019, the ATOMEX Regional Forum of Nuclear Industry Suppliers was held in Volgodonsk (Rostov Region), Ulan-Ude (Republic of Buryatia), Izhevsk (Udmurt Republic) and Saint Petersburg.



8.6.4. IMPROVEMENT OF FOREIGN PROCUREMENT PROCESSES

In 2019, ROSATOM reviewed global experience in contract management. Following this review, pilot projects were implemented to adopt global practices and adapt them to business processes in the industry.

In 2019, lists of additional requirements for products to be supplied and organizations to be engaged were compiled for the Tianwan NPP and Xudabao NPP construction projects in China. These materials were made publicly available on ROSATOM's procurement website; they will enable potential suppliers to study examples of requirements for overseas NPP construction projects in advance.

ROSATOM actively participated in finalizing an interactive manual on supply chain management prepared by the IAEA, which incorporates quality assurance tools and procurement systems used in the industry.

In the reporting year, a methodology for developing contract strategies for overseas NPP construction projects was approved. The use of this methodology will help to reduce the number of lots to be purchased by consolidating them, which will stimulate interest from leading market players and will enable ROSATOM to monitor the fulfilment of obligations by subcontractors. In addition, it will be possible to develop a contracting approach and a construction schedule taking into account the needs of the customer country, external conditions and restrictions affecting the project (including local content requirements) as early as at the pre-contract stage.

order to reduce the lead time and improve product quality. By the end of 2019, more than 9,000 users in 827 organizations of ROSATOM had been connected to the system.

8.6.5. DIGITIZATION OF PROCUREMENT ACTIVITIES

In 2019, the first stage of development and introduction of ROSATOM's Unified Industry-Wide Quality Management System, UIS-Quality, was completed. The system is designed for automating assessment and irregularity management processes in

8.6.6. TRAINING AND DEVELOPMENT IN THE SPHERE OF PROCUREMENT

The Procurement, Logistics and Quality School continued to function as part of ROSATOM's Corporate Academy. In 2019, more than 2,000 applications for training and more than 5,000 applications for testing were received. The first wave of testing was completed, which involved 1,900 people taking tests. Based on the results of the tests, 40% of employees were issued with certificates of competence, while the rest were enrolled on refresher training courses in the relevant subject areas.

In the reporting year, the Procurement Assistance Portal information system was rolled out in all of ROSATOM's organizations. It enables employees to continuously gather information on existing and emerging issues without sending official letters. ROSATOM started to develop an integrated knowledge base on procurement on this platform.

In 2019, ROSATOM and its Divisions continued to develop the Qualified Buyer Service. The Service performs the full range of procurement activities, from the identification of needs to the conclusion of contracts. This has enabled a transformation of the entire procurement cycle and a reduction in procurement lead time: in 2019, the lead time was reduced by 30%.



The Corporation organized an annual industry-wide conference on procurement, logistics and quality, which was attended by 280 employees from 150 organizations in the industry.

8.6.7. PLANS FOR 2020 AND FOR THE MEDIUM TERM

- To develop the Qualified Buyer Service, including establishing similar functions in organizations in the industry;
- To create a single information space for communication between customers and suppliers covering the entire procurement cycle, from the identification of needs to the performance of contracts, including the integration of local modules, industry-wide and national systems, globalization of data, wider use of electronic document management in procurement, and the use of robots to reduce the amount of time and effort spent on routine operations;
- To develop contract strategies for ROSATOM's overseas projects based on the methodology developed in 2019;
- To develop the Procurement, Logistics and Quality School (to develop new training programmes and improve the training system as a whole);
- To contribute to developing Russian legislation on procurement activities.

8.7. INTERNAL CONTROL SYSTEM

Key results in 2019

- ROSATOM topped the ranking of chief federal budget administrators compiled by the Federal Treasury of Russia.
- Inspections conducted in the Corporation and its organizations by Russian government bodies did not reveal any major violations that had not been detected by the industry-wide Internal Control and Audit Function.

The internal control system in ROSATOM and its organizations is based on:

- Russian laws and regulations;
- The IAEA requirements;
- The COSO model (The Committee of Sponsoring Organizations of the Treadway Commission);
- Guidelines for Internal Control Standards for the Public Sector by the Internal Control Standards Committee of the International Organization of Supreme Audit Institutions (INTOSAI).

Key characteristics of the internal control system include the following:

- Preventive control and development of timely, comprehensive and practicable corrective measures;
- Efficient communication and cooperation with operating divisions at all stages of operations;
- Proactive change management;
- Growing demand from executives of organizations in the industry for advisory services provided by the Internal Control and Audit Function (ICAF).

8.7.1. RESULTS IN 2019

INSPECTIONS CONDUCTED IN ROSATOM AND ITS ORGANIZATIONS

In the reporting year, ROSATOM's specialized internal control bodies (SICBs) conducted 704 inspections in the Corporation and its organizations.

External supervisory bodies conducted 15 inspections, including assessment of compliance with the budget legislation; these included 6 inspections and 4 expert reviews by the Accounts Chamber of the Russian Federation. No instances of misuse or illegal use of budget funds or assets were detected in ROSATOM or its organizations.

Following the inspections, the ICAF developed 622 corrective measures and approved them for implementation, with more than 97% of these measures implemented in the reporting year.

In the reporting year, an internal audit was conducted to assess the efficiency of cooperation between organizations in the industry in the sphere of NPP design abroad. Recommendations were produced for improving the efficiency of design work and adopting a more customer-centric approach.

Based on the findings of inspections conducted in 2019, disciplinary sanctions were imposed on 586 employees of ROSATOM and its organizations, including the dismissal of 11 senior managers.

PROFESSIONAL DEVELOPMENT OF AUDITORS

To support professional development of auditors, in 2019:

- A 'mentoring' practice was adopted: auditors from nuclear organizations participate in inspections conducted by the Corporation's ICAF in order to share experience; for each thematic audit, a training session is held, which is attended by SICB employees;
- Training was organized for SICB employees in the following areas: business process audit, project activities, performance evaluation of the internal control function and the risk management system, and IT audit;

STAKEHOLDER CONTROL

In 2019, the Central Arbitration Committee of ROSATOM and the arbitration committees of the Power Engineering, Fuel and Engineering Divisions received 902 reports (complaints) from stakeholders regarding violations of procurement rules established by Russian legislation, ROSATOM's Uniform Industrial Procurement Standard and other regulations of ROSATOM and its organizations.

606 complaints were investigated; 157 complaints (26% of the total number of investigated complaints) were deemed to be valid. Other complaints were withdrawn by complainants before being investigated by an arbitration committee or were dismissed on the following grounds:

- Because the deadline for filing the complaint had expired;
- Because a similar complaint had been accepted for investigation or investigated by the Federal Antimonopoly Service;
- Because the complainant was not entitled to file a complaint (after the deadline for submitting bids has expired, complaints may only be filed by bidders that have submitted a bid).

8.7.2. PLANS FOR 2020

- To implement an action plan for achieving the SICB 2020 target state;
- To improve control activities of the SICBs at the level of organizations and enterprises;

- Large-scale certification in accordance with the Internal Control Specialist (Internal Control) professional standard was conducted for the first time in Russia;
- Standard internal audit programmes were included in the best practice library forming part of the 1C IT system supporting the ICAF activities.

In 2019, ROSATOM's Central Arbitration Committee introduced the Partner Special Monitoring and Analytics Unit (SKB Partner), an automated system for the sending of notices of receipt of complaints, their acceptance for investigation, the outcomes of the investigation and the publication of the relevant resolutions.

Systematic work of arbitration committees helps to minimize the number of violations in the procurement process: in 2019, the number of valid complaints as a percentage of the total number of purchases totalled 0.21% (0.23% in 2018).

See also the section 'Procurement Management'.

8.8. PREVENTION OF CORRUPTION AND OTHER OFFENCES

Key results in 2019

- All measures forming part of ROSATOM's Anti-Corruption Plan were implemented.
- Employees provided information on their income, expenses, property and liabilities, and the information was posted on ROSATOM's official website (<http://www.rosatom.ru/about/protivodeystvie-korrupsii/svedeniya-o-doxodax-rabotnicov>).
- Financial losses exceeding RUB 13 billion were prevented.

ROSATOM is committed to preventing corruption and works systematically to ensure that all its employees, including senior executives of ROSATOM and its organizations, comply with legislation. These efforts are based on anti-corruption regulations (including the Code of Ethics⁴⁹ and the Uniform Industry-Wide Anti-Corruption Policy of ROSATOM and Its Organizations⁵⁰).

Measures to prevent corruption and other offences are implemented in accordance with ROSATOM's Anti-Corruption Plan for the period from 2018 through 2020⁵¹ (issued pursuant to Federal Law No. 273-FZ on Combating Corruption dated December 25, 2008, Decree No. 378 of the Russian President on

The Hotline is one of the key tools of ROSATOM's anti-corruption system. Employees in the industry and other persons can use it to report suspected instances of corruption and other violations (<https://rosatom.ru/en/about-us/anti-corruption-policy/>).

the National Anti-Corruption Plan for the Period from 2018 through 2020 dated June 29, 2018 and other anti-corruption laws and regulations).

were submitted to law enforcement agencies for legal review; based on these materials, over 140 criminal proceedings were instituted.

8.8.1. KEY RESULTS IN 2019

DAMAGE PREVENTION

Inspections conducted in the reporting year enabled ROSATOM to prevent financial losses exceeding RUB 13 billion. Financial and disciplinary sanctions were imposed against 1,200 executives. About 320 files providing evidence of detected violations

⁴⁹ <https://rosatom.ru/en/sustainability/code-of-conduct-and-ethics/>.

⁵⁰ <http://www.rosatom.ru/about/protivodeystvie-korrupsii/normativnye-pravovye-i-inye-akty>.

⁵¹ <http://www.rosatom.ru/about/protivodeystvie-korrupsii/normativnye-pravovye-i-inye-akty>.

PREVENTIVE MEASURES

Every manager was assigned responsibility for compliance of their subordinates with applicable legislation and timely implementation of effective measures in order to prevent and resolve conflicts of interest. In 2019, more than 1,100 inspections were conducted to verify compliance with requirements for preventing or resolving conflicts of interest.

Employment contracts concluded with newly hired employees include an anti-corruption clause; the employees were informed about their obligation to comply with existing restrictions and bans. Information on the income, expenses, property

and liabilities of ROSATOM's employees, candidates nominated to vacant positions and their family members was analysed.

A number of industry-wide regulations were published, including on matters related to communication and cooperation with law enforcement agencies in the course of corruption investigations; the list of positions in ROSATOM subject to the requirement that candidates nominated to and ROSATOM's employees holding such positions must provide information on their income, property and liabilities was expanded.

EMPLOYEE TRAINING IN ANTI-CORRUPTION PRACTICES

In 2019, a set of nine training programmes was developed for different categories of employees and executives of nuclear organizations. Two online training courses were launched at ROSATOM's Corporate Academy.

In the reporting year, 654 employees completed face-to-face anti-corruption training and development courses; more than 2,400 employees completed online courses.

8.8.2. PLANS FOR 2020 AND FOR THE MEDIUM TERM

In 2020, ROSATOM will continue to implement measures stipulated in the National Anti-Corruption Plan for the period from 2018 through 2020.

In the medium term, the Corporation plans to continue to implement the Uniform Industry-Wide Anti-Corruption Policy of ROSATOM and Its Organizations with a focus on:

- Improving the efficiency of information support, analytics, organizational and methodological support for the activities of the relevant divisions;
- Developing the competences of executives of ROSATOM's organizations who are responsible for preventing corruption and other offences.

9

DEVELOPMENT OF HUMAN POTENTIAL AND INFRASTRUCTURE

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9.1. IMPLEMENTATION OF THE HR POLICY

Key results in 2019

- ROSATOM was declared to be the best Russian employer by HeadHunter, Russia's largest online recruitment platform;
- ROSATOM's team won the WorldSkills Hi-Tech national competition for workers and engineers for the fifth time;
- ROSATOM ranked first in the Industrial Engineering and Manufacturing category in the international youth ranking compiled by Universum;
- ROSATOM was included in the top three in terms of social programmes for women in the first ranking of the best employers compiled by Forbes Woman;
- ROSATOM's Corporate Academy received the Global Council of Corporate Universities international award in the Best Corporate University category;
- The employee engagement rate stood at 82%, on a par with the best employers in Russia;
- 84% of employees appointed to the positions of Chief Executive Officers in the Corporation's organizations and enterprises were members of the executive succession pool;
- Over 500 employees of ROSATOM and its organizations received government awards, certificates of appreciation and acknowledgements from the President of the Russian Federation;
- Over 7,700 employees and veterans received industry awards;
- The average monthly salary totalled RUB 84,100 per month (up by 6.4% against 2018).



TATYANA TEREITYEVA
Chief HR Officer

– One of the key priorities of ROSATOM's current HR policy is to unlock the potential of its employees. How does the Corporation assess the potential of an employee and progress in unlocking it? What are ROSATOM's requirements for its employees, and how will these requirements evolve in the future?

– To assess progress in unlocking the potential of our employees, we use a matrix developed by The Boston Consulting Group. It includes three dimensions: skills, opportunities and motivation.

We are a high-technology corporation whose operations cover the entire production cycle, and therefore, we employ well-educated people with extensive professional experience and a wide range

of skills, which we seek to identify and support. This approach attracts the best talent available on the market. Best students are eager to join our company: the grade point average of university graduates hired by the Corporation totals 4.7 points, i.e. one in every three young employees has graduated with honours.

As a global company, we are trying to create as many opportunities as possible for our employees, from a transparent career management system to training available 24/7 from anywhere in the world on our web portal, in the RECORD Mobile app, at ROSATOM's Academy, the Technical Academy or in specialized universities led by NRNU MEPhI. We regularly launch new industry-wide programmes to create a favourable environment con-

ducive to unlocking our employees' potential. For instance, 2019 was declared the Year of Health in ROSATOM; accordingly, we launched a well-being programme covering five areas: physical, emotional, financial, professional and social. At the same time, we are improving our digital and IT services and working on on-line accounts and a shared communication space for employees.

In terms of motivation for our talent, we are trying to find activities matching the needs and interests of different employees. Some people are motivated by career growth; others seek to develop their competences and gain experience, tackle large-scale problems, take part in national projects or engage in social activism. That is why we support and develop industry-wide communities comprising 8,000 mentors and 3,500 experts in engineering and blue-collar jobs, 2,500 members of change support teams and change leaders, 200 members of the Women in Nuclear organization, 100 representatives of the Youth Council and 210 members of the Runners' Club.

As for requirements for our employees, it is obvious that requirements for specialists have fundamentally changed in recent years, which is particularly true with regard to engineering and blue-collar jobs. Today, an engineer is a multidisciplinary job requiring a wide range of competences. In addition to engineering and technical disciplines, engineers need to know the basics of economics, speak English, be able to take part in international negotiations, work in a cross-cultural environment and in remote teams. Blue-collar jobs in ROSATOM require higher education and continuous development of skills in accordance with international WorldSkills standards. IT skills have also become an integral part of today's basic training.

– In 2019, ROSATOM took an active part in the signing of the Kazan Declaration after the conclusion of the WorldSkills competition. Could you outline its key provisions? How will the principles set out in the Declaration be put into practice, including in ROSATOM?

The Kazan Declaration has been adopted in response to a major challenge facing the global labour market, namely the 'skills gap'. Its underlying cause is that the personnel training system is still functioning in the same way as in the middle of the 20th century, preparing a person to do only one job for the entire life. But the labour market has fundamentally changed since then. There is often a mismatch between specialists' qualifications and employers' needs as early as at the time of graduation. During

global crises such as the coronavirus pandemic, the situation is exacerbated even further.

The principles set out in the Kazan Declaration suggest that this problem should be overcome through a transition from standardized mass personnel training to a human-centric approach, whereby each employee is considered as an individual, taking into account all their needs, capabilities and talents. At the same time, personnel training is provided in cooperation with the government, the educational system, businesses and employees themselves.

ROSATOM has been using a systemic approach to personnel training for many years. We are developing an in-house continuous education system, which ensures that skills obtained in the course of training are relevant as early as at the current stage of the career path. We also attach considerable importance to fundamental training provided by third-party institutions as part of our partnerships with universities, schools and even kindergartens. Last year alone, about 200,000 employees underwent training at ROSATOM's Academy. We are actively developing a digital educational environment and successfully transitioned all our training programmes to the online format during the coronavirus pandemic. In April and May 2020, over 14,000 people took part in 500 training events, which is 3.5 times more than during the same period in 2019.

– ROSATOM is actively developing corporate volunteering. Could you give more detail about the main outcomes and long-term objectives in this area?

– The shared misfortune that has befallen the entire world has driven a considerable increase in the number of our volunteers. During the coronavirus pandemic, even those who had not been volunteers before started to take part in municipal initiatives, for instance, by helping to deliver food to people in need. In April and May 2020, about 800 new volunteers joined our initiatives. They fulfilled a total of over 10,000 requests for help as part of the #WeAreTogether nationwide campaign. In addition, the volunteers congratulated 3,500 veterans ahead of May 9. At the same time, we have launched a new initiative: collection of donations. For instance, 300 top managers of ROSATOM and its organizations donated their monthly salary (RUB 160 million in total) to the Medical Volunteers Movement as part of the #WeAreTogether campaign. Corporate volunteering is becoming part of the cultural code of nuclear industry workers. And now, after the pandemic, it is very important to make sure that this trend continues.

For ROSATOM to achieve its strategic goals, it is necessary for its employees to be able to fully unlock their potential. This is why people are ROSATOM's most important capital. The Corpo-

ration's HR policy prioritizes rapid competence development, the ability to work in a new, changing environment and the training of leaders at all levels.

9.1.1. KEY PERSONNEL CHARACTERISTICS

In 2019, ROSATOM and its organizations employed 266,400 people (including 1,780 people in foreign organizations), with men and women accounting for 67% and 33% of the total headcount respectively.

Number of employees⁵² by employee category:

- Executives: 32,500 people;
- Specialists: 107,600 people;
- White-collar workers: 10,100 people;
- Blue-collar workers: 116,200 people.

153,200 employees (57.5% of the total headcount) have a university degree. 3,787 employees (1.4% of the total headcount) are Candidates and Doctors of Sciences.

Prominent people play a fundamental role in the history of the nuclear industry and its development. A group of brilliant scientists led by Igor Kurchatov have achieved an unprecedented technological breakthrough, while talented administrators, the legendary 'nuclear' minister Efim Slavsky being the foremost among them, have created a new industry, which has become a driver of development for the entire economy.

The age of employees averaged 43.4 years (46.5 years for executives). 30.7% of employees were aged under 35.

In 2019, the personnel turnover rate stood at 13.2%⁵³.

Division/complex/organization	2017	2018	2019
AVERAGE HEADCOUNT BY BUSINESS AREA, '000 PEOPLE			
Nuclear Weapons Division	93.79	93.41	91.28
Emergency preparedness units	2.04	2.51	2.54
Northern Sea Route Directorate	–	–	2.26 ⁵⁴
Mining Division	6.66	7.24	7.17
Fuel Division	21.79	22.45	22.11
Sales and Trading Division	0.61	1.96 (1.35)	1.95 ⁵⁵ (1.31) ⁵⁶
Uranium One Holding	1.51 (1.4)	–	–

⁵² Hereinafter, the term 'employee' has the same meaning as in the GRI Sustainability Reporting Standards (GRI SRS).

⁵³ The personnel turnover rate did not include dismissals due to downsizing.

⁵⁴ Before 2019, the Northern Sea Route Directorate and its divisions had been part of the Nuclear Weapons Division.

⁵⁵ Including Uranium One Holding, which became part of the Sales and Trading Division in 2018.

⁵⁶ Figures in brackets indicate the average headcount in foreign organizations.

Power Engineering Division	48.43	51.51	54.41
Mechanical Engineering Division	17.1 (0.32)	16.82 (0.34)	16.55 (0.36)
Advanced Materials and Technologies	0.63	0.79	0.86
Overseas Division	0.75	1.8	2.2 (0.01)
New businesses	0.54	0.66	0.04
Process Control Systems and Electrical Engineering Engineering Division	–	–	1.22 ⁵⁷
Engineering Division	14.54 (0.11)	19.2 (0.11)	26.71 (0.1)
Back-End Division	8.64	8.34	7.53
Innovation Management Unit	10.37	9.24	8.94
JSC ITPC	3.34	3.2	3.1
Security units	8.72	8.66	9.15
JSC Rusatom Healthcare	1.56	1.53	1.47
Wind Power	–	0.29	0.27
Administrative units	6.18	5.7	6.6
Non-core assets	0.08	0.05	0.02
ROSATOM, total	247.3	255.36	266.4

9.1.2. PERSONNEL COSTS AND REMUNERATION SYSTEM

In 2019, personnel costs totalled RUB 360.55 billion, up by 11.1% year on year. The costs per employee per year increased by 6.6%, from RUB 1,264,700 in 2018 to RUB 1,347,800 in 2019.

	2017	2018	2019
STRUCTURE OF PERSONNEL COSTS, %			
Payroll fund	75.4	75.1	74.9
Insurance contributions	20.7	21	21.1
Social and other expenses (including personnel training)	3.9	3.9	4

⁵⁷ The Process Control Systems and Electrical Engineering business comprises JSC SNIP (previously part of the Mechanical Engineering Division) and JSC RASU (previously part of New Businesses).

REMUNERATION SYSTEM

The current remuneration system in ROSATOM:

- Provides competitive remuneration matching the compensation in the best Russian companies;
- Is result-based: the size of employees' salaries is linked to their efficiency, professionalism and achievement of key performance indicators (KPIs).

ROSATOM has in place a flexible remuneration system which includes a variety of tools ensuring that employees achieve business targets and are closely focused on results.

Managerial KPIs of ROSATOM are based on the strategic goals, priorities and KPIs established for the Corporation by the Super-

visory Board, while strategic objectives set for the organizations and enterprises are converted into KPI maps of specific executives and cascaded down to business units and employees.

In 2019, the monthly average salary per employee at ROSATOM increased by 6.4% compared to 2018 and totalled RUB 84,100 per month. The salary growth rate in the nuclear industry in 2019 was higher than the inflation rate in Russia (3%), which reflects an increase in employees' real income. This was possible largely due to the ongoing improvement of labour productivity and operational performance, and cost control.

9.1.3. EXECUTIVE SUCCESSION POOL

In order to ensure succession and train employees to be appointed to managerial positions, an executive succession pool (ESP) is being formed and developed in ROSATOM.

- ROSATOM's Capital (middle-level executives);
- ROSATOM's Talents (promising specialists and junior executives).

ESP members are included in the executive succession pool through the career and succession planning process. The ESP is divided into four levels in order to select development programmes that are best suited to the target positions of ESP members. The ESP level is determined by their target position:

- ROSATOM's Assets and ROSATOM's Assets. Basic Level (top executives);

Since the establishment of the executive succession pool, the number of its members has exceeded 4,300 people. ESP members account for 84% of appointments to the position of Chief Executive Officer in ROSATOM's organizations and enterprises.

Gender	2017		2018		2019	
	Number	Share	Number	Share	Number	Share
NUMBER OF ESP MEMBERS, WITH A BREAKDOWN BY GENDER						
men	2,148	80%	2,884	79%	3,407	79%
women	540	20%	765	21%	923	21%

APPOINTMENT OF ESP MEMBERS TO NEW POSITIONS, %⁵⁸

	2017	2018	2019
Share of ESP members appointed to vacant top and senior executive positions (top 30 and top 1,000 executives in the industry)	57.7	63.6	67.5
Share of ESP members appointed to the vacant position of Chief Executive Officer in ROSATOM's organizations and enterprises	63.6	72.2	84
Share of ESP members appointed to vacant positions of Deputy Chief Executive Officer for core business	68	71.7	73.8
Share of ESP members among senior, middle-level and junior executives appointed to a new (managerial) position	45	72	74

A special feature of succession pool development programmes is their practical focus. Future executives not only complete training modules, but also work on their own projects contributing to

the achievement of strategic goals of the Corporation. In 2019, ESP members completed a module-based training programme aimed at developing managerial knowledge and skills.

ESP level	Development programme	Key training areas	Number of participants ⁵⁹		
			2017	2018	2019
TRAINING AS PART OF ESP DEVELOPMENT PROGRAMMES					
Senior executives	ROSATOM's Assets	Strategy, strategic leadership, horizontal cooperation, change management, finance, marketing for high-technology companies	295	304	324
	ROSATOM's Assets. Basic Level		114	180	250
Middle-level executives	ROSATOM's Capital	Leadership and project management, advanced managerial skills, data management	1,102	1,490	1,800
Junior executives	ROSATOM's Talents		1,177	1,675	1,956
Total			2,688	3,649	4,330

⁵⁸ In 2018, promotion of succession pool members was assessed based on the number of ESP members appointed to new positions during the last three reporting years. In 2019, the assessment focused on the share of promoted succession pool members included in the ESP in 2017.

⁵⁹ The number of members included in the ESP is shown as a cumulative total for the period from 2017 through 2019.

9.1.4. SUCCESSOR ASSESSMENT

To facilitate rapid development of competences, which is one of the priorities of ROSATOM's HR policy, an innovative approach to assessing high-potential employees has been adopted in the Corporation. As part of this approach, executives are involved in talent pool assessment and have a greater personal responsibility for developing succession plans and reducing the duration and cost of assessments.

This approach is based on best practices adopted in major international companies; it was piloted in 2018. In 2019, the approach was rolled out in five Divisions in the industry; the assessment covered 1,700 executives in 51 of ROSATOM's organizations. About 30% of successors covered by the assessment have been appointed to new managerial positions.

9.1.5. PERSONNEL TRAINING

The Corporation's HR policy prioritizes the development of competences and employee training.

ROSTATOM's Corporate Academy is the central training platform for specialists and executives in the industry⁶⁰. The Academy implements projects aimed at developing the corporate culture and unlocking the leadership potential of ROSATOM's employees. It also trains a new generation of workers and engineers in accordance with WorldSkills Standards.

In 2019, over 146,000 employees (54.8% of the average headcount) underwent training and retraining and completed pro-

To develop negotiation skills of employees taking part in negotiations with foreign partners, ROSATOM is implementing a module-based training programme, International Negotiations in the Nuclear Industry. In 2019, 321 employees completed this training programme.

fessional development programmes. The number of training hours per employee averaged 28.4 hours.



Employee category

NUMBER OF EMPLOYEES WHO UNDERWENT TRAINING

Top executives
Senior executives
Middle-level executives
Junior executives
Specialists and white-collar workers
Blue-collar workers
Total

Number of employees who completed at least one training programme

	2017	2018	2019
Top executives	43	30	30
Senior executives	1,356	1,404	1,445
Middle-level executives	7,317	7,324	8,497
Junior executives	12,893	12,163	14,442
Specialists and white-collar workers	38,342	42,043	65,913
Blue-collar workers	56,105	50,104	55,673
Total	116,056	113,068	146,000

⁶⁰ <http://rosatom-academy.ru>.

DIGITAL COMPETENCES AND CULTURE

2019 saw the launch of a new focus area of the Digital ROSATOM strategic programme: Digital Competences and Culture.

Key outcomes:

- Primary demand for IT specialists until 2024 was assessed, and key IT positions were identified; a diagnostic assessment of maturity of the digital culture was carried out; a single industry-wide onboarding programme was developed;

- About 45,000 employees in the industry were covered by face-to-face and online programmes aimed at promoting digital literacy and developing IT competences. An application for online training, RECORD Mobile, was developed, and the RECORD Mobile web portal was created;
- The Corporation launched a new training format for digitization leaders: the Digital Seasons Production Technology Club; it was joined by 70 IT managers and 80 representatives of manufacturing enterprises and the business.

9.1.6. EMPLOYEES' PARTICIPATION IN EXTERNAL AND INDUSTRY-WIDE PROFESSIONAL COMPETITIONS

LEADERS OF RUSSIA

Employees of ROSATOM and its organizations actively participate in the Leaders of Russia national management competition. More than 1,500 nuclear industry employees took part in

the second competition (in 2018/2019). 84 people reached the semi-finals, with 4 people progressing to the final; winners included one of ROSATOM's employees.

WORLDSKILLS

In the 45th WorldSkills International Competition, WorldSkills Kazan 2019, ROSATOM's employees won two gold medals and two Medallions for Excellence, while representatives of ROSATOM participating in the Future Skills competition, which is focused on professions of the future, won another 11 medals. In addition, ROSATOM was a strategic partner of the competition.

testants and 145 experts represented 27 skills across all sections of the competition (the national competition, WorldSkills Juniors and Skills of the Wise) and won 58 medals: 42 golds, 10 silvers and 6 bronzes.

In the WorldSkills Hi-Tech 2019 Competition (Ekaterinburg), which became the fifth national competition of cross-industry skilled professions for workers in high-technology industries held in accordance with the WorldSkills methodology, ROSATOM's team once again achieved impressive results. 133 con-

More than 600 participants and over 600 experts representing more than 80 organizations and core universities of ROSATOM took part in the AtomSkills industry-wide competition in 2019. A career guidance programme for school and university students titled 'Conquering the Arctic' was held as part of the competition; it was attended by more than 1,200 people.

After the conclusion of the WorldSkills Kazan 2019 competition, the Kazan Declaration was signed by 82 countries on the initiative of Russia, with active support from ROSATOM. The aim of the Declaration is to standardize international approaches to training quality assessment and professional development. It is underpinned by a human-centric approach. This document provides a foundation for the labour market of the future.

Principles of the Kazan Declaration:

1. Skills of the future for everyone. Every person should receive a basic set of competences needed for employment in the context of uncertainty and rapid changes in the labour market. These should include basic and cognitive skills, as well as social, cultural, green, and digital competences.
2. Self-conscious development. Every person's professional development should follow a unique and individual path throughout their life.

3. Transparent and fair opportunities. Information on employment and educational opportunities in and outside the employee's region should be easily accessible. Employees should be hired on the basis of their skills and actual experience, regardless of their formal education, life situation, gender, physical health, or social status.
4. Skills mobility. Labour mobility within existing legal frameworks, flexible employment (training) formats, and/or remote (virtual) employment should be available to all regardless of their current place of residence.
5. Appreciation of values and Respect for the individual. Workplaces and working conditions should enable self-fulfilment and professional development for all regardless of their values or beliefs with due respect to sustainable development.



9.1.7. ROSATOM'S PERSON OF THE YEAR

ROSATOM's Person of the Year is an industry-wide recognition programme whereby executives express their appreciation for the achievements of the best employees. Key selection criteria include major work achievements, the ability to think out of the box, commitment to corporate values, and professional competences of the candidates. The programme includes more than 50 individual and team nominations in three areas: divisional professions, company-wide professions and special nominations put forward by the Director General and the

Chairman of the Supervisory Board of ROSATOM. To support the launch of an industry-wide volunteer movement and contribution to the achievement of the UN Sustainable Development Goals, a new special category, Sustainable Development, was introduced in 2019.

Overall, a record-breaking 2,353 applications were submitted for the competition in 2019, and 300 finalists were selected.

9.1.8. CORPORATE VOLUNTEERING

Nuclear organizations continue to develop a large number of volunteering initiatives.

Key objectives of corporate volunteering include:

- Forming a pool of social leaders comprising employees of organizations in the industry;
- Developing horizontal cooperation;
- Enhancing the image of ROSATOM as a socially responsible company.

In 2019, ROSATOM held the first volunteers' forum. It was attended by more than 70 representatives of nuclear enterprises and more than 30 representatives of administrations of 'nuclear' towns and cities.

About 400 employees took part in a tree-planting campaign conducted in Nizhny Novgorod as part of an industry-wide Youth Congress.

ROSATOM launched a campaign titled 'School Bag for a Friend' for children affected by a flood in the Irkutsk Region. As part of this initiative, more than 1,600 school bags filled with school supplies were donated to school students.

Boxes were installed in ROSATOM's head office in order to collect old clothes, appliances and batteries.

In 2019, employees collected (and later transferred for processing and recycling):

- 54 kilograms of batteries;
- 38 kilograms of appliances;
- 1.1 tonnes of unwanted items.

ROSATOM's Divisions organized blood donation campaigns.

In the reporting year, ROSATOM participated for the first time in the International Volunteer Forum in Sochi, which was attended by the Russian President. ROSATOM's delegation comprised more than 50 leaders of volunteer groups who represented about 20 organizations and enterprises in the nuclear industry.

Work of Change Support Teams (CSTs)

ROSATOM has a tradition of supporting 'bottom-up' initiatives and thus enabling talented employees to fulfil themselves.

The CSTs comprise proactive employees who implement projects in order to promote changes. Participation in the CSTs not only enables them to put their ideas into practice, but also provides an informal channel for communicating directly with industry executives. In turn, this provides employees with new career opportunities and serves as an efficient tool for training new leaders at the local level. By the end of 2019, more than 100 such teams had been formed; they comprise about 2,500 employees from different organizations and enterprises of ROSATOM.



Code of Ethics

ROSATOM has adopted a Code of Ethics and Professional Conduct for Employees. The Code of Ethics communicates corporate values and establishes the relevant ethical principles of conduct in the course of interaction with a wide range of external and internal stakeholders. The rules of conduct set out in the Code concern combating corruption, ensuring the security of resources, property and information, occupational safety and health, industrial and environmental safety, preventing conflicts, resolving conflicts of interest and keeping up the corporate image.

The Code of Ethics is available on ROSATOM's official website (<https://rosatom.ru/en/sustainability/code-of-conduct-and-ethics/>).



9.1.9. EMPLOYEE ENGAGEMENT⁶¹

According to the findings of a survey among 50,402 employees in 70 of ROSATOM's organizations, in 2019, the employee engagement rate stood at 82%, on a par with the best employers in Russia.

The target for the next three to five years is to maintain the average employee engagement rate on a par with global leaders in high-technology industries (at least 77%) and to achieve this rate in most organizations that participate in the survey.

2014	2015	2016	2017	2018	2019
CHANGES IN EMPLOYEE ENGAGEMENT RATE AT ROSATOM AND IN ITS ORGANIZATIONS					
75%	78%	77%	83%	80%	82%

9.1.10. SOCIAL POLICY

ROSATOM's social policy is designed to:

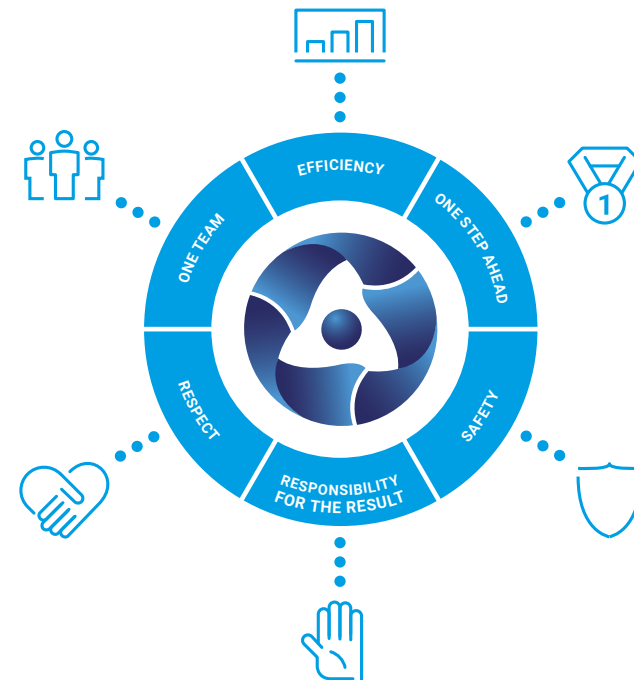
- Make ROSATOM more attractive as an employer;
- Engage and integrate young professionals and highly skilled specialists;
- Improve employee loyalty;
- Improve the efficiency of social expenditure.

Employment benefits provided to employees and retirees comply with the Uniform Industry-Wide Social Policy, which is based on standardized corporate social programmes.

The structure of corporate social programmes and the relevant expenses are determined on the basis of ROSATOM's priorities in personnel management:

- Importance of maintaining health and a long working life;
- Protecting the health of people working in conditions that deviate from the standard conditions (which is why the bulk of funding is allocated for additional personal insurance and health resort treatment for employees);

ROSATOM'S VALUES



⁶¹ Engagement is an emotional and intellectual state encouraging employees to do their job to the best of their abilities. Employee engagement surveys have been conducted in the Russian nuclear industry since 2011 under the international methodology with assistance from an independent expert organization. The engagement rate is defined as the share of engaged employees as a percentage of the total number of respondents.

- Traditions established at ROSATOM: companies in the Russian nuclear industry always pay great attention to retired employees who had worked in the industry for a long time; veterans receive social assistance and are involved in various events, including working with young people;
- Government policy focused on promoting the development of mass sports, providing additional pensions, and supporting families with children, young professionals and people in need.

In 2019, programmes to support soon-to- retire employees in ROSATOM and its organizations were developed. As part of these programmes:

- 2,553 soon-to- retire employees underwent health screenings;
- 2,682 employees were given vouchers for health resort treatment;
- 3,268 employees underwent training and retraining, with 320 employees switching over to flexible working hours.

Corporate social programmes	2017	2018	2019
EXPENDITURE ON CORPORATE SOCIAL PROGRAMMES AT ROSATOM, RUB BILLION⁶²			
Voluntary health insurance and personal insurance against accidents and diseases	1.9	2	2.4
Health resort treatment and recreation for employees and their children, including:	1.1	1.2	1.1
<i>health resort and rehabilitation treatment for employees</i>	0.8	0.8	0.8
<i>health resort treatment and recreation for children</i>	0.3	0.3	0.3
Providing better living conditions for employees	0.8	0.8	0.8
Private pension plans	0.9	0.9	0.6
Support for retirees	1.2	1.3	1.3
Sporting and cultural events	1.3	1.5	1.7
Assistance to employees	1.1	1.2	1.7
Other	0.7	0.3	0.2
Total	9	9.2	9.8

2019 was declared the Year of Occupational Health and Safety and Healthy Lifestyle in the nuclear industry. The practice of organizing health days, health screenings and detailed medical examinations for employees has been introduced in ROSATOM's organizations.

The biggest sporting event of 2019 was the Running Race of Nuclear Towns and Cities; its participants included 16,500 employees, members of their families and residents of 20 towns and cities where nuclear organizations operate.

An industry-wide futsal competition was held for the first time to mark the 120th anniversary of the birth of Efim Slavsky, with the teams of 12 divisions playing in the final.

Employees of ten of ROSATOM's divisions took part in the 10th Winter Spartakiad for Employees in Nuclear Power, Industry and Science 'Atomiada 2019'. 280 top athletes competed in the final stages of the event for 35 sets of medals and 12 cups in four disciplines.

⁶² Compensations and benefits forming part of ROSATOM's corporate social programmes are provided to full-time employees.

At the Ready for Labour and Defence National Festival held among employee teams with support from the Russian Ministry of Sport, ROSATOM's team ranked first in the team standings.

At the 18th International Issyk Kul Games in Cholpon-Ata (Kyrgyzstan), ROSATOM's team of 25 athletes won 94 medals (58 golds, 28 silvers and 8 bronzes) and a trophy for the 1st place in the team standings.

SUPPORT FOR INDUSTRY VETERANS

The Interregional Social Movement of Veterans of Nuclear Power and Industry (ISMV NPI)⁶³ comprises 130 veteran organizations in Russia with a total of 312,200 members.

In reporting year, at the request of ISMV NPI:

- 128 veterans were presented with the Veteran of Nuclear Power and Industry badge, a departmental award for outstanding work;
- 106 veterans were awarded ROSATOM's badges;

SOCIAL PARTNERSHIP IN THE NUCLEAR INDUSTRY

ROSATOM adheres to the Industry-Wide Agreement on Nuclear Power, Industry and Science for 2018–2020. The Agreement is based on the established practice of social partnership in the nuclear industry and is aimed at implementing the Integrated Standardized Remuneration System, the Uniform Industry-Wide Social Policy and the Occupational Safety Management System.

The agreement has been developed and is being implemented jointly with the Russian Trade Union of Nuclear Power and Industry Workers (RTUNPIW)⁶⁴. As at December 31, 2019, the Union had 134,771 members, i.e. 56.4% of the average headcount at ROSATOM. In the reporting year, the Union focused on ensuring compliance with the current Industry-Wide Agreement on Nuclear Power, Industry and Science, safeguarding employees' legal rights, assisting trade unions in drafting and signing collective agreements, and actively participating in the work of the Russian Trilateral Commission on the Regulation of Social and Labour Relations.

⁶³ <http://www.veteranrosatom.ru>.

⁶⁴ <http://www.profatom.ru>.

ROSATOM's team of 36 athletes won 44 medals (26 golds, 16 silvers and 2 bronzes) and a trophy for the 3rd place in the team standings at the 16th International Workers' Sports Festival in Albena (Bulgaria).

- 93 veterans were awarded certificates of appreciation and letters of acknowledgment from ROSATOM.

As part of a special industry-wide wellness programme for veterans, in 2019, over 16,000 veterans of the nuclear industry were provided with subsidized vouchers for treatment at health resorts of the Russian Federal Biomedical Agency (FMBA) and the industrial trade union.

Collective agreements in all of ROSATOM's organizations provide for a minimum notice period of two months for significant operational changes and of three months for situations that may lead to dismissals.

Collective agreements cover 85% of employees working in ROSATOM's enterprises.

The Agreement gives priority to the protection of employees' lives and health (see the section 'Occupational Safety and Health'). Jointly with the trade union, employers maintain records of and analyse morbidity among employees, including based on records of periodic medical examinations and sick leave, and build an integrated health care programme titled Health. The Agreement incorporates the opportunities provided by legislation on the special inspection of working conditions (SIWC) and stipulates an additional mechanism for cooperating with the trade union in conducting an SIWC and analysing inspection findings. See also the section 'Occupational Safety'.

9.1.11. COOPERATION WITH UNIVERSITIES AND RECRUITMENT OF YOUNG PROFESSIONALS

In March 2020, an official ceremony was held at NRNU MEPhI to mark the unveiling of a monument 'To the Creators of the Russian Nuclear Project' commemorating the 75th anniversary of the Russian nuclear industry. The sculpture became one of the key and most distinctive ensembles of the Avenue of Nobel Prize Winners, a complex of monuments at the university campus. The composition is centred around an atom, which serves as a conceptual and sculptural focus of a group comprising the figures of three great scientists (Igor Kurchatov, Yakov Zeldovich and Yuliy Khariton).

Specialized educational organizations training specialists for the nuclear industry form part of the Consortium of Core Universities of ROSATOM (18 universities specializing in disciplines relevant to the nuclear industry). The National Research Nuclear University MEPhI (NRNU MEPhI) is the central university for the nuclear industry. Its alumni include six Nobel Prize winners.

In 2019, a total of 1,834 students attended universities under arrangements with nuclear enterprises.

5,669 university students undertook internships in nuclear organizations. Over 660 people were subsequently hired by the organizations.

Overall, more than 1,500 university graduates were hired, with about 70% of them graduating from core universities (including branches of NRNU MEPhI). ROSATOM attracts the best students: in 2019, the grade point average of university graduates hired by the Corporation totalled 4.7 points, i.e. one in every three young employees hired by ROSATOM had graduated with honours.

Career events involving representatives of nuclear enterprises are a traditional tool for promoting ROSATOM's employer brand at core universities. In 2019, ROSATOM's Career Days were held in Ekaterinburg, Nizhny Novgorod, Tomsk and Moscow; in addition,

NRNU MEPhI is included in leading global and national educational rankings:

- Top 25 of the QS Emerging Europe and Central Asia Rankings;
- Top 25 of the U-Multirank ranking in the student mobility category;
- 48th place in the Times Higher Education (THE) University Impact Rankings in the Industry, Innovation and Infrastructure category;
- 51st to 100th place in the QS Physics & Astronomy subject ranking;
- 5th place in the U.S. News & World Report ranking in Physics;
- 46th place in the Round University Ranking in Natural Sciences;
- 1st place among engineering universities in the ranking of demand for Russian universities compiled by Russia Today International News Agency;
- 1st place in the Russian Universities Through the Eyes of Students ranking compiled by Russia Today International News Agency;
- 2nd place in the National Ranking compiled by Interfax;
- 3rd place in the National Ranking compiled by RAEX/Expert RA;
- 4th place in the National Ranking of the Best IT Universities compiled by RAEX/Expert RA;
- 2nd place in the ranking of the best Russian universities compiled by Forbes in terms of education quality;
- 4th place in the ranking of the best Russian universities compiled by Forbes;
- Top 3 leading Russian universities participating in Project 5-100.

In 2019, over 35,000 school students and over 2,000 university students took part in competitions held by NRNU MEPhI, including over 2,000 school students and over 500 university students from foreign countries.

The average score achieved in the Unified State Examination by students who were enrolled based on the examination results totalled 93.5 (top 5 of the best Russian universities).

career fairs were held in Saint Petersburg and Ivanovo. The total number of participants exceeded 6,500. More than 45 enterprises were presented at these events and offered over 300 vacancies and 475 internships to students and graduates.

TEMP TOURNAMENT

ROSATOM attaches special importance to attracting and selecting promising graduates and offering them employment in nuclear enterprises. The TeMP Tournament for Young Professionals is the main competition in the nuclear industry. In 2019, over 2,000 graduates and students from 200 specialized and

ROSATOM has prepared a forecast until 2030 for the industry's demand for specialists who have received university education or secondary vocational education. The industry organizations are expected to hire around 1,800 graduates of core universities per year on average, including around 900 graduates of NRNU MEPhI and its branches.

core universities participated in the Tournament. The competition participants presented 85 ideas and 20 projects, with 142 participants advancing to the finals. Five projects that reached the finals are being considered by nuclear enterprises for further implementation.

9.1.12. INTERNATIONAL COOPERATION IN EDUCATION

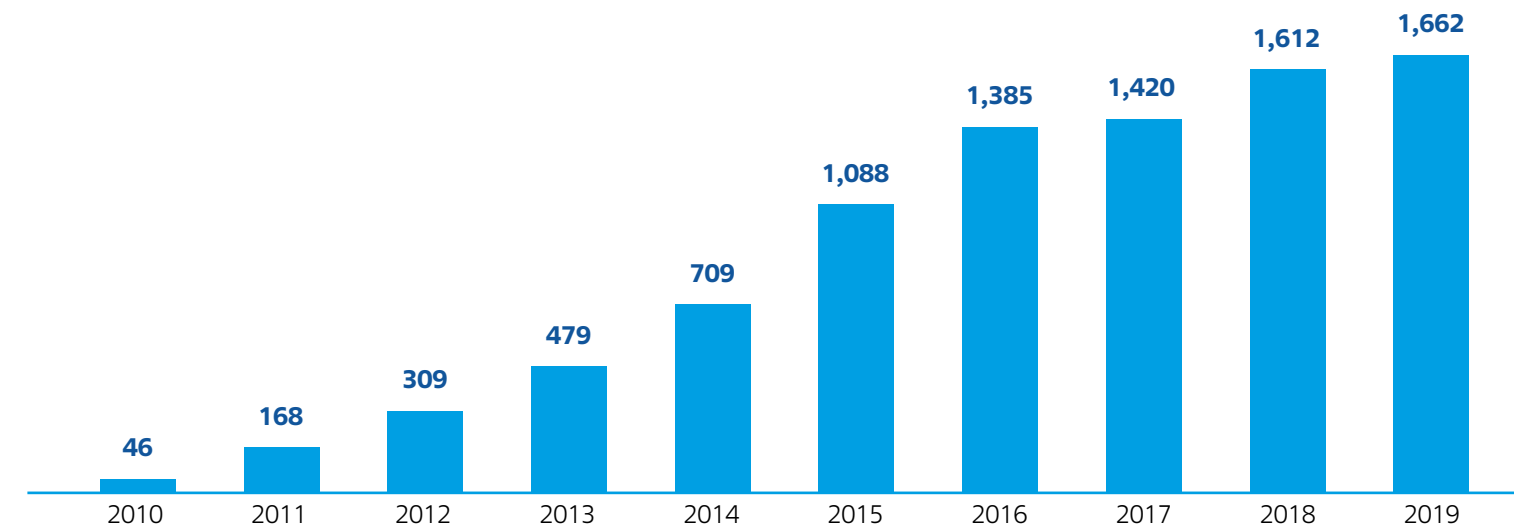
ROSATOM successfully exports Russian nuclear education to potentially attractive markets. Foreign students study at NRNU MEPhI, as well as at ROSATOM's core universities and partner universities.

In 2019, more than 1,600 foreign students from Vietnam, Rwanda, Bolivia, Uzbekistan, Turkey, Bangladesh, Jordan, Egypt, Algeria, Nigeria, South Africa, Ghana and other countries studied at Russian universities. Another 275 students from 58 countries are due to enrol on courses in nuclear and related disciplines in 2020.

In order to promote the development of national nuclear education systems in ROSATOM's partner countries, joint educational programmes are being implemented in cooperation with foreign universities in Egypt, Bolivia, Ghana, Turkey, Armenia, Kazakhstan and Rwanda. 131 students were enrolled for these joint programmes in 2019.

To train personnel for the nuclear industry of the Republic of Uzbekistan, in 2019, NRNU MEPhI opened its first overseas branch in Tashkent. Following a competitive examination, 100 candidates were enrolled on first-year courses.

NUMBER OF FOREIGN STUDENTS AT THE CORPORATION'S CORE UNIVERSITIES AND PARTNER UNIVERSITIES



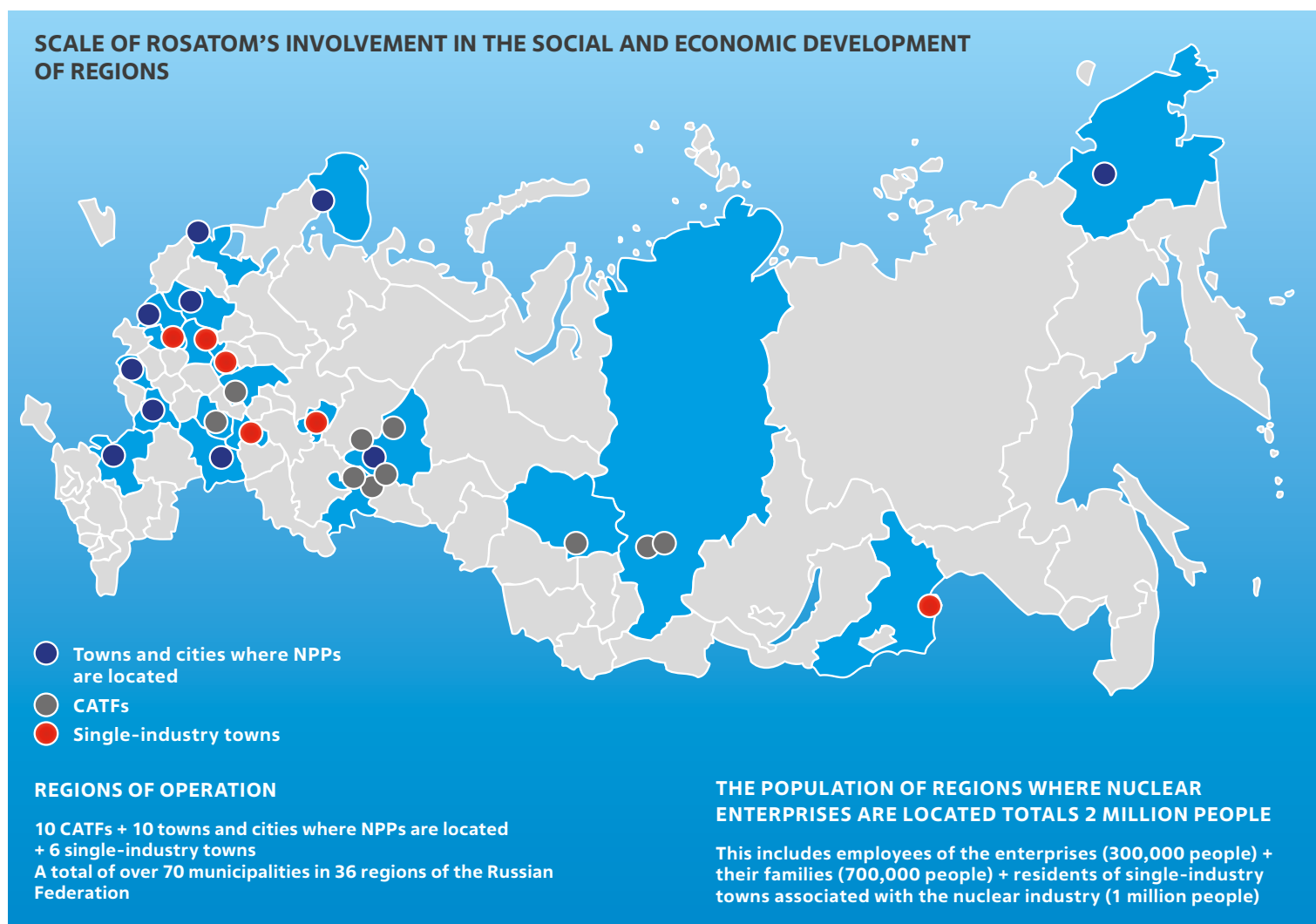
9.1.13. PLANS FOR 2020 AND FOR THE MEDIUM TERM

- To enable rapid development of key business competences;
- To create a digital environment and promote employees' digital literacy;
- To train leaders at all levels;
- To develop a safety culture aligned with the Vision Zero paradigm (for details, see the section 'Occupational Safety and Health');
- To improve the quality of employees' lives and promote a healthy lifestyle;
- To continue to top the rankings of the best employers;
- To develop an online training system and increase the number of employees covered by training programmes.

9.2. DEVELOPING THE REGIONS OF OPERATION

Key results in 2019

- Taxes paid to Russian budgets of all levels totalled RUB 207.4 billion.
- NPPs accounted for 19.0% of the total electricity output in Russia.



9.2.1. ENSURING THE ENERGY SECURITY OF RUSSIAN REGIONS

Nuclear power generation contributes significantly to power systems across Russia. NPPs accounted for 19% of the total electricity output (18.7% in 2018), while in European Russia the share of nuclear power generation exceeded 25%.

	Russia	European Russia	IPS of the Centre	IPS of the Middle Volga	IPS of the North-West	IPS of the South	IPS of the Urals	PS of the East*
Nuclear power generation at ROSATOM, billion kWh	208.78	208.6	96.31	30	38.6	33.89	9.78	0.21
Share of nuclear power generation, %**	19	25.2	40.8	27.2	34.2	32.9	3.7	0.41

* Including isolated systems.

** Data on power generation in Russia for 2019 according to a press release of the System Operator of the Unified Power System dated January 13, 2020 (available on the SO UPS website at www.so-ups.ru).

9.2.2. TAX PAYMENTS TO BUDGETS OF VARIOUS LEVELS

ROSATOM's organizations and enterprises have a significant impact on budget revenue in ROSATOM's regions of operation. ROSATOM is one of the largest taxpayers in Russia. In 2019, payments to budgets of all levels totalled RUB 207.4 billion.

Taxes	2017	2018	2019
TAXES PAID BY ROSATOM AND ITS ORGANIZATIONS, RUB BILLION			
Total, including:	148.5	188.2	207.4
to the federal budget	95.1	116.8	135.4
to the budgets of federal subjects of Russia	52.7	70.8	71.5
to local budgets	0.7	0.6	0.5

9.2.3. GENERATING EMPLOYMENT THROUGH NPP CONSTRUCTION

The construction and commissioning of nuclear facilities, including NPP power units, creates new jobs, as enterprises often recruit employees from local communities within a 100-kilometre radius of the construction site. For instance, as construction work progressed at the site of Rooppur NPP in Bangladesh in 2019, thousands of local residents gained employment. Importantly, these projects also create jobs in related sectors of the economy (the metals industry, mechanical engineering, etc.).

The construction of the Belarusian NPP has become a major infrastructure project providing employment to thousands of people, both at the NPP itself and in organizations that are servicing it. In 2019, more than 30 local contractors were involved in NPP construction.

NPP	Actual headcount, including contractors	Including employees recruited from local communities ⁶⁵
EMPLOYMENT IN KEY NPP CONSTRUCTION PROJECTS (AT YEAR-END 2019)		
Leningrad NPP-2 (Russia)	3,416	3,249
Kursk NPP-2 (Russia)	4,566	4,566
Belarusian NPP	7,873	1,849
Rooppur NPP (Bangladesh)	8,850	7,454
Akkuyu NPP (Turkey)	5,643	4,435

9.2.4. SUPPORTING THE IMPLEMENTATION OF NATIONAL PROJECTS IN ROSATOM'S REGIONS OF OPERATION

In 2019, the Corporation continued its work focused on the implementation of national projects in all nuclear towns and cities. ROSATOM took part in developing a methodology for improving the efficiency of participation of its regions of operation in national projects to enable them to focus their efforts on projects of key importance for a town, a city or the entire region. The methodology was tested in three towns in

the Chelyabinsk Region: ROSATOM's specialists analysed social and economic indicators, identified development areas and the most significant projects and then compiled road maps for the development of these towns. In the future, this practice may be rolled out in other regions.

⁶⁵ Employees who are nationals of the country in which the NPP is being built.

STATUS OF PARTICIPATION OF CITIES AND TOWNS ASSOCIATED WITH THE NUCLEAR INDUSTRY IN NATIONAL PROJECTS IN 2019

Since 2018, ROSATOM has been providing support for the participation of towns and cities in national projects:

- Enabling the towns and cities to make a greater contribution to the achievement of national goals
- Focused on finding comprehensive solutions for the issues facing the towns and cities
- Enabling the towns and cities to focus on their strategic development priorities

POTENTIAL FOR BROADER PARTICIPATION



1.7 million people = 1.1% of Russia's population



RUB 4.5 billion = 0.41% of the consolidated budget of federal subjects of Russia allocated for national projects

Per capita potential for raising funds as part of national projects

Number of towns and cities participating in national projects

23 HOUSING AND URBAN ENVIRONMENT

16 EDUCATION

15 DEMOGRAPHIC SITUATION

14 CULTURE

9 SMALL AND MEDIUM-SIZED BUSINESSES

9 ROAD SAFETY

4 DIGITAL ECONOMY

4 ENVIRONMENT

2 HEALTHCARE

63% OF MEASURES ANNOUNCED BY THE TOWNS AND CITIES IN 2018 HAVE BEEN APPROVED AND WERE BEING IMPLEMENTED IN 2019

Town/city	RUB million
SAROV	1,011,585.6
OBNINSK	634,135.6
NOVOURALSK	513,568.9
BALAKOVO	388,183.4
SEVERSK	376,230
GLAZOV	245,112.96
VOLGODONSK	215,185.4
ZARECHNY (Penza Region)	213,927.6
ZARECHNY (Sverdlovsk Region)	184,985.3
LESNOY	149,708.2
POLYARNYE ZORI	147,387.12
KURCHATOV	104,207.1
DIMITROVGRAD	94,442.33
UDOMLYA	88,180.9
SNEZHINSK	62,681.81
ZHELEZNOGORSK	54,943.85
ZELENOGORSK	47,635.65
SOSNOVY BOR	42,493.8
NOVOVORONEZH	34,638.7
OZERSK	30,838.97
DESNOGORSK	16,704.22
TRYOKHGORNYY	12,037.38

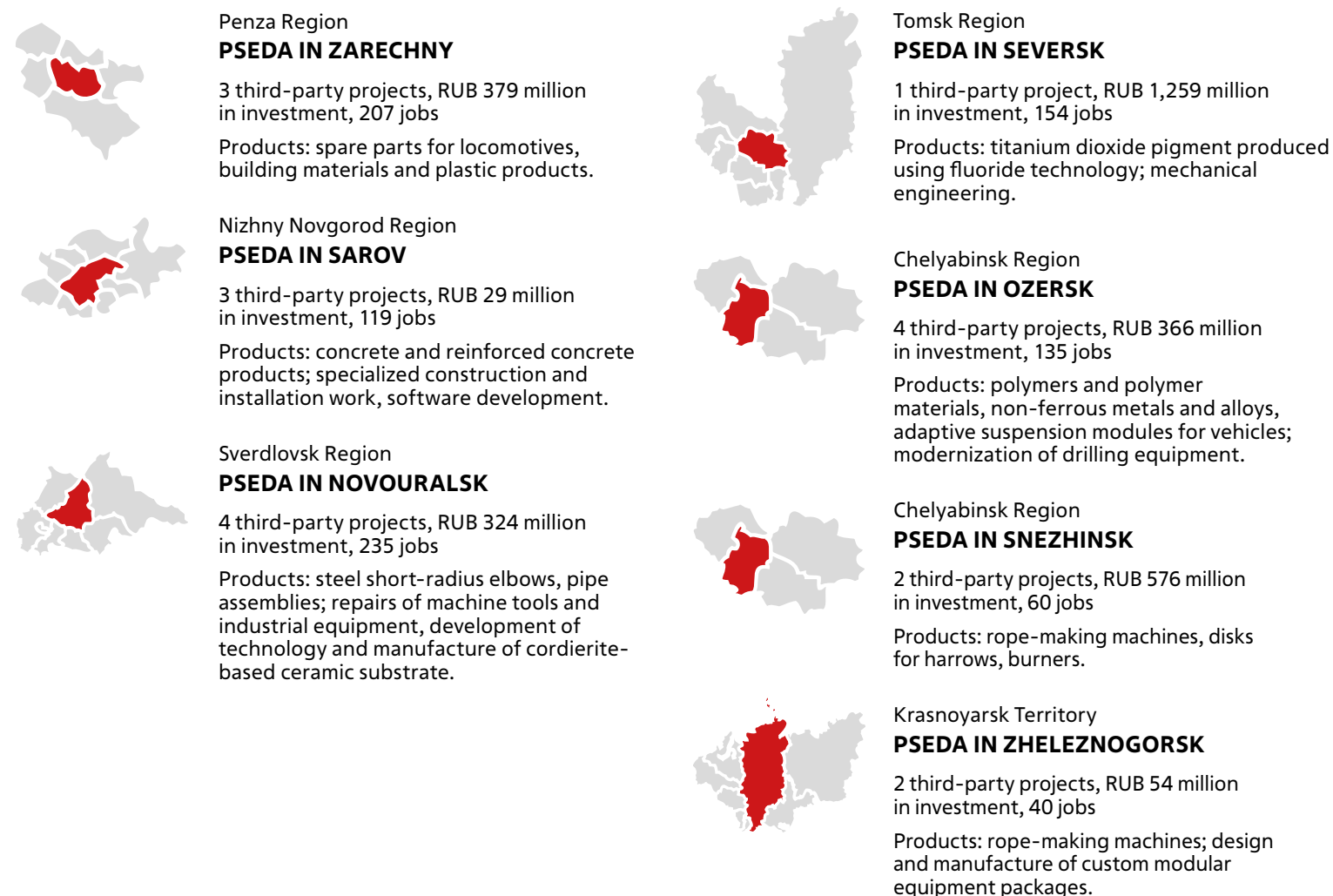
THE TOWNS AND CITIES HAVE INITIATED THE IMPLEMENTATION OF MEASURES WORTH A TOTAL OF RUB **4.5** BILLION

9.2.5. PRIORITY DEVELOPMENT AREAS IN NUCLEAR TOWNS AND CITIES

In 2019, 18 companies became residents of priority social and economic development areas (PSEDAs) in the CATFs of Sarov, Zarechny, Seversk, Novouralsk, Zheleznogorsk, Snezhinsk and Ozersk. According to the residents' business plans, the total

amount of investments that they intend to attract will exceed RUB 3 billion, including capital investment. Overall, 870 new jobs will be created. It is intended that 19 more companies will become residents in 2020.

STATUS OF PROJECT IMPLEMENTATION IN PSEDAS



PSEDA development is managed by JSC ATOM-TOR. In 2019, JSC ATOM-TOR signed cooperation agreements with the governments of the Tomsk and Penza Regions and the administrations of the CATFs of Zarechny and Seversk. In addition, Long-Term Plans for the Development of PSEDAs in the CATFs in the Nuclear Industry were formulated.

The first closed town in the USSR appeared following the launch of the nuclear project. It was necessary to build a special site situated away from the capital and other major cities. To maintain secrecy, the nuclear centre was located in remote woodland, in a small village of Sarov in the Nizhny Novgorod Region, near the Saint Seraphim-Diveyevo Monastery. On April 9, 1946, the USSR Council of Ministers adopted a resolution on establishing a Design Bureau (KB-11) at Laboratory No. 2 of the USSR Academy of Sciences. Pavel Zernov was appointed as head of the Bureau, and Yuliy Khariton was appointed as its scientific director. Thus, Sarov became the first closed and secret town in the Soviet Union. In late 1949, there were 4,507 people working in KB-11; today, the population of Sarov exceeds 95,000 people.

9.2.6. IMPROVING THE QUALITY OF HEALTHCARE SERVICES IN THE TOWNS AND CITIES OF OPERATION

In 2019, the first stage of the Right to Health social project initiated by ROSATOM's Public Council and the Russian Patients' Association was implemented in six towns where ROSATOM operates. Residents of Novouralsk, Lesnoy, Ozersk, Snezhinsk, Tryokhgorny and Zarechny (Sverdlovsk Region) can now consult legal advisors using a free hotline. Over 40 training sessions on legal matters for patients were held in these towns; as a result, over 1,200 people improved their knowledge in this field. 12 healthcare professionals were retrained as consulting experts in conflict-free communication with patients and now provide training in these techniques to employees of healthcare centres. The project has helped to make communication between doctors and patients more efficient. In 2020, further steps will be taken to organize special dialogue platforms.

The Corporation signed an agreement with the Federal Biomedical Agency of Russia on cooperation in four areas:

- Healthcare quality control and implementation of the Lean Polyclinic project;
- Upgrading the capabilities of healthcare organizations of the FMBA;
- Creating nuclear medicine centres and providing them with equipment;
- Production of radiopharmaceuticals.

In addition, underlying principles were formulated for a new model of provision of healthcare services by FMBA organizations to people living in CATFs and other regions of ROSATOM's operation. The model includes public-private partnerships, digital technology and telemedicine mechanisms.

See also the section 'ROSATOM Production System'.

9.2.7. URBAN INFRASTRUCTURE DEVELOPMENT

ROSATOM is implementing the Smart City project in its regions of operation. This project forms part of the Housing and Urban Environment National Project and the Digital Economy National Programme; its aim is to make Russian towns and cities more competitive, develop an efficient system for the management of municipal services and create a safe and comfortable environment for local residents. The project has been implemented in Sarov (Nizhny Novgorod Region). Over the year and a half since the launch of the Smart City system, the amount of time required to process enquiries and complaints received from residents has been reduced four-fold; the amount of time required for public transport dispatch operations has been reduced from two and a half days to an hour and a half, while the time of response to accidents or utility service failures has been reduced from 30 to 3 minutes.

In 2019, ROSATOM signed a number of cooperation agreements with Russian regions covering the following areas:

- Digitization of municipal services in order to improve transport and social infrastructure;
- Making the regions more attractive to investors; upgrading utility infrastructure using modern approaches based on digital technology.

Under an agreement with Udmurtia, ROSATOM will implement an investment project which will help to increase the reliability of water supply in Glazov. The Corporation will upgrade the entire municipal water supply and sewerage infrastructure system, including the construction of new facilities, renovation and overhaul of existing ones. RUB 1.2 billion will be allocated for these purposes over the next five years. A pilot project in the sphere of water supply and sewerage management is also being implemented by the Corporation in Lesnoy (Sverdlovsk Region).

Agreements with the Nizhny Novgorod Region and the city of Sochi provide for upgrading the housing and utility infrastructure using modern digital approaches, including such elements of the Smart City as Smart Utilities and the Smart Water Supply and Sewerage System.

The Smart City is underpinned by the sustainable use of resources and the use of state-of-the-art digital technologies. Information obtained as a result of a thorough process analysis at the local level is digitized and provides a basis for a continuous improvement system.

The Smart City includes the Digital Water Supply and Sewerage System as one of its elements. This is a system for the automation and digitization of production and distribution processes which enables effective management of water supply and sewerage systems.

JSC Smart City Digital Platforms and Solutions, an organization of ROSATOM, acts as the integrator of solutions in the following areas: Centralization of Municipal Utility Systems, Clean Water and the Smart City.

Implementation of agreements with the Republic of Dagestan, the Tomsk, Kursk and Murmansk Regions will also be based on ROSATOM's experience and developments in the field of the smart city. For instance, the Corporation is cooperating with the administration of the Tomsk Region to create a regional digital platform for supporting the implementation of the Region's social and economic development strategy. The Our North portal, a digital solution with a range of functions similar to the Active Citizen platform, was promptly developed and adopted for the Murmansk Region. Citizens can use the portal to report problems in the sphere of housing, utilities and municipal administration and submit proposals concerning municipal services or the development of the Region as a whole.

See also the section 'ROSATOM Production System'.

9.2.8. GRAZHDANIN STRANY ROSATOM APP

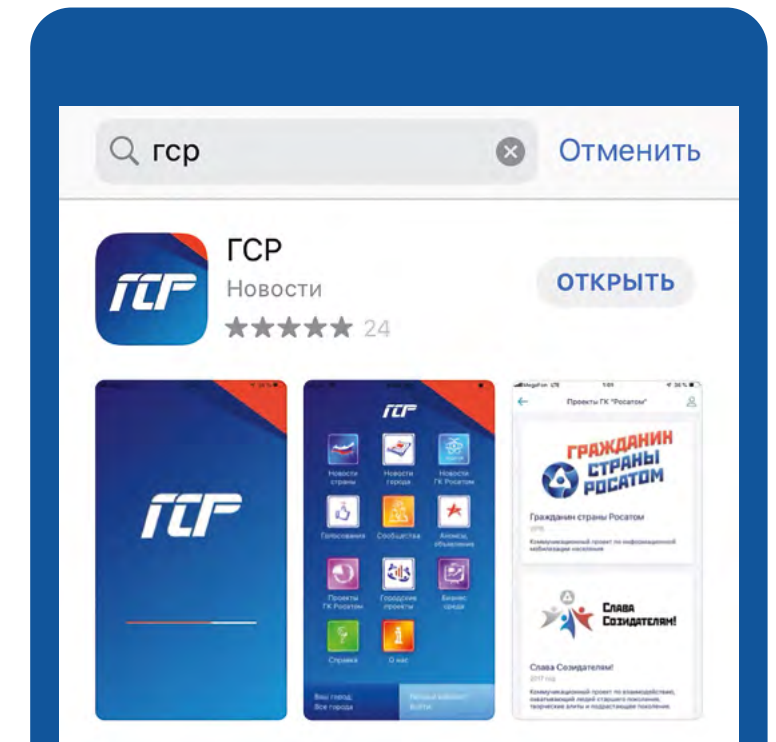
In 2019, ROSATOM launched a mobile app, Grazhdanin Strany ROSATOM. It is a communication platform designed to engage people living in ROSATOM's regions of operation in the discussion of relevant issues related to urban and social life. The service involves targeting users based on their gender, age and preferences according to the data entered during registration, including via social media.

Key services available through the app include:

- Surveys and feedback collection, with users being able to propose subjects for discussion with the help from moderators;
- A discussion platform;
- A system of bonuses for active survey respondents, who can then use bonus points when ordering paid services via the mobile app (a partner programme run in cooperation with municipal organizations and businesses);
- Prompt provision of information to residents (municipal and federal-level news, information about ROSATOM's projects);
- Access to background information about local enterprises and organizations;
- Online booking of tickets to cultural events, tables in cafes, etc.

In the reporting year, the app provided coverage of events in Russia, ROSATOM's projects and life in 27 towns and cities where nuclear enterprises are located. By the end of 2019, the app had over 70,000 registered users.

CITIZEN OF ROSATOM'S COUNTRY (GSR) MOBILE APP



9.2.9. IMPLEMENTATION OF SOCIAL AND CHARITY PROGRAMMES IN ROSATOM'S REGIONS OF OPERATION

#ROSATOMVMESTE

In 2019, a large-scale competition of social projects titled #ROSATOMVMESTE ('ROSATOM Together') was held for the second time. The goal of this competition is to create 'change teams' in towns and cities, to form an efficient environment for communication between employees in the nuclear industry and residents of ROSATOM's host towns and cities, and to raise their awareness.

In 2019, the competition was held in 20 of ROSATOM's host towns and cities and included five stages:

- The Town/City Brand;
- ROSATOM's Million;
- A competition for social project coordinators;
- ROSATOM's Best Month;
- ROSATOM's Day of Towns and Cities.

ROSATOM'S SCHOOL⁶⁶

The long-term project titled ROSATOM's School is aimed at providing children with first-class education regardless of where they live, while preserving and developing the unique character of municipal education systems. The project is implemented in 21 towns and cities in which ROSATOM operates. It covers almost 250 schools and over 400 nursery schools with a total of over 200,000 children and school students.

In 2019, the Corporation began to develop efficient technologies for providing additional education to children. Five 'Atom – Class!' Interschool Network Competence Centres were provided with the necessary equipment and started to function in Tryokhgornyy (Chelyabinsk Region), Udomlya (Tver Region), Zelenogorsk (Krasnoyarsk Territory), Novovoronezh (Voronezh Region) and Zarechny (Sverdlovsk Region).

In the reporting year, a network competence centre for teachers forming part of ROSATOM's School held a 10-week remote methodological marathon, with over 9,500 people from 53 fed-

In 2019, the #ROSATOMVMESTE project won the Silver Archer National PR Award in the Corporate Social Responsibility category.

More than 500,000 people from 20 nuclear towns and cities participated in the competition. The town of Zarechny (Penza Region) was declared the winner. The town received a money prize (RUB 10 million); these funds will be used to support social projects in the field of education, culture, sports and the veteran movement.

eral subjects of Russia participating in this event. 97 remote workshops were held, and an electronic platform was created which contains over 100 hours of video materials prepared for these workshops.

ROSATOM's School held the sixth Meta-Disciplinary Academic Competition. Participants of the competition included more than 1,000 teams, more than 4,000 students and more than 1,000 teachers from all schools in the towns and cities participating in the initiative.

The Corporation held the ARTatomCITY visual arts festival, with artwork submitted by 1,500 young artists from 18 towns and cities participating in the project.

⁶⁶ <http://rosatomschool.ru>.

ACCELERATOR OF SOCIAL INITIATIVES

In 2019, the Accelerator of Social Initiatives competition was held for the second time. The competition was held in Lesnoy, Zarechny and Novouralsk (Sverdlovsk Region), Zarechny (Penza Region), Zelenogorsk and Zheleznogorsk (Krasnoyarsk Territory). 855 people participated in the competition, with about 50 projects submitted for critical review. Authors of the most exciting and well-thought-out concepts presented them to

CHARITY WORK

Continuing the traditions established in the nuclear industry, ROSATOM and its organizations adhere to the principles of responsible business conduct. The Corporation is guided by the priorities of social and economic development of Russia, its regions and its cities, including the CATFs in the nuclear industry, and consistently implements industry-wide social and charity programmes.

As part of its charity initiatives, ROSATOM gives priority to the following areas:

- Social and environmental initiatives, including assistance to victims of natural disasters, industrial accidents and environmental disasters related to the nuclear legacy;

TERRITORY OF CULTURE⁶⁷

ROSATOM's Territory of Culture is a programme aimed at finding and supporting creative talents in the cities and towns where ROSATOM operates, improving the performance of cultural institutions and introducing residents of Russian nuclear cities and towns to the highlights of performing, figurative and dramatic arts.

In 2019, the following events were held as part of the programme:

- The second Music Academy of Nuclear Towns and Cities under the auspices of the People's Artist of Russia Yuriy Bashmet;
- Meet-the-artist sessions and master classes with famous Russian performers (including People's Artists of Russia Alexey Guskov and Yulia Rutberg, Honoured Artists of Russia Anna Bolshova, Daniil Spivakovsky, etc.);
- Creative laboratories as part of a project titled 'Theatre of Nations to Theatres of Nuclear Towns and Cities';

⁶⁷ <http://tercult.ru/>.

municipalities, representatives of ROSATOM and regional funds supporting entrepreneurship. The projects that reached the finals included aerial gymnastics, fitness and dance studios, family dental clinics, leisure centres for children, shops selling goods for diabetic patients, cleaning companies, chess clubs and other organizations whose services are in demand.

- Initiatives aimed at protecting people's life and health (support for the disabled, elderly people, orphans or disadvantaged children; emergency medical care);
- Support for educational projects, assistance to socially important cultural and educational initiatives;
- Preservation of cultural heritage sites and historic monuments;
- Promoting a healthy lifestyle, physical education, popular and amateur sports;
- Fostering moral and spiritual values and strengthening the civil identity;
- Supporting the youth education system based on spiritual, moral and patriotic values traditional for the Russian culture.

- A choir festival featuring singers from the Turetsky Choir and the Soprano art project.

In addition, as part of the Programme, special emphasis was placed in 2019 on professional development of people involved in the organization of cultural events, which contributed to an increase in the number of such events and facilitated their promotion. Events aimed at developing the competences of heads of cultural institutions included onsite workshops, specialized webinars and professional development programmes for regional civil servants. Special online communities were created to enable prompt exchange of information between experts in the relevant areas and representatives of local governments.

9.2.10. WORK OF THE PUBLIC COUNCIL

ROSATOM's Public Council⁶⁸ established in 2006 is tasked with providing support for cooperation between ROSATOM's organizations and individuals, non-profit organizations, regional and local governments in Russia and abroad.

In 2019, the Public Council, together with the Northern Sea Route Directorate and FSUE Atomflot, prepared and published a book titled 'Captains' to mark the anniversary of the nuclear-powered icebreaker fleet. The book contains information on the history of the Russian nuclear-powered icebreaker fleet, biographies and stories told by captains of nuclear icebreakers; it also outlines plans for the development of the Northern Sea Route.

PUBLIC DIALOGUE FORUM

In November 2019, the Public Council took part in the organization of the International Public Dialogue Forum and the AtomEco 2019 Exhibition in Hungary. The event was aimed at opening a dialogue between specialists in the nuclear industry, government agencies, experts, ecologists and the general public. It was attended by more than 570 people from 16 countries. Participants of the forum included representatives of international organizations (the IAEA, the OECD NEA, Nuclear Transparency Watch) and Russian and Hungarian non-governmental organizations (Bellona, Energiapolitika 2000).

The findings of pre-operational radiation and environmental assessment of the environment in the vicinity of the Belarusian NPP ('Zero' Background Radiation Level at the Belarusian NPP) were

One of the focus areas of the work of the Public Council in 2019 was cooperation with the regional expert community. More than 70 experts from research institutions and universities, including the Ural Federal University named after Boris Yeltsin, Tomsk State University and Siberian Federal University, discussed matters related to the safety of nuclear technologies and nuclear power and demand for them in today's world. Experts from Lomonosov Moscow State University were engaged in the discussion of matters related to public control and public participation in decision-making with regard to the development of the Russian nuclear industry.

Overall, in the reporting year, the Council published 1,483 items of information material on regional, industry-wide and corporate sites.

also presented at the forum. In 2019, the Corporation formed a group of international experts, representatives of non-governmental organizations and ATOMTEX, a Belarusian research institution; the group developed an algorithm for assessing the status of the environment, conducted instrumental measurements, collected samples and studied the special features of the natural environment and the landscape in the vicinity of the Belarusian NPP. As a result of this survey, the group publicly recorded a zero background radiation level, confirming the findings of state environmental monitoring. The survey methodology and the findings are available for use as part of public control and further verification of the safety of operation of the Belarusian NPP.

CONTEST OF SOCIALLY IMPORTANT PROJECTS⁶⁹

As part of ongoing cooperation between ROSATOM and non-governmental and non-profit organizations in its regions of operation, in 2019, the Corporation once again held the annual contest of socially beneficial initiatives implemented by non-profit organizations and associations.

To be eligible to participate in the contest, an applicant organization must invest its own funds totalling at least 25% of the total project cost.

Following two stages of the competition, 73 socially important projects in various areas were declared winners. They included the Active Longevity School, a dance marathon titled 'Zarechny: the Dance Territory', an adventure game and competition titled 'Ecology of the Future', Motor Sports at ROSATOM, the Summer Students' Camp, the Navigator National Online Intellectual Competition, etc.

9.3. STAKEHOLDER ENGAGEMENT

Key results in 2019

- 73.7% of the population in Russia supports the use of nuclear energy.
- 335,000 people visited Nuclear Energy Information Centres.
- Viewership of channels broadcasting the *Strana ROSATOM* TV programme in various regions of Russia totals 7.3 million people.

9.3.1. APPROACHES TO STAKEHOLDER ENGAGEMENT

Due to its scale and special characteristics of its business (simultaneous performance of state and business tasks, operation across a large number of markets), ROSATOM has a wide range of stakeholders both in Russia and worldwide.

Targeted stakeholder engagement is aimed at achieving strategic goals and getting the public on board for developing nuclear energy.

The Corporation fosters systematic and constructive stakeholder engagement in each area of its business and communicates with society as a whole.

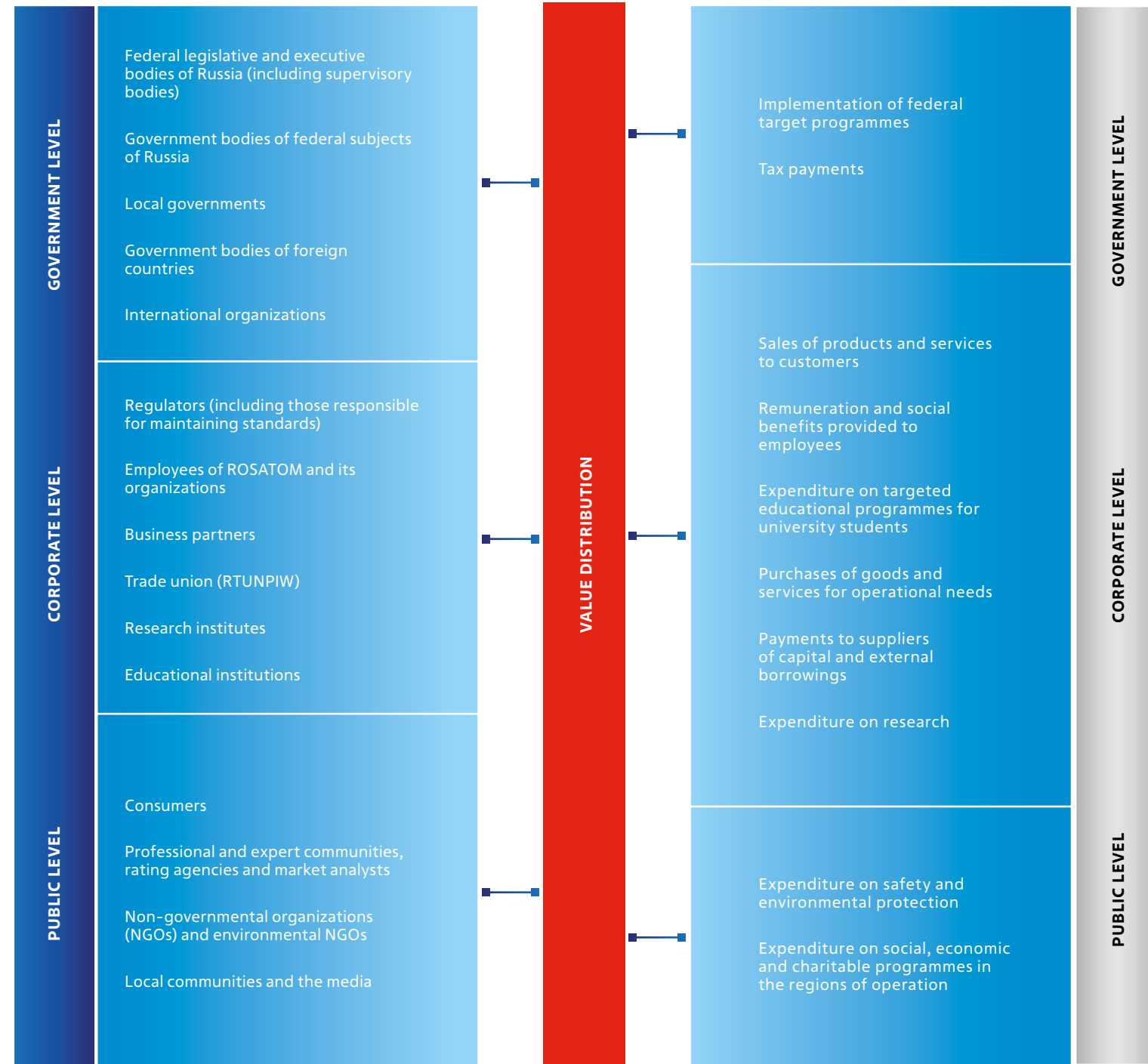
Fundamental principles of stakeholder engagement are as follows:

- Respect and accommodation of the interests of all participants;
- Open efficient cooperation;
- Timely and exhaustive information on ROSATOM's activities;
- Striving to provide specific benefits to all participants;
- Fulfilment of obligations.

⁶⁸ <https://osatom.ru/en/>.

⁶⁹ <https://oskonkurs.ru/>.

STAKEHOLDER MAP



STAKEHOLDER INTERESTS AND TYPES OF STAKEHOLDER ENGAGEMENT

Government bodies of the Russian Federation	1–16, B, C, E, F, G, P, Q
Government regulators (supervisory bodies)	1, 2, 4, 6, 7, 10, B, C, N, P, Q
Regional governments	2, 6, 10, 15, B, C, E, F, G, P, Q
Local governments in the regions of operation	2, 11, 15, C, E, F, G, K, P, Q
Government bodies of foreign countries	1, 2, 6, 7, 10–13, 16, A, D, J, K, P, Q
International organizations, including those in the nuclear sector	1, 2, 6, 7, 10–13, 16, A, D, J, K, P, Q
Organizations forming part of ROSATOM	3, 5, 6, 13, 16, D, K, P, Q
Manufacturers and suppliers of equipment and services	5, 7, 10, K, I, P, Q
Consumers of technologies, products and services	3, 5, 6, 7, 8, 9, 12, K, H, P, Q
Business partners	5, 6, 7, 8, 9, 12, K, M, P, Q
Professional associations	6, 14, 16, F, D, K, O, P, Q
Non-governmental organizations, including environmental NGOs	2, 10, 11, 15, C, E, G, K, O, P, Q
Employees of the Corporation and its organizations, as well as organizations representing their interests	6, 10, 14, 16, F, D, I, E, O, P, Q
Local communities in the regions of operation	11, 15, C, E, F, G, H, K, O, P, Q
Educational institutions	3, 14, 16, D, J, P, Q
Financial institutions	3, 5, 8, 10, K, P, Q
Rating agencies, market analysts, experts	5, 10, 13, K, P, Q
Citizens of the Russian Federation	1, 2, 4, 6, 10, 11, 12, 15, H, O, P, Q
Research institutes	3, 11, K, O, P, Q

STAKEHOLDER INTERESTS

- 1 | Ensuring non-proliferation of nuclear materials and technologies
- 2 | Nuclear and environmental safety
- 3 | Technological modernization in the nuclear industry
- 4 | Efficient use of budget funds
- 5 | Economic efficiency of ROSATOM's organizations
- 6 | Compliance with international and Russian legislation
- 7 | Fair competition and responsible behaviour in the market
- 8 | Competitiveness in global markets
- 9 | Improvement of product and service quality
- 10 | Transparency of ROSATOM's operations, including transparency of procurement activities
- 11 | Dealing with the legacy of past business operations and defence efforts in the industry
- 12 | Reliable electricity supply
- 13 | Adoption of international governance norms and standards
- 14 | Adequate remuneration to employees; support for professional development of employees; safe working conditions
- 15 | Improvement of the quality of life in the regions of operation
- 16 | Talent development in ROSATOM and its organizations

TYPES OF STAKEHOLDER ENGAGEMENT

- A | Cooperation with specialized international organizations, participation in international programmes and projects
- B | Participation in law-drafting activities
- C | Public consultations and public environmental impact assessments of NPP power unit construction projects
- D | Employee training and development programmes
- E | Social programmes and projects
- F | Participation in the development of the regions of operation
- G | Opinion polls, customer satisfaction surveys
- H | Charity work
- I | Hotlines
- J | Programmes of cooperation with specialized universities
- K | Dialogues, presentations, forums, conferences
- L | Open and competitive procurement procedures
- M | Programmes of cooperation with other companies
- N | Programmes of cooperation with government regulators (supervisory bodies) and law enforcement agencies
- O | Public governing and supervisory bodies
- P | Information and communication
- Q | Public reports

9.3.2. NUCLEAR ENERGY INFORMATION CENTRES (NEICs)⁷⁰

The objective of NEICs is to raise awareness among local communities in the regions about the nuclear industry and the development prospects of nuclear power and radiation technologies, make professions in the industry more prestigious, promote science, innovative technologies and technical education, and cooperate with the professional scientific community in promoting science.

As at December 31, 2019, the NEIC network comprised 17 centres in Russia, as well as centres in Minsk (Belarus) and Nur-Sultan (Kazakhstan). In 2019, 335,000 people visited the centres.

⁷⁰ <http://www.myatom.ru>.

In 2019, almost every NEIC held a city-wide event. Vladimir and Zheleznogorsk (Krasnoyarsk Territory) hosted a mini science festival, *Scientific Encounters*; an adventure game titled *Stark Is Alive!* was designed in Ulyanovsk and successfully replicated in Voronezh, Novovoronezh and Rostov-on-Don; residents of Minsk and Smolensk took part in a science and sporting event, *AtomDvizh* ('AtomMove'). Centres in Ekaterinburg, Kaliningrad and Novosibirsk held the KSTATI ('By the Way') Festival of Science, which has become an annual event in these cities. Employees of the NEIC in Nizhny Novgorod organized a Science Tour in six districts in the northern part of the Nizhny Novgorod Region, while the NEIC in Saratov held a *Science Lawn* festival, which consisted of a 30-day non-stop series of workshops for children, popular science talk shows, musical performances and outdoor games. The NEIC in Belarus launched a special project, *Construction DNA*, as part of a town festival in Ostrovets and a programme titled *Sounds of a Construction Site* in Minsk.

9.3.3. ATOMEXPO INTERNATIONAL FORUM

ATOMEXPO is an event initiated by ROSATOM that serves as a global industry-wide discussion platform. Held annually since 2009, it is the largest exhibition and business platform for discussing the current state of the nuclear industry and setting future trends.

The 2019 Forum was titled 'Nuclear for Better Life'; its business agenda was focused on the contribution of state-of-the-art nuclear technology to the achievement of the UN Sustainable Development Goals.

The Forum was attended by more than 4,000 people from 74 countries and 40 official delegations, including 8 ministers and high-ranking officials holding equivalent positions. More than 40 cooperation agreements, memoranda and contracts, including 6 official interdepartmental agreements, were signed on the sidelines of the Forum.

Nuclear Kids (NucKids) (<http://nuckids.ru/en>) is an annual international art project for the children of employees of Russian nuclear organizations and ROSATOM's foreign partners. The project is being implemented in 15 countries. Many NucKids alumni study at well-known universities, such as the Russian Institute of Theatre Arts (GITIS), the Moscow Art Theatre School, the Russian State University of Cinematography (VGIK) and the Oleg Tabakov Studio. They perform in films and work in show business.

In 2019, 57 children took part in the project. Under the supervision of professional choreographers, directors, voice coaches and singing teachers, they staged a play titled *In the Beginning Was the Word*, based on *Chuchelo* ('The Scarecrow'), a novella by Vladimir Zhelezniakov. This frank and profound piece focused on the problem of teenage bullying and 'living online'. It was premiered in Debrecen (Hungary), followed by performances in Russian 'nuclear' towns of Sosnovy Bor (Leningrad Region) and Udomlya (Tver Region), as well as in Saint Petersburg and Moscow.

The Russia – IAEA Nuclear Energy Management School was run at the ATOMEXPO venue. This event was attended by delegates representing 19 countries; they studied practices used in addressing matters related to various aspects of implementation of national nuclear power programmes.

The ATOMEXPO AWARDS ceremony was held; this is an international professional award for outstanding achievements, which is presented to global industrial companies that have made an important contribution to the development of the nuclear industry and the use of nuclear power for the benefit of humankind.

9.3.4. PARTICIPATION IN THE WORK OF INTERNATIONAL CORPORATE ORGANIZATIONS

ROSATOM and its organizations are members of the World Nuclear Association (WNA) and actively participate in all WNA events, including country workshops and the annual Symposium. In 2019, the Corporation was one of the key participants of World Nuclear Spotlight Brazil.

ROSATOM has been a Patron of the World Energy Council (WEC) since 2017 and a member of the Russian National Committee of the World Energy Council since 2012. In 2019, as part of its cooperation with the WEC, the Corporation actively participated in panel discussions and the exhibition during the 24th World Energy Congress held in Abu Dhabi (UAE) on September 9-12. In addition, the WEC and the WNA published a joint report on the nuclear industry for the first time with assistance from the Corporation.

Throughout 2019, ROSATOM and its organizations also actively participated in the work of other international nuclear organizations: the World Association of Nuclear Operators, the World Nuclear University, the European Nuclear Society, the Japan Atomic Industrial Forum, the Brazilian Association for the Development of Nuclear Activities (ABDAN), the Nuclear Industry Association of South Africa, etc. Overall, in the reporting year, ROSATOM took part in more than 40 forums and conferences abroad and organized 16 displays at overseas exhibitions.

For details on cooperation with international non-governmental organizations, see the section 'International Cooperation'.

9.3.5. PROJECTS IN THE SPHERE OF COMMUNICATION AND THE HUMANITIES IMPLEMENTED IN COOPERATION WITH FOREIGN PARTNERS

In 2019, ROSATOM organized 25 events in the field of the humanities in Russia and seven partner countries. As part of these events, foreigners learnt about Russia, the Russian culture and way of life. The events were attended by more than 2,000 people from 43 countries.

Four international shifts were organized as part of the International Smart Holidays project, with 94 children from the Corporation's partner countries participating in the project.

The Corporation provided support for community relations projects in the countries in which it operates (the Benois de la Danse World Ballet Festival, the Geographical Dictation, the FIDE World Chess Championship, etc.).

About 25 technical tours of nuclear facilities in Russia and construction sites of Russian-design NPPs abroad were organized for Russian and foreign journalists and experts (more than 200 people).

9.3.6. INDUSTRY MEDIA

To inform employees and other stakeholders of the news and key events in ROSATOM and its organizations, a range of corporate media outlets under the common brand name *Strana ROSATOM* ('The Country of ROSATOM') is used in the industry:

- A newspaper (published weekly in all enterprises in the Russian nuclear industry, with a circulation of 59,000 copies and a readership of over 250,000 people);
- A radio programme (it is broadcast two or three times a week in 30 of ROSATOM's organizations and has an audience of 50,000 people);
- A television programme (it is aired weekly in 20 towns and cities where nuclear organizations operate; the viewership of the channels that broadcast the programme totals 7.3 million people).

Throughout 2019, ROSATOM and the TASS news agency were cooperating on joint multimedia projects. They won a number of awards in the sphere of journalism and design. Andrey Reznichenko, editor-in-chief of TASS Science, won a prize in the Energy of Words International Media Contest for journalists reporting on the energy industry for his special project, *Secrets of Radiation Technologies*, implemented jointly with ROSATOM's Communications Department. A project titled 'Northern Sea Route 2.0' won the Digital Communication Awards, a prestigious award in the field of design, in the Long Read category. This project is an interactive presentation on the history of the Northern Sea Route, the modernization of the nuclear-powered icebreaker fleet and its development prospects.

9.3.7. ONLINE COMMUNICATIONS

ROSATOM is actively developing online communication with stakeholders. In 2019, the Corporation's official website at www.rosatom.ru was visited by more than 700,000 people, or approximately 5,000 people on average every weekday.

The Corporation is also expanding its presence on social media in order to inform users of various developments in the Russian nuclear industry, answer questions and conduct awareness-raising

events. In 2019, ROSATOM recorded the largest increase in the number of followers on social media platforms focused on visual content: Instagram (where the official community expanded by more than 70% year on year) and YouTube (an increase of more than 50%). At year-end 2019, ROSATOM's communities on social media comprised a total of more than 158,000 people.

Platform	Number of followers as at December 31, 2018*	Increase (+%)	Number of followers as at January 1, 2020*
INCREASE IN THE NUMBER OF FOLLOWERS IN 2019			
Vkontakte	42,600	6,900 (+16.1%)	49,500
Facebook	31,500	8,300 (+26.3%)	39,800
Instagram	18,100	13,300 (+73.4%)	31,400
YouTube	16,400	9,500 (+57.9%)	25,900
Twitter	10,800	600 (+5.5%)	11,400
Odnoklassniki	—	100	100
Total	119,400	38,700 (+32.4%)	158,100

* Follower numbers have been rounded to hundreds

9.3.8. OPINION POLLS

ROSATOM analyses the public perception of the development of nuclear power in Russia on a yearly basis and adjusts its communication with stakeholders accordingly.

According to an independent opinion survey by Levada-Centre⁷¹, 73.7% of the Russian population supported the use of nuclear power (74.5% in 2018). Over the past few years, this figure remains persistently high.

— DO YOU THINK THAT THE NUCLEAR POWER INDUSTRY SHOULD BE ACTIVELY DEVELOPED, MAINTAINED AT ITS CURRENT LEVEL, CURTAILED OR TOTALLY ABANDONED?	
Actively developed	46.9%
Maintained at the current level	26.8%
Curtailed	7.7%
Totally abandoned	9.4%
I do not know	9.2%

— DO YOU AGREE WITH THE FOLLOWING STATEMENT: ‘NUCLEAR ENERGY IS A “GREEN”, ENVIRONMENTALLY FRIENDLY TYPE OF POWER GENERATION’?	
I completely agree	17.7%
I partly agree	36.5%
I partly disagree	22.7%
I completely disagree	14%
I do not know	9.1%

⁷¹ The survey was conducted from February 14 through February 28, 2020 across a representative sample of Russian citizens consisting of 3,951 people aged 18 and above.



10.1. Nuclear and Radiation Safety;
Occupational Safety and Health

216

10.2. RAW and SNF Management and Decommissioning
of Facilities Posing Nuclear and Radiation Hazards

228

10.3. Environmental Safety

234

10

SAFETY AND ENVIRONMENTAL PROTECTION



10.1. NUCLEAR AND RADIATION SAFETY; OCCUPATIONAL SAFETY AND HEALTH

Key results in 2019

- No events rated at level 1 or higher on the INES scale were detected.
- The injury frequency rate and the lost time injury frequency rate (LTIFR) stood at 0.22 and 0.1 respectively.
- Individual radiation risk was calculated for 64,932 people using the IRAW system.

10.1.1. NUCLEAR AND RADIATION SAFETY MANAGEMENT

ROSATOM focuses on effective exercise of powers and performance of functions stipulated by the laws of the Russian Federation on the use of nuclear power, with safety and environmental protection as the top priority. This task is addressed by various divisions of ROSATOM and its organizations using all the main government and non-governmental regulation mechanisms.

Nuclear and radiation safety management functions are performed by the following divisions of ROSATOM:

- The General Inspectorate prepares proposals for shaping the state policy on nuclear and radiation safety, takes measures to ensure the safety of nuclear facilities and monitors safety in ROSATOM's organizations;
- The Nuclear and Radiation Safety, Licensing and Permitting Department is tasked with ensuring that personnel and equipment are ready to respond to emergencies at nuclear facilities and monitoring the implementation of emergency prevention measures;
- The Directorate for Public Policy on Radioactive Waste, Spent Nuclear Fuel and Nuclear Decommissioning plays a leading role in the system for the management of government programmes aimed at addressing nuclear legacy issues;
- The Technical Regulation Department formulates technical safety requirements for the use of nuclear power.

The following bodies were established in 2019:

- An industry-wide Coordinating Council for Safety Culture;
- An industry-wide coordinating council for the development and implementation of an occupational risk management system in ROSATOM's organizations;
- An industry-wide Council for Occupational and Industrial Safety.

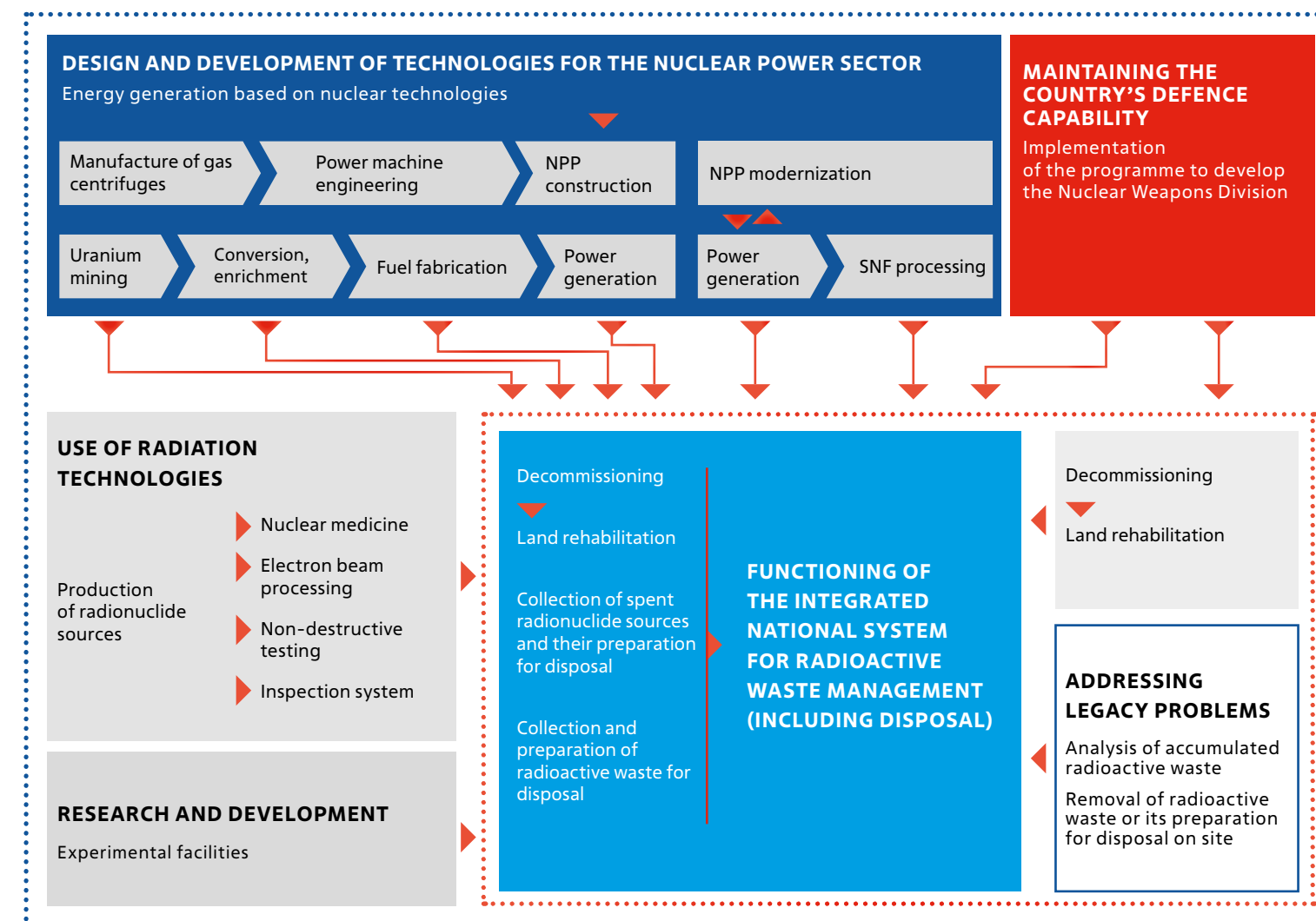
In 2019, at the third Industry-Wide Dialogue Forum titled 'Nuclear Power and Industry Safety Day', the Safety Culture Policy Statement of ROSATOM and Its Organizations was reviewed and adopted. The document states the principles of the Safety Culture Policy, the main focus areas of its implementation, as well as the relevant obligations of ROSATOM's management (http://www.nwatom.ru/images/Documents/Politika_bezopasnosti_Rosatom.pdf).

In 2019, 876 employees of the Corporation received training as part of programmes aimed at developing a culture of safe behaviour.

NUCLEAR AND RADIATION SAFETY MANAGEMENT

..... Nuclear and radiation safety circuit I.
Safe operation of nuclear facilities

..... Nuclear and radiation safety circuit II.
Completion of final stages of process cycles



10.1.2. NUCLEAR AND RADIATION SAFETY AT NUCLEAR FACILITIES

In 2019, ROSATOM ensured safe and steady operation of enterprises in the nuclear industry. There were no incidents involving radiation leaks. Limits on employee radiation exposure were not exceeded. No licences were revoked in the nuclear industry.

Despite a large number of inspections conducted in ROSATOM's organizations by supervisory government agencies, the number of violations detected at potentially hazardous facilities has been decreasing in recent years. In 2019, 580 violations were detected (698 in 2018; 814 in 2017). No violations affecting safe operation were detected at 90% of the nuclear facilities inspected in 2019 by regulatory authorities. This positive result is due to the fact that all technical personnel focus closely on compliance with safety requirements.

The safety status of nuclear facilities is assessed based on the number and scale of recorded deviations in their operation that are benchmarked against the IAEA International Nuclear and Radiological Event Scale (INES). Events on the scale are rated at seven levels: the upper levels (4–7) are termed 'accidents', while the lower levels are 'incidents' (2–3) and 'anomalies' (1). Events that have no safety significance are called 'deviations' and are rated as below scale, at level 0. Events that have no safety relevance are classified as 'out of scale'.

NUCLEAR POWER PLANTS

As in many recent years, in 2019, no events rated at level 2 or higher on the international INES scale were detected at Russian nuclear power plants. Moreover, in 2019, there were no events rated at level 1.

In 2019, 38 deviations were recorded at Russian nuclear power plants. Deviations (rated at level 0) do not pose a risk to employees operating the facilities, local residents or the environment.

CHANGES IN THE NUMBER OF ANOMALIES AND DEVIATIONS IN NPP OPERATION ON THE INES SCALE

	2017	2018	2019
Total, including:	33	42	38
Level 0 and out of scale	33	40	38
Level 1	0	2	0

The deviations were mainly associated with failures of thermal mechanical and electrical equipment; a small number of deviations was caused by failures of monitoring and control systems. Equipment failures were due to hidden defects that could not be detected during manufacturing, installation and adjustment.

Failures of monitoring and control systems were caused by deficiencies in self-diagnostic and defect detection functions. Following investigations into the deviations, corrective measures have been developed and implemented to prevent such deviations in the future.

RESEARCH NUCLEAR FACILITIES

In 2019, there were no nuclear, radiation or technical accidents at research nuclear facilities in ROSATOM's organizations. No events rated higher than level 0 on the INES scale were detected.

A total of 5 deviations occurred in the reporting year (1 in 2018, 3 in 2017). They were caused mainly by deficiencies in previously adopted equipment design solutions.

MARINE NUCLEAR PROPULSION UNITS

There were no violations of safe operating limits and conditions for propulsion units of nuclear-powered vessels in 2019. The radiation level remained within permitted limits. No events rated higher than level 0 on the INES scale were detected.

There were a total of 5 deviations in the reporting year (16 in 2018, 11 in 2017). Most deviations were due to leaks in the pipe systems of steam generators during operation. A decrease in the number of such deviations (from 12 in 2018 to 2 in 2019) has been achieved by introducing a new technology when replacing a defective unit in the pipe systems of steam generators.

10.1.3. PHYSICAL PROTECTION OF NUCLEAR FACILITIES

The security and physical protection of ROSATOM's nuclear facilities posing nuclear and radiation hazards and of nuclear and radioactive materials used and stored by ROSATOM (including during their transportation) complies with Russian legislation and the provisions of the Convention on the Physical Protection of Nuclear Material and is consistent with the IAEA recommendations.

In 2019, there were no violations of access control and internal security requirements at ROSATOM's facilities resulting in the theft of nuclear materials, terrorist acts or sabotage at nuclear facilities.

In 2019:

- Departmental inspections of the condition of physical protection systems were carried out in 12 organizations of the Corporation;
- ROSATOM upgraded and replaced security equipment along 27 kilometres of the perimeters of protected areas of facilities posing nuclear and radiation hazards, including checkpoints;
- Over 2,500 items of equipment were installed in protected areas as part of equipment systems for physical protection;
- Equipment for physical protection was upgraded in 34 buildings;
- More than 25 kilometres of cable routes for physical protection systems were laid.

In the reporting year, ROSATOM's departmental security agency in cooperation with the federal executive government ensured the safety of Akademik Lomonosov floating power unit during its transportation from Murmansk to Pevek (Chukotka Autonomous District). This experience in safe transportation can be used in the future, including in international practice.

10.1.4. EMERGENCY PREPAREDNESS⁷²

In order to ensure the safe operation of the nuclear industry and protect employees, local population and areas against the possible effects of accidents (emergencies), ROSATOM operates an emergency prevention and response system (EPRS), which is a functional subsystem forming part of the integrated state system for emergency prevention and response (ISSEPR).

As at December 31, 2019, 14 professional emergency response teams (ERTs) and 62 volunteer ERTs had been formed and were in a state of readiness in the nuclear industry. They comprise a total of 2,315 emergency response workers.

In 2019, transportation of nuclear materials fully complied with the relevant laws and regulations. There were no violations. In all instances, transportation was monitored using an automated system for the safe transportation of nuclear materials.

In 2019, 505 operational training exercises were held, including 5 command post exercises, 20 special tactical exercises, 2 tabletop exercises, 38 emergency response exercises and 11 comprehensive training exercises.

10.1.5. INDUSTRY-WIDE RADIATION MONITORING SYSTEM

The Industry-Wide Radiation Monitoring System (IRMS) is in operation in Russia as a functional subsystem of the Integrated State Automated Radiation Monitoring System in the Russian nuclear industry.

The upper level of the IRMS is the departmental information and analysis centre for radiation monitoring, which integrates data from:

- On-site automated radiation monitoring systems (ARMSs). On-site ARMSs are in operation in the locations of 31 of ROSATOM's facilities posing radiation hazards;
- The on-site subsoil condition monitoring (OSCM) system. The industry-wide OSCM system has been implemented in 55 organizations of the Corporation, including all environmentally relevant organizations. Information collected by the system is used to assess and predict changes in the condition of the subsoil, provide rationale for design solutions and evaluate the effectiveness of remediation measures.

In 2019, the IRMS included:

- 435 fixed on-site ARMS stations;
- 2,695 OSCM wells;
- 206 air quality monitoring stations;
- 176 atmospheric precipitation monitoring stations;

An information and analysis system for radiation and environmental monitoring has been piloted at FSUE Mayak Production Association and JSC Siberian Chemical Plant. It is used to systematize the findings of routine monitoring of radionuclide content in discharges and emissions from enterprises and in the natural environment (water, soil, vegetation, the atmosphere, atmospheric precipitation, bottom sediments, etc). In 2019, the system was launched at PJSC MSZ.

- 455 stations monitoring surface water bodies;
- 213 stations monitoring bottom sediments;
- 561 soil monitoring stations;
- 404 ground vegetation monitoring stations;
- 92 stations monitoring algae and aquatic organisms;
- 397 stations monitoring the snow cover;
- 290 stations monitoring food products;
- 432 absorbed dose monitoring stations.

Real-time data from automated radiation monitoring stations operated by ROSATOM's organizations is available on the website at <http://www.russianatom.ru>.

⁷² Detailed information on the operation of the emergency prevention and response system is available at <https://enwww.skcr.ru/>, <http://www.nwatom.ru>, and on the official websites of the Corporation and industry organizations.

10.1.6. INDUSTRIAL SAFETY

As at December 31, 2019, 98 of ROSATOM's organizations operated 737 hazardous industrial facilities (739 facilities in 2018), including 6 hazard class 1 facilities, 32 hazard class 2 facilities, 282 hazard class 3 facilities and 417 hazard class 4 facilities.

In 2019, there were no events classified as 'accidents at a hazardous industrial facility' at ROSATOM's industrial facilities. One event classified as an incident occurred at JSC NIKIET: a lead leak happened at an experimental lead-cooled reactor,

which was contained and repaired by the organization's personnel (there were no injured persons).

All equipment used at the Corporation's facilities undergoes timely technical inspection and industrial safety assessment. Personnel operating hazardous production facilities are provided with special clothing and personal protective equipment of appropriate quality.

10.1.7. FIRE SAFETY

The fire situation at the Corporation's facilities is stable. Since 2015, there have been no fires at facilities under construction in the industry. In 2019, there was a fire at LLC Petrozavodskmash Foundry (Mechanical Engineering Division). When a decommis-

sioned baggage and mail car was being cut, insulation caught fire due to sparks and scale falling under the casing. There were no injured persons or damage to property.

10.1.8. OCCUPATIONAL SAFETY AND HEALTH

The fundamental principle underlying ROSATOM's operations is to protect the life and health of employees in the course of operation of equipment, buildings, structures and production processes, including those involving radioactive materials and hazardous substances. ROSATOM has adopted a Single Industry-Wide Policy on Occupational Safety and Health, which defines the goals, principles and obligations of the Corporation in this area⁷³.

In 2019, ROSATOM joined the Vision Zero⁷⁴ international campaign in order to achieve a zero injury rate in its organizations.

The industry-wide occupational safety and health management system is an important element of mutual obligations undertaken by ROSATOM, the Russian Union of Employers in the Nucle-

ar Industry, Power and Science and the Russian Trade Union of Nuclear Power and Industry Workers in accordance with the Industry-Wide Agreement on Nuclear Power, Industry and Science (in the reporting year, the agreement for the period from 2018 through 2020 was in force). The Agreement incorporates the opportunities provided by legislation on the special inspection of working conditions (SIWC) and stipulates an additional mechanism for cooperating with the trade union in conducting an SIWC and analysing inspection findings. In 2019, 81,841 workplaces were inspected as part of the SIWC.

A KPI-based incentive system adopted in ROSATOM is one of the key mechanisms for improving safety performance.

⁷³ <https://rosatom.ru/sustainability/menedzhment-bezopasnosti-truda-i-okhrany-zdorovya/>.

⁷⁴ Vision Zero is based on the belief that all accidents, diseases and harm at work are preventable and on the commitment of Vision Zero Companies and Partners to promote the three core values of this campaign: Safety, Health and Well-Being (<http://visionzero.global/>).

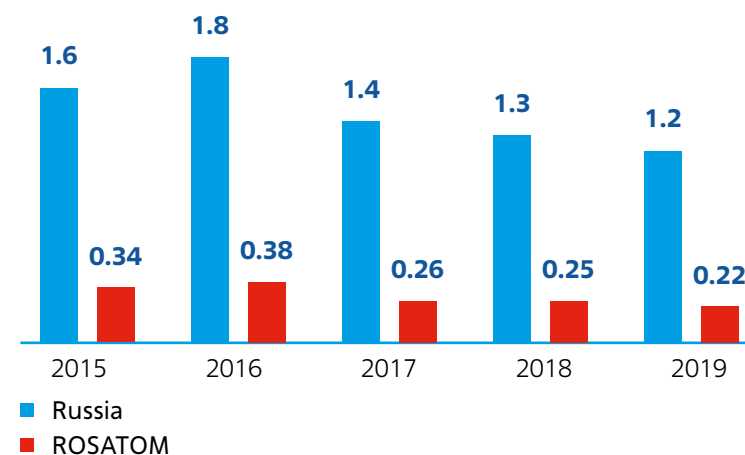
Indicator	2017	2018	2019
OCCUPATIONAL SAFETY AND HEALTH INDICATORS			
Number of people injured in accidents	67	66	62
Number of fatalities	10	4	3
Injury frequency rate (FR) ⁷⁵	0.26	0.25	0.22
LTIFR ⁷⁶	0.13	0.12	0.1
Number of people newly diagnosed with an occupational disease	37	10	12

INDUSTRIAL INJURIES AND ACCIDENTS

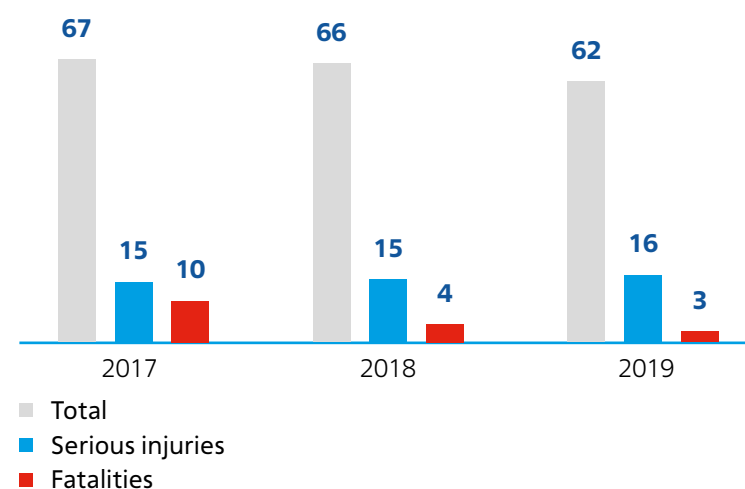
In 2019, the injury frequency rate remained relatively low compared to major Russian companies (despite an increase in the average headcount in ROSATOM's organizations by 11,000 people in the reporting year). The injury frequency rate (FR) stood at 0.22, which is more than five times lower than the national average (FR = 1.2).

62 persons were injured in 2019, including 41 men and 21 women⁷⁷. Out of the total number of the injured, 16 persons suffered serious injuries; there were 3 fatalities (all three victims were male). The main causes of injuries include falling on the premises, road accidents, the impact of moving mechanisms or rotating equipment parts, and the fall of an object on the victim.

COMPARATIVE DATA ON INDUSTRIAL INJURIES IN RUSSIA AND ROSATOM, INJURY FREQUENCY RATE (FR)



CHANGES IN THE NUMBER OF INJURED PERSONS



⁷⁵ FR stands for the number of industrial injuries per 1,000 employees per year.

⁷⁶ LTIFR is a ratio of the number of Lost Time Injuries (LTIs) to the total work hours (WH) in a division or organization during the reporting year normalized to 1 million man-hours.

⁷⁷ The number of persons injured in accidents is based on data on employees at ROSATOM's sites, including abroad, provided that the employee works for an organization within the scope of consolidation of ROSATOM, is employed under Russian law, and the accident has been investigated under Russian law. ROSATOM records those accidents the investigation of which has been completed (after all necessary documents have been prepared).

Injury factor	Number of injured persons		
	2017	2018	2019
CAUSES OF INDUSTRIAL INJURIES			
Falling from a height	3	3	6
Electric shock	4	2	0
Falling on the premises (on the surface of the same level, with a difference in heights, etc.)	21	29	16
Road accident	15	6	13
Impact of moving or scattering objects, structures or parts	13	11	9
Fall of an object on the victim	10	8	9
Burns (thermal, etc.)	0	4	3
Other (unclassified factors)	1	3	4
Sports-related injury	0	0	1
Animal bite	0	0	1
Total	67	66	62

A total of 9 people were injured in 2019 in contractor organizations, including 1 person who suffered serious injuries and 1 fatality. Falls from a height were the main cause of the accidents. Over the past five years, the number of injuries in contractor organizations has decreased threefold.

The risk of injuries remains high for employees involved in the operation and maintenance of equipment, and for those employees who do not follow safety precautions when moving around the premises of an organization.

In addition to the FR injury frequency rate, ROSATOM also uses the lost time injury frequency rate (LTIFR), which enables it to benchmark the injury rate across the Corporation against that of

other companies and countries. The LTIFR has been included in the KPI maps of all Division executives.

The reference value of the LTIFR for ROSATOM's Divisions, units, holding companies and the Corporation as a whole has been set at 0.5, which is a good result for any company in any country globally. The target for ROSATOM as a whole has been set at 0.4, which is better than the reference value. Individual values not exceeding the baseline values (a three-year average) have been accepted as target LTIFR values for the Divisions, units and holding companies within ROSATOM.

In 2019, the LTIFR across the Corporation and its organizations stood at 0.1⁷⁸.

⁷⁸ The LTIFR calculation does not include employees injured in traffic accidents caused by third parties, those whose health suddenly deteriorated due to an illness and those who suffered a sports-related injury (16 people).

Division/complex/unit	2017	2018	2019
CHANGES IN LTIFR			
Mining Division	0.28	0.22	0.22
Fuel Division	0.06	0.08	0.02
Mechanical Engineering Division	0.21	0.11	0.14
Engineering Division	0.06	0.05	0.06
Power Engineering Division	0.08	0.08	0.04
Life Cycle Back-End Division	0.05	0.20	0.13
Nuclear Weapons Division	0.14	0.16	0.13
Innovation Management Unit	0.00	0.00	0.00
Total across the Corporation	0.13	0.12	0.10

A further decrease in injury rates in the Corporation's organizations will be achieved through process improvement, the introduction of a safety culture and the enhancement of controls.

OCCUPATIONAL DISEASES

At year-end 2019, the number of employees in jobs that are characterized by harmful and (or) hazardous working conditions in ROSATOM's organizations totalled 120,061 people.

In 2019, the number of employees newly diagnosed with occupational diseases totalled 12 people (10 people in 2018, 37 people in 2017), including:

- 11 people in the Mining Division (PJSC PIMCU);
- 1 person in the Life Cycle Back-End Division (FSUE Mining and Chemical Plant).

The main occupational diseases of employees in the industry include diseases of the musculoskeletal system and the peripheral nervous system, as well as diseases caused by vibration (more than 80% of the total incidence). As a rule, people newly diagnosed with occupational diseases are employees aged 50 to 60 years who have been working in the industry for about 20 to 30 years on average.

A high risk of occupational diseases persists at PJSC PIMCU. To prevent them and to improve working conditions, mine equipment is being upgraded. In addition, strict disciplinary sanctions are imposed on employees who do not use respiratory protective equipment.

In addition, ROSATOM has organized the provision of medical treatment and preventive care to employees, which includes not only preliminary and periodic medical examinations, but also measures aimed at treating and preventing diseases and enabling the employees' rehabilitation, if necessary (provision of health food and milk, health resort treatment).

10.1.9. RADIATION EXPOSURE OF EMPLOYEES

Ionizing radiation is an occupational hazard specific to ROSATOM's enterprises. The criteria of employee radiation safety are laid down in the Radiation Safety Standards (NRB-99/2009), the Basic Sanitary Rules of Radiation Safety (OSPORB-99/2010) and

other regulations. ROSATOM's organizations provide workplace conditions that fully comply with the requirements set out in these documents.

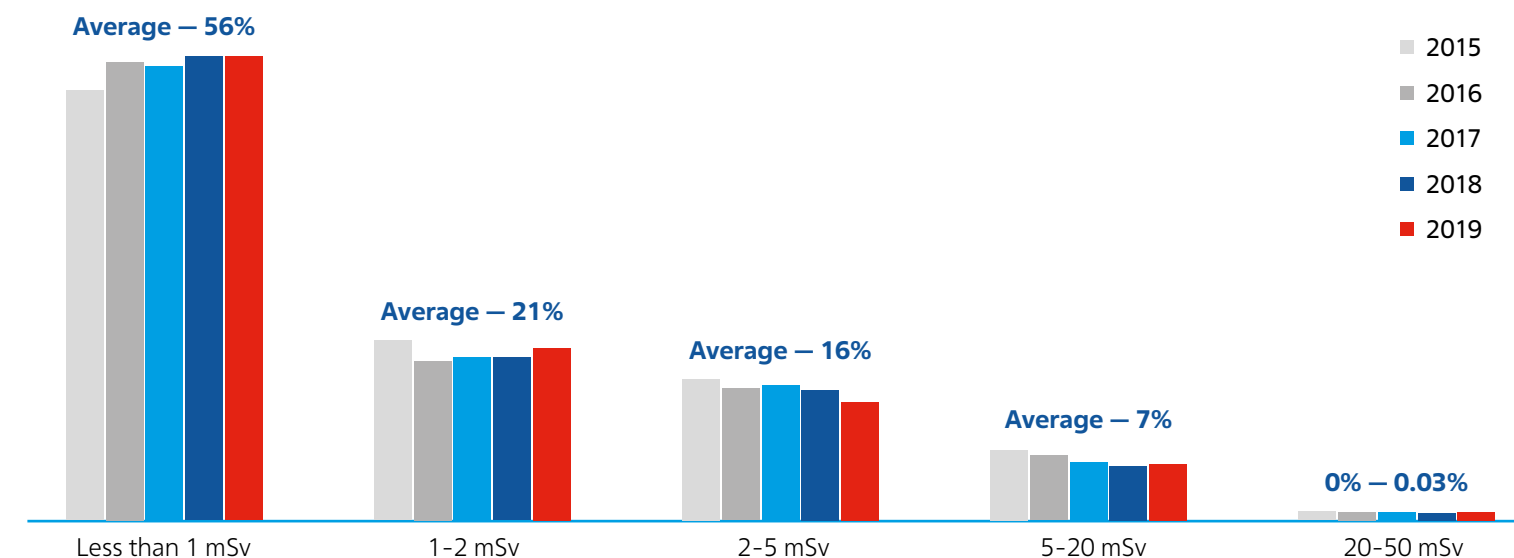
AVERAGE ANNUAL EFFECTIVE RADIATION DOSE AND COLLECTIVE RADIATION DOSE OF THE PERSONNEL

As at December 31, 2019, 65,069 people (group A personnel) were under individual radiation exposure monitoring in ROSATOM's organizations. The number decreased by 0.3% compared to 2018.

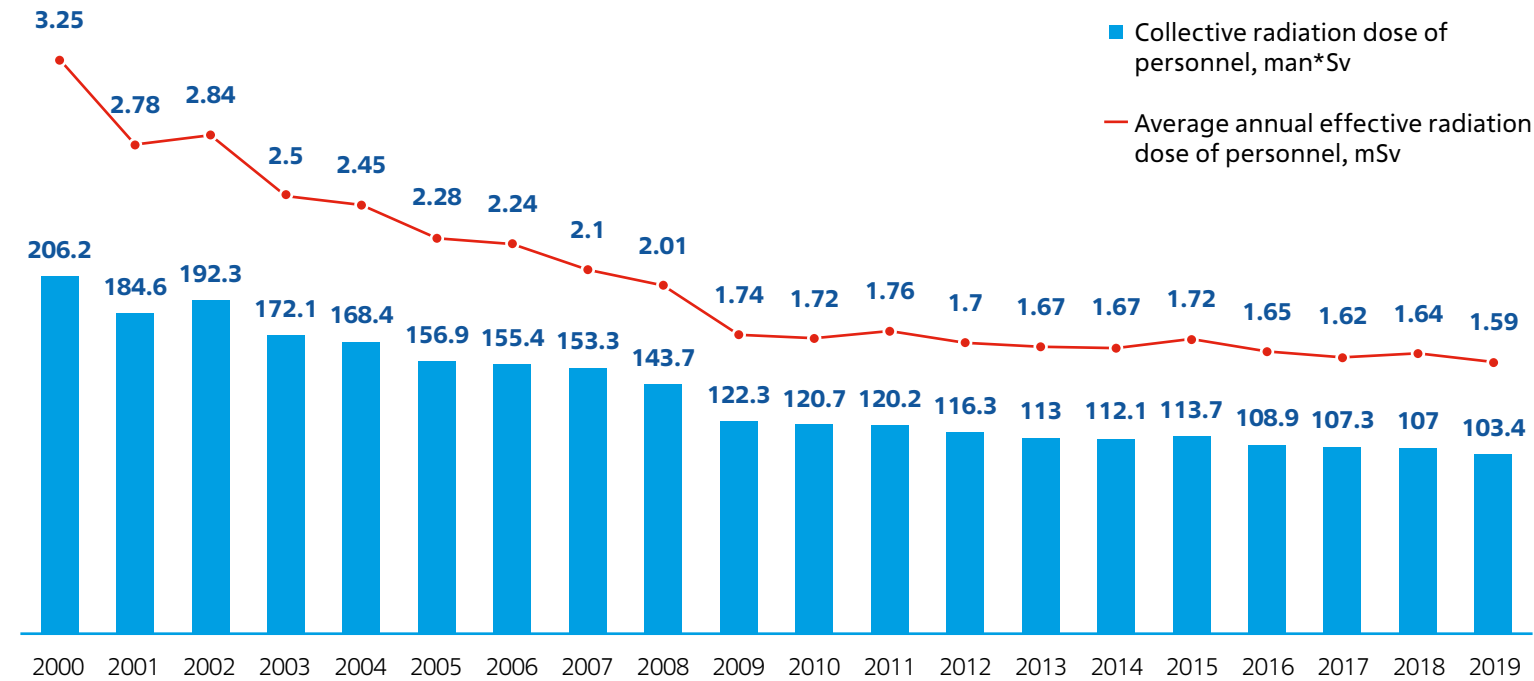
In 2019, the average annual effective radiation dose of ROSATOM's personnel totalled 1.59 mSv. In the reporting year, employee radiation exposure did not exceed regulatory limits. The

total effective dose for any employee did not exceed 100 mSv over five consecutive years. The annual dose limit of 50 mSv was not exceeded. Over the past ten years, average effective employee radiation exposure, its structure and the number of people exposed to radiation have been varying insignificantly and remain low.

DISTRIBUTION OF GROUP A PERSONNEL BY DOSE RANGES, %



CHANGES IN THE COLLECTIVE AND AVERAGE ANNUAL EFFECTIVE RADIATION DOSE OF THE PERSONNEL



INDIVIDUAL RADIATION RISKS

In 2019, ROSATOM continued to monitor radiation risks for group A personnel using the IRAW occupational radiation risk assessment system. Individual risk was calculated for 64,932 people, or 99.8% of the total number of group A employees. The absolute majority of group A employees work in the conditions of accept-

able occupational risk. For 700 people (1.08% of the number of employees included in the IRAW system), individual risk exceeded the regulatory level of 10^{-3} . The high-risk group comprises mainly veterans of the industry, whose average age exceeds 60 years.

CHANGES IN THE KEY INDICATORS OF THE IRAW SYSTEM, %

	2017	2018	2019
Share of employees in the negligible and acceptable occupational risk areas	98.79	98.92	98.92
Share of employees in the high-risk group	1.21	1.08	1.08
Share of employees in the industry undergoing individual radiation exposure monitoring and included in the IRAW system	99.4	98.8	99.8

Over the last three years, the average individual radiation risk across ROSATOM did not exceed 7% of the regulatory limit, while the maximum individual risk has been decreasing steadily.

Division/complex/unit	2017	2018	2019
INDIVIDUAL RADIATION RISKS OF PERSONNEL			
Power Engineering Division	$1.1 \cdot 10^{-4}$	$9.6 \cdot 10^{-5}$	$9 \cdot 10^{-5}$
Fuel Division	$2.7 \cdot 10^{-5}$	$2.4 \cdot 10^{-5}$	$2.5 \cdot 10^{-5}$
Nuclear Weapons Division	$4.5 \cdot 10^{-5}$	$4.5 \cdot 10^{-5}$	$4.4 \cdot 10^{-5}$
Mining Division	$2.3 \cdot 10^{-5}$	$2.5 \cdot 10^{-5}$	$2.8 \cdot 10^{-5}$
Life Cycle Back-End Division	$4.4 \cdot 10^{-5}$	$3.7 \cdot 10^{-5}$	$3.8 \cdot 10^{-5}$
Innovation Management Unit	$9.1 \cdot 10^{-5}$	$7.9 \cdot 10^{-5}$	$7.4 \cdot 10^{-5}$
Mechanical Engineering Division	$5.1 \cdot 10^{-5}$	$4.5 \cdot 10^{-5}$	$4 \cdot 10^{-5}$
Engineering Division	$2.4 \cdot 10^{-5}$	$2.9 \cdot 10^{-5}$	$1.6 \cdot 10^{-5}$
Northern Sea Route Directorate	–	–	$4.8 \cdot 10^{-5}$
JSC Rusatom Healthcare	–	–	$2 \cdot 10^{-5}$
Total across the Corporation	$7 \cdot 10^{-5}$	$6.3 \cdot 10^{-5}$	$6.1 \cdot 10^{-5}$

10.1.10. FUNCTIONING OF SYSTEMS FOR TECHNICAL REGULATION, STANDARDIZATION, COMPLIANCE ASSESSMENT AND ENSURING THE UNIFORMITY OF MEASUREMENTS

STANDARDIZATION IN THE PEACEFUL USE OF NUCLEAR ENERGY

Standardization in the peaceful use of nuclear energy is aimed at:

- Using standardization tools to ensure that the safety performance of nuclear facilities meets the required standards;
- Establishing a uniform technical standardization policy with regard to the safety of nuclear facilities;
- Improving the quality and competitiveness of products of the Russian nuclear power industry.

In the reporting year, 20 in-house standards were developed and approved in ROSATOM, and the Corporation plans to develop another 78 standards by 2023.

In 2019, ROSATOM received 85 applications for the provision of government accreditation services in the use of nuclear energy (8 applications were subsequently withdrawn by the applicants) and issued 24 accreditation certificates (following initial accreditation and (or) renewal). ROSATOM considered 28 applications from individuals regarding the certification of experts on accreditation in the use of nuclear energy, and issued 14 certificates of accreditation expert certification. Information on persons who underwent accreditation and certification is available on ROSATOM's official website⁷⁹.

ROSATOM is a full member of 11 technical committees on standardization in the Russian Federation. The Corporation's organizations are members of and participate in the work of 44 technical committees on standardization and 3 project technical committees on standardization in Russia.

In 2019, 18 national standards were developed and approved. Plans until 2022 include developing 137 national standards (17 of which will be aligned with international standards).

⁷⁹ <https://www.rosatom.ru/about/tekhnicheskoe-regulirovanie/akkreditatsiya-v-oblasti-ispolzovaniya-atomnoy-energii/>.

ENSURING THE UNIFORMITY OF MEASUREMENTS IN THE USE OF NUCLEAR ENERGY

Mandatory metrological evaluation of 9 draft national standards developed for the use of nuclear energy and more than 30 draft standards of the Corporation was carried out.

In the reporting year, a Calibration System for the use of nuclear energy was created. As part of this system, a core organization of the metrological calibration service was created. The com-

petence of two organizations of ROSATOM was verified, and 43 calibration methods were developed.

In 2019, metrological supervision was carried out in 29 organizations of the Corporation; measurement capabilities were assessed in 59 laboratories of organizations in the industry.

10.1.11. PLANS FOR 2020

- To ensure accident-free operation of nuclear facilities;
- To reduce the number of violations of safety requirements detected by supervisory government agencies;
- To reduce the number of industrial injuries;
- To improve the incident investigation system: to identify the root causes of incidents, thoroughly plan and implement preventive measures;
- To develop a safety culture among industry employees and contractors.

10.2. RAW AND SNF MANAGEMENT AND DECOMMISSIONING OF FACILITIES POSING NUCLEAR AND RADIATION HAZARDS

Key results in 2019

- All targets of FTP NRS 2 were achieved or exceeded; progress in the achievement of the Programme's main goal totalled 15.8% (as against a target of 15%).
- Six facilities posing nuclear and radiation hazards were decommissioned.
- Two nuclear submarines, one surface ship with a nuclear propulsion unit and two nuclear maintenance ships were dismantled.

10.2.1. OUTCOMES OF THE FEDERAL TARGET PROGRAMME ON NUCLEAR AND RADIATION SAFETY FOR THE PERIOD FROM 2016 THROUGH 2020 AND FOR THE PERIOD UNTIL 2030 (FTP NRS 2)⁸⁰

In 2019, active work continued as part of the implementation of FTP NRS 2, including:

- Maintaining the Techa Cascade of Reservoirs (Chelyabinsk Region) in a safe condition;
- Dismantling the Sibir nuclear icebreaker and decommissioning the Arktika nuclear icebreaker;
- Preparing the shut-down power units at Bilibino and Beloyarsk NPPs for decommissioning;
- Reprocessing of SNF from power and industrial reactors, propulsion units and research reactors at FSUE Mayak Production Association;
- Commissioning data terminals forming part of the analytical information system for on-site subsoil condition monitoring at two industrial sites of FSUE RosRAO;

In 1950, the Council of Ministers of the USSR adopted a resolution on the construction of Combine No. 815 of the First Main Directorate in the Krasnoyarsk Territory (now FSUE Mining and Chemical Plant). Within a short period of time, a unique underground industrial facility unparalleled in the world was built inside a mountain, under 200 metres of rock. Original technological solutions were developed for the construction of the plant. Builders removed a total of 15 million cubic metres of rock. The volume of those mine workings, which became the largest known underground structure in the world, is comparable to the total volume of the tunnels of the Moscow metro in the early 1960s. Reactor rooms built in rock are still the largest man-made excavations in the history of mankind and are listed in the Guinness Book of Records.

- Mothballing RAW storage pools at JSC SCP;
- Developing SNF and RAW management infrastructure at Leningrad, Smolensk and Kursk NPPs;
- Rehabilitating radiation-contaminated sites; in the reporting year, the area of rehabilitated sites totalled 106,800 m².

At year-end 2019, all targets under FTP NRS 2 were achieved; progress in the achievement of its main goal totalled 15.8%, as against the target of 15%.

Today, FSUE Mining and Chemical Plant is a key enterprise in the Life Cycle Back-End Division of ROSATOM. The plant is developing a set of technological solutions for the recycling of energy materials in a two-component nuclear fuel cycle. Over the past decade, dozens of new facilities were built in the enterprise, including 'wet' (renovation) and 'dry' storage facilities for spent nuclear fuel, a plant producing MOX fuel for the BN-800 fast reactor, and the first start-up facility forming part of a pilot and demonstration centre for radiochemical SNF reprocessing.

⁸⁰ For more information about the goals and objectives of FTP NRS 2, see the website: <http://xn---2030-bwe0hj7au5h.xn--p1ai/>.

10.2.2. DEVELOPMENT OF THE INTEGRATED NATIONAL SYSTEM FOR RADIOACTIVE WASTE MANAGEMENT

	Very low-level waste	Low-level waste	Intermediate-level waste	High-level waste
RAW GENERATION IN 2019				
Solid RAW, m ³	7.23·10 ⁵	5.53·10 ³	9.14·10 ²	2.63·10 ²
Liquid RAW, m ³	–	6.67·10 ⁵	9.93·10 ⁴	2.36·10 ⁴

At year-end 2019, the volume of RAW totalled 5.66·10⁸ m³, of which 5.53·10⁸ m³ were classified as accumulated RAW ('nuclear legacy').

In 2019, work continued on the third stage of development of the Integrated National System for Radioactive Waste Management (INS RAW).

The construction of power supply facilities for an underground research laboratory in the Nizhnekansky Rock Massif was continued as part of the construction of a deep repository for class 1 and 2 RAW in Zheleznogorsk (Krasnoyarsk Territory).

Disposal of class 3 and 4 RAW in the repository in Novouralsk (Sverdlovsk Region) continued; in the reporting year, 5,900 m³ of RAW were accepted for disposal.

Construction and installation work was carried out on schedule as part of the renovation of the near-surface disposal site for solid radioactive waste in Novouralsk. Positive opinions were obtained on design documentation for disposal sites for class 3 and 4 RAW in the CATF of Ozersk (Chelyabinsk Region) and the CATF of Seversk (Tomsk Region); construction and installation work forming part of the preparatory stage was carried out at the sites.

In the reporting year, three deep repositories for class 5 liquid RAW were in operation in the CATFs of Dimitrovgrad (Ulyanovsk Region), Seversk (Tomsk Region) and Zheleznogorsk (Krasnoyarsk Territory).

10.2.3. SNF MANAGEMENT

As at December 31, 2019, the volume of SNF accumulated in the Russian Federation totalled 24,669 tonnes (including 16,580 tonnes of SNF in federal ownership). In the reporting year, 774 tonnes were accumulated.

During the reporting year, 999.4 tonnes of SNF were removed from nuclear facilities in the Russian Federation, and 106.6 tonnes of various types of SNF were reprocessed (including 28.5 tonnes of SNF in federal ownership).

In 2019, the construction of the second start-up facility of the Pilot and Demonstration Centre (PDC) for SNF Reprocessing continued at FSUE Mining and Chemical Plant. The PDC is expected to become a leading-edge SNF reprocessing plant with a high level of environmental and economic performance.

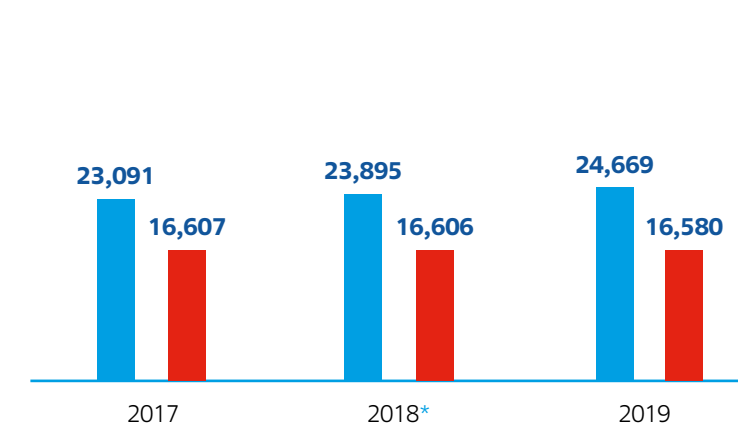


In 2019:

- 6,336 spent fuel assemblies from RBMK-1000 reactors were removed and placed in dry storage at FSUE Mining and Chemical Plant;
- 344 spent fuel assemblies from VVER-1000 reactors were removed and placed in temporary storage for subsequent reprocessing at FSUE Mining and Chemical Plant;
- 432 spent fuel assemblies from VVER-440 reactors, 175 spent fuel assemblies from BN-600 reactors and 98 spent fuel assemblies from VVER-1000 reactors were removed and transported to FSUE Mayak Production Association for processing;

- 1,584 spent fuel assemblies from the AMB reactor (70 bundles) were removed from Beloyarsk NPP and transported to FSUE Mayak Production Association. Taking into account the amount of previously removed SNF, this made it possible to completely empty one of the two storage pools at Beloyarsk NPP and enabled safe storage of the remaining spent fuel assemblies from the AMB reactor at Beloyarsk NPP until their complete removal;
- Removal of SNF from research institutes and industrial reactor facilities continued.

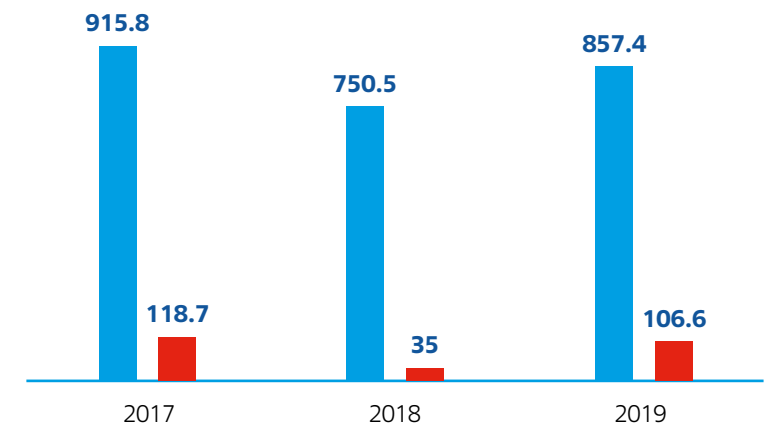
SNF ACCUMULATION IN RUSSIA, TONNES



- Total SNF accumulation in Russia
- Accumulation of SNF in federal ownership

* Indicators for 2018 have been adjusted following the processing of the inventory of nuclear materials at nuclear facilities.

SNF PLACEMENT INTO STORAGE AND REPROCESSING, TONNES



- SNF placement into centralized storage facilities
- SNF reprocessing

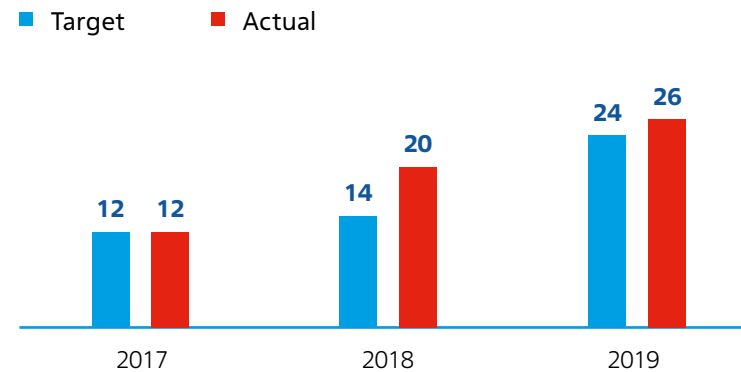
10.2.4. DECOMMISSIONING OF FACILITIES POSING NUCLEAR AND RADIATION HAZARDS

In 2019, six facilities posing nuclear and radiation hazards were decommissioned.

In 2019, a five-year Consolidated Programme of Measures to Ensure the Safety of ROSATOM's Organizations Operating Facilities Presenting Particularly High Levels of Nuclear and Radiation Hazards came into force; the Programme covers all stages of the life cycle and development of such facilities and is financed from the special reserve funds of ROSATOM.

Radiation and environmental monitoring of the Yenisei River floodplain was continued; by the end of 2019, no areas requiring rehabilitation had been identified.

DECOMMISSIONING AND DISMANTLING OF FACILITIES POSING NUCLEAR AND RADIATION HAZARDS, UNITS (AS A CUMULATIVE TOTAL SINCE 2016)



10.2.5. DISMANTLING OF NUCLEAR SUBMARINES

In 2019, two nuclear submarines, one surface ship with a nuclear propulsion unit and two nuclear maintenance ships were dismantled.

17 reactor compartments of dismantled nuclear submarines were prepared and put in long-term storage.

2,058 spent fuel assemblies were unloaded and transported for further processing.

2.96 tonnes of spent nuclear fuel and 300 m³ of liquid radioactive waste were processed; 700 m³ of solid radioactive waste were conditioned.

In 2019, using international technical assistance funds (a total of RUB 1.26 billion was received), ROSATOM cleaned up the pool of an emergency SNF storage facility and removed 6,125 spent fuel assemblies from the storage facility in Andreev Bay; SNF unloading from the storage facility of the disused Lapse floating maintenance base continued.

10.2.6. PLANS FOR 2020

In 2020, ROSATOM will continue to implement FTP NRS 2, including:

- Completion of construction of the Pilot and Demonstration Centre (the second start-up facility) for SNF reprocessing based on innovative technologies at FSUE Mining and Chemical Plant;
- Completion of construction of a disposal facility for class 3 and 4 RAW in Novouralsk (Sverdlovsk Region);
- Transportation of accumulated spent nuclear fuel from NPP sites to long-term storage facilities at FSUE Mining and Chemi-

cal Plant and FSUE Mayak Production Association;

- Removal of RAW from storage sites, preparation for disposal, transportation to disposal sites and transfer for disposal;
- Decommissioning of a number of facilities in ROSATOM's organizations;
- Completion of the mothballing of the B-1 and B-25 storage pools for radioactive waste at JSC SCP;
- Dismantling of one nuclear submarine and one nuclear maintenance ship.

10.3. ENVIRONMENTAL SAFETY

Key results in 2019

- Expenditure on environmental protection totalled RUB 23.55 billion.
- Energy costs were reduced by 9.7% compared to 2015 as the base year.
- Gross greenhouse gas emissions in the Corporation's organizations decreased by 6.4% compared to 2018.

10.3.1. ENVIRONMENTAL SAFETY AND ENVIRONMENTAL PROTECTION MANAGEMENT

The environmental footprint of the nuclear power industry is substantially smaller than that of carbon-based power generation using fossil fuel. Emissions of hazardous chemicals, including those that destroy the ozone layer or contribute to the greenhouse effect, from nuclear power plants are close to zero.

ROSATOM and its enterprises operate responsibly in accordance with the following principles:

- Giving priority to preserving natural ecosystems;
- Making use of the latest scientific achievements and ensuring environmental safety as a mandatory requirement;
- Transparency and making information on environmental aspects of operations of enterprises in the industry publicly available.

The Corporation's goals and initiatives in the sphere of environmental safety and environmental protection are stipulated in the Uniform Sectoral Environmental Policy of ROSATOM and Its Organizations⁸¹.

A list of environmentally relevant organizations of ROSATOM is compiled and updated on an annual basis (54 organizations⁸² in 2019). The Corporation's management gives special focus to their operations. On an annual basis, environmentally relevant organizations issue public reports on environmental safety⁸³.

An important tool for the implementation of the environmental policy is a three-year Comprehensive Implementation Plan. In 2019, the Corporation approved the Comprehensive Plan for 2019–2021, which stipulates organizational, operational and technical measures to be implemented by the Corporation and its organizations (including environmentally relevant organizations).

To assess progress in the implementation of the Environmental Policy, ROSATOM has developed the Uniform Industry-Wide Guidelines for the Use of Environmental Performance Indicators. The Guidelines are based on the requirements of environmental legislation of the Russian Federation and incorporate modern scientific and methodological approaches, as well as recommendations of international standards for corporate and non-financial reporting on environmental aspects.

The results of environmental performance assessment should be taken into account when making any management decisions which may have a negative impact on the environment (including during economic planning).

In the reporting year, the Corporation continued to develop its environmental, energy and quality management systems, as well as the occupational health and safety management system. Inte-

grated management systems are in place in 13 environmentally relevant organizations. They comprise:

- Environmental management systems compliant with the ISO 14001 standard;
- Quality management systems compliant with the ISO 9001 standard;
- Occupational health and safety management systems compliant with the OHSAS 18001 standard;
- Energy management systems compliant with the ISO 50001 standard.

During 2019, 45 inspection audits were conducted in ROSATOM's organizations to assess their compliance with the requirements of the ISO 14001 environmental management system standard, the ISO 9001 quality management system standard and the OHSAS 18001 occupational health and safety management system standard. In the reporting year, recertification audits of the quality management system and the environmental management system were carried out in three organizations of ROSATOM.

10.3.2. IMPROVED ENERGY EFFICIENCY

ENERGY EFFICIENCY MANAGEMENT SYSTEM

Energy conservation is an important prerequisite for the efficient use of energy resources in the nuclear industry, making it more competitive and reducing its negative environmental impact. ROSATOM is implementing an energy conservation and energy efficiency improvement programme for the period from 2018 through 2022.

ROSATOM's organizations have implemented most elements of the energy management system compliant with the international ISO 50001 standard (JSC Rosenergoatom and JSC TVEL have been issued with an international certificate, while other organizations have implemented individual elements of this management system).

Since 2015, ROSATOM has been using an Automated Energy Efficiency Management System, through which 80 organizations of the Corporation submit quarterly reports on energy savings.

ROSATOM holds an annual competition titled Environmentally Exemplary Organization in the Nuclear Industry; its aim is to support initiatives launched by the Corporation's environmentally relevant organizations to improve their environmental performance.

In 2019, 52 environmentally relevant organizations took part in the competition. The winners were chosen based on a benchmarking of all areas of work of their environmental functions: environmental footprint, efficiency of management and organization of environmental activities, and compliance with the principle of information transparency set out in the Uniform Sectoral Environmental Policy of ROSATOM and Its Organizations.

The competition winners were Kola NPP (ranked first), JSC PA ECP (ranked second) and Balakovo NPP (ranked third).

⁸¹ <https://rosatom.ru/upload/iblock/05d/05db3c9f22e2eed5bb72f30f57a75620.pdf>.

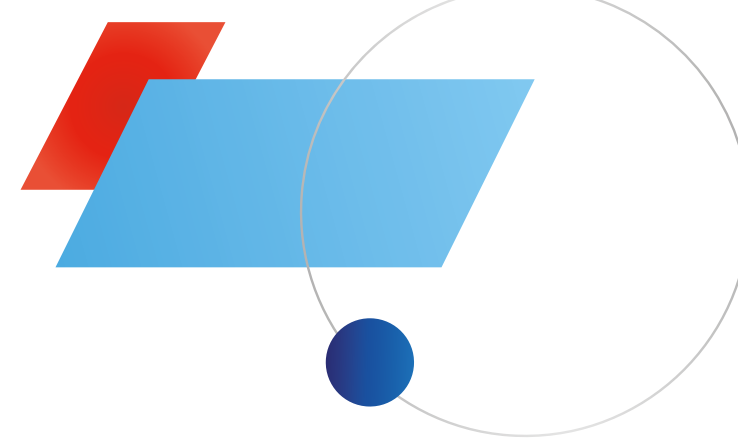
⁸² The list of organizations is available in the interactive version of the Report (<https://report.rosatom.ru/1628.html>).

⁸³ <https://rosatom.ru/en/sustainability/environmental-management/>.

RESULTS IN 2019

In 2019, energy costs in the nuclear industry (under comparable conditions against 2015 as the base year) totalled RUB 26.4 billion (excluding VAT), including:

- RUB 6.1 billion for heat;
- RUB 2.1 billion for water;
- RUB 12 billion for electricity;
- RUB 6.2 billion for other types of energy resources.



Division/complex/organization	Heat		Water		Electricity	
	'000 Gcal	%	'000 m ³	%	'000 kWh	%
ENERGY CONSUMPTION IN 2019 IN PHYSICAL TERMS (UNDER COMPARABLE CONDITIONS AGAINST 2015)						
Power Engineering Division	369	6.3	1,270,685.66	64.2	830,452.02	14.7
Fuel Division	1,995.25	34	317,146.16	16	2,780,255.09	49.1
Nuclear Weapons Division	1,908.81	32.5	65,911.34	3.3	768,162.31	13.6
FSUE Atomflot	–	0	183.45	0	25,791.59	0.5
Life Cycle Back-End Division	586.01	10	27,142.73	1.4	306,653.44	5.4
Mining Division	635.56	10.8	3,721.34	0.2	584,949.62	10.3
Mechanical Engineering Division	54.53	0.9	3,893.67	0.2	120,653.19	2.1
JSC Rusatom Healthcare	6.35	0.1	56.54	0	18,864.75	0.3
JSC RPC Khimpromengineering	8.22	0.1	50.52	0	22,807	0.4
Engineering Division ⁸⁴	23.83	0.4	108.77	0	17,213.49	0.3
Sales and Trading Division	1.99	0	12.46	0	2,626.97	0
Innovation Management Unit	241.62	4.1	6,244.78	0.3	175,464.74	3.1
JSC Rosatom Emergency Response Centre	3.13	0.1	4.75	0	680.1	0
Other	33.09	0.6	283,033.83	14.3	5,372.64	0.1
Total across ROSATOM	5,867.39	100	1,978,196	100	5,659,946.95	100

⁸⁴ Data on Russian projects and organizations managed by the Engineering Division, where annual consumption in monetary terms exceeds RUB 7 million.

In accordance with the government programme of the Russian Federation 'Development of the Nuclear Power and Industry Complex', the energy conservation target for ROSATOM for 2019 had been set at 6%. The actual cumulative total energy savings against 2015 as the base year under comparable conditions amounted to 9.7%, including:

- 13.7% for heat;
- 12% for water;
- 8.9% for electricity.

Energy savings totalled RUB 2.9 billion in monetary terms and 7,077,615 GJ in physical terms.

The most significant reduction in energy consumption was achieved in the Fuel Division, the Nuclear Weapons Division and the Life Cycle Back-End Division.

Division/complex/organization	Cumulative total compared to 2015, RUB million (excluding VAT)	Cumulative total compared to 2015, %
ENERGY COST REDUCTION IN 2019		
Power Engineering Division	95.94	4.78
Fuel Division	1,241.9	13.45
Nuclear Weapons Division	613.82	12.31
FSUE Atomflot	8.67	6.04
Life Cycle Back-End Division	446.59	18.74
Mining Division	197.19	10.95
JSC Rusatom Healthcare	7.76	7.36
Innovation Management Unit	71.29	7.75
JSC Rosatom Emergency Response Centre	0.9	13.14
JSC ITPC	56.88	1.06
Other	173.37	up to 34.94
Total across ROSATOM	2,914.31	9.7

PLANS FOR 2020

The energy conservation target for 2020 under the government programme 'Development of the Nuclear Power and Industry Complex' has been set at 7% (as a cumulative total against 2015 as the base year, under comparable conditions). ROSATOM

sets individual differentiated targets for annual energy savings (expressed as a percentage) for its Divisions, complexes and organizations, provided that the overall target set under the programme is achieved.

Division/complex/organization	%
ENERGY CONSERVATION TARGETS FOR 2020, AS A CUMULATIVE TOTAL AGAINST 2015 AS THE BASE YEAR (UNDER COMPARABLE CONDITIONS)	
Power Engineering Division	4.2
Fuel Division	8
Nuclear Weapons Division	7.2
FSUE Atomflot	6
Life Cycle Back-End Division	7.4
Mining Division	12
Mechanical Engineering Division	8
JSC Rusatom Healthcare	3
JSC RPC Khimpromengineering	7.3
JSC ASE EC	7
Sales and Trading Division	5
Innovation Management Unit	8
JSC Rosatom Emergency Response Centre	6
JSC ITPC	7

In addition, ROSATOM plans to continue to monitor progress on energy audits in its organizations, assess the outcomes of energy conservation measures implemented over the past five years as

part of the government programme 'Development of the Nuclear Power and Industry Complex' and prepare proposals for the next reporting period.

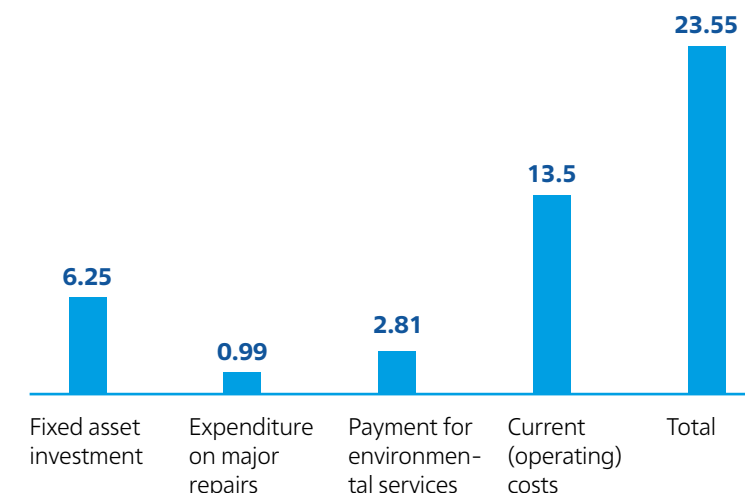
10.3.3. FINANCING OF ENVIRONMENTAL MEASURES

In 2019, expenditure on environmental protection in ROSATOM's organizations totalled RUB 23.55 billion, including expenditure

on environmental measures totalling RUB 17.30 billion and fixed asset investment totalling RUB 6.25 billion.

Indicator	2017	2018	2019
DISTRIBUTION OF ENVIRONMENTAL COSTS AT ROSATOM, RUB BILLION			
Expenditure on environmental measures	14.37	15.44	17.3
Fixed asset investment	8.09	8.8	6.25
Total	22.46	24.24	23.55

ENVIRONMENTAL COST STRUCTURE AT ROSATOM IN 2019, RUB BILLION



The largest volume of expenditure on environmental measures was allocated for ensuring radiation safety (48.0%), collecting and treating wastewater (19.6%), managing industrial and consumer waste (14.9%), protecting the atmosphere and preventing climate change (7.7%). Environmental costs increased by RUB 1.86 billion year on year. This was due to an increase in current costs at JSC Chepetsk Mechanical Plant as tailings storage facility No. 3, which had been in federal ownership, was recorded on the balance sheet of the enterprise.

Branches of JSC Rosenergoatom account for a major share (89.3%) of the total amount of fixed asset investment of the Corporation's organizations aimed at environmental protection. In the reporting year, fixed asset investment decreased by RUB 2.55 billion year on year as a result of the completion of construction and the start of commercial operation of power unit No. 1 of Leningrad NPP-2. ROSATOM's organizations account for 3.96% of the total volume of environmental investments in the Russian Federation⁸⁵.

10.3.4. ENVIRONMENTAL CHARGES AND FINES

In 2019, charges for the negative environmental impact totalled RUB 55 million, including charges for allowable emissions and discharges of pollutants, disposal of industrial and consumer waste totalling RUB 34 million (61.8%), and charges for excess

emissions and discharges totalling RUB 21 million (38.2%). A reduction in charges for the negative environmental impact compared to 2017 and 2018 was due to the timely receipt of permits by ROSATOM's organizations in the reporting year.

	Payment amount, RUB million		
	2017	2018	2019
CHARGES FOR THE NEGATIVE ENVIRONMENTAL IMPACT (ENVIRONMENTAL CHARGES) PAID BY ROSATOM'S ORGANIZATIONS			
Charges for allowable emissions (discharges) of pollutants (disposal of industrial and consumer waste), total, including:	36.4	33.7	34
into water bodies	7.2	7.3	6
into the atmosphere	1.9	2.9	3.1

⁸⁵ Hereinafter in this section, the shares of ROSATOM and its organizations in the overall figures for Russia are calculated based on the data provided in the Government Report on the Status and Protection of the Environment in the Russian Federation in 2018.

	Payment amount, RUB million		
	2017	2018	2019
for disposal of industrial and consumer waste	27.3	23.5	24.9
Charges for excess emissions (discharges) of pollutants (disposal of industrial and consumer waste), total, including:	46	51.9	21
into water bodies	13.6	13.4	5.7
into the atmosphere	6.1	22.7	8.8
for disposal of industrial and consumer waste	26.3	15.8	6.5
Charges for allowable and excess emissions (discharges) of pollutants (disposal of industrial and consumer waste), total	82.4	85.6	55

In 2019, environmental regulators detected 36 violations, for which they imposed administrative penalties on ROSATOM's organizations in the form of fines totalling RUB 1.8 million (in 2018 and 2017, 46 and 41 violations were detected and fines were imposed totalling RUB 2.2 million and RUB 3.1 million respectively). The violations did not pose a threat to the well-being of the population and did not necessitate restrictions on the operations of the organizations.

10.3.5. WATER USE

The nuclear industry is a major water user. In 2019, water withdrawal from natural sources by ROSATOM's organizations made up 9.6% of the total water withdrawal in Russia. The main consumers of water among ROSATOM's organizations and enterprises are Leningrad NPP and Kola NPP (82.4% of the total water withdrawal).

In 2019, there were no instances of non-financial sanctions against ROSATOM's organizations for non-compliance with environmental legislation and regulatory requirements.

In the reporting year, water withdrawal by ROSATOM's organizations totalled 6,531.3 million m³, which is 786.5 million m³ less than in 2018. The decrease was mainly due to a reduction in sea water withdrawal at Leningrad NPP due to the shutdown of power unit No. 1 for decommissioning.

Source	Volume, million m ³		
	2017	2018	2019
TOTAL WATER WITHDRAWAL			
Sea water	5,061.1	4,979.7	4,215.1
Fresh surface water, including rivers, marshes and lakes	2,239.1	2,219.7	2,203.5
Groundwater	87.7	100.4	96.9
Rainwater	2	2	2
Water from third-party organizations	21.1	16	13.8
Total	7,411	7,317.8	6,531.3

	Volume, million m ³		
	2017	2018	2019
VOLUME OF RECYCLED AND REUSED WATER			
Total volume of recycled and reused water, million m ³	34,159.7	34,740	35,096.7
Water withdrawal, million m ³ (% of the volume of recycled and reused water)	7,411 (21.7%)	7,317.8 (21.1%)	6,531.3 (18.6%)
Total, million m³	41,578.6	42,057.8	41,628
Share of recycled and reused water as a percentage of water withdrawal, %	460.9	474.7	537.4

In 2019, the volume of water used by ROSATOM's organizations for their own needs totalled 6,450.4 million m³, which is 735.4 million m³ less than in 2018. This was mainly due to a decrease in water consumption at Leningrad NPP (by 696.2 million m³).

Type of consumption	Volume, million m ³		
	2017	2018	2019
WATER CONSUMPTION BY ROSATOM'S ORGANIZATIONS FOR THEIR OWN NEEDS			
Drinking and sanitary purposes	41.9	37.9	41.5
Operational needs	7,126	7,133.3	6,395.7
Other types	18	14.6	13.2
Total	7,185.9	7,185.8	6,450.4

WATER DISCHARGE

In 2019, wastewater discharge by ROSATOM's organizations totalled 5,864.5 million m³, with clean water compliant with regulatory requirements accounting for 96.1% of the total volume, while the share of treated wastewater compliant with regulatory

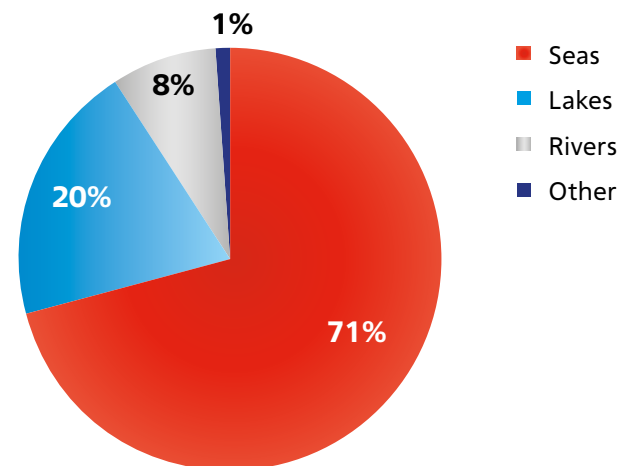
requirements and contaminated wastewater stood at 0.8% and 3.1% respectively. Wastewater discharge decreased by 762.4 million m³ compared to 2018 due to a decrease in the discharge from Leningrad NPP into the Gulf of Finland in the Baltic Sea.

Water category	Volume, million m ³		
	2017	2018	2019
TOTAL WASTEWATER DISCHARGE			
Clean water compliant with regulatory requirements	6,600.1	6,512.3	5,635.3
Treated wastewater compliant with regulatory requirements	37.3	44.5	44.9
Contaminated wastewater	79	70.1	184.3 ⁸⁶
Total	6,716.4	6,626.9	5,864.5

In the reporting year, discharge of treated wastewater compliant with regulatory requirements totalled 44.9 million m³, of which 25.1% was treated using the biological method, while wastewater treated using the physical and chemical method and the mechanical method accounted for 1.9% and 73.0% of the total volume respectively.

Contaminated wastewater discharge totalled 184.3 million m³ in 2019. In 2019, contaminated wastewater discharge by ROSATOM's organizations accounted for 1.4% of the total volume of discharges in Russia.

WASTEWATER DISCHARGE IN 2019 BY DESTINATION



Implementation of initiatives to reduce the environmental impact on water sources in 2019:

- Beloyarsk NPP: modernization of chemical wastewater treatment facilities enabled a 27% reduction in the weight of pollutant discharges compared to 2017 as the base year;
- FSUE VNIITF: the introduction of a recycled water supply system and reuse of treated water in the production cycle resulted in a 99% reduction in the weight of pollutant discharges;
- PJSC MSZ: the creation of a system for collecting industrial wastewater and storm water runoff was completed; as a result, the discharge of industrial wastewater and storm water runoff from the production site totalling 1,285,500 m³ per year ceased, and withdrawal of river water was reduced.

⁸⁶ A significant change compared to 2017 and 2018 is related to a new approach to determining the degree of pollution of discharged wastewater (adopted in order to ensure compliance with Order No. 815 of the Federal State Statistics Service dated December 27, 2019 on Approval of a Federal Statistical Observation Form and Instructions for Filling It Out for the Organization of Federal Statistical Observation of Water Use by the Federal Agency for Water Resources). Accordingly, in 2019, wastewater discharged by JSC SCP was classified as contaminated (previously, it had been classified as clean water compliant with regulatory requirements).

POLLUTANT CONTENT IN WASTEWATER IN 2019, TONNES

Chemical oxygen demand	10,973.379	Molybdenum	0.467
Suspended matter	3,087.757	Nickel	0.18
Iron	60.327	Trivalent chromium	0.095
Phosphates (phosphorus content)	44.118	Hexavalent chromium	0.081
Manganese	0.979	Lead	0.033
Zinc	0.673	Cadmium	0.001
Copper	0.56	Antimony	0

10.3.6. POLLUTANT EMISSIONS INTO THE ATMOSPHERE

In 2019, pollutant emissions into the atmosphere totalled 38,600 tonnes; the pollutant capture rate reached 91.4%.

Implementation of initiatives to reduce the environmental impact on the atmosphere in 2019:

In 2019, the Corporation's organizations accounted for 0.1% of the total emissions in the Russian Federation. Pollutant emissions into the atmosphere decreased by 1,300 tonnes compared to 2018 due to a decrease in fuel combustion at ROSATOM's thermal power plants (CHPPs).

FSUE SRI SIA LUCH: modernization and renovation of the ventilation system, including the installation of dust collectors and gas-capturing equipment at production facilities, made it possible to reduce pollutant emissions into the atmosphere by 99.9%.

POLLUTANT EMISSIONS INTO THE ATMOSPHERE⁸⁷, KT

	2017	2018	2019
Total (excluding CO ₂), including:	36.4	39.9	38.6
emissions of solid particles	12.8	13.8	13.4
NO _x emissions	9.2	10.6	10.2
SO ₂ emissions	8.6	9.4	9.7
CO emissions	3.6	3.7	3.5
carbon emissions, including:	1.8	1.7	1.4
methane emissions	0.3	0.2	0.2
volatile organic compounds	1.2	1.2	1.1
other gases and liquids	0.4	0.7	0.4

⁸⁷ Pollutant emissions are reported by ROSATOM's organizations using chemical analysis methods or automatic gas analysers.

	From fuel combustion for electricity and heat generation	From production and other processes
POLLUTANT EMISSIONS FROM INDIVIDUAL GROUPS OF POLLUTION SOURCES, KT		
Solid particles	12.3	1.1
NO _x	9.3	1
SO ₂	8.9	0.8
CO	2.6	0.9
Hydrocarbons, including volatile organic compounds (excluding methane)	0.02	1.2

CHPP location	2017	2018	2019
SPECIFIC POLLUTANT EMISSIONS FROM ROSATOM'S CHPPS, G/MWH			
Novouralsk	3,142	2,696	1,821
Seversk	5,652	9,183	8,312
Glazov	2,939	3,057	2,959
Krasnokamensk	9,826	9,126	9,124
Dimitrovgrad	2,437	2,496	3,038

An increase in specific emissions from the CHPP in Seversk between 2017 and 2019 was due to a change in the fuel combustion structure (the coal/gas/fuel oil ratio). Changes in specific emissions from the CHPPs in Dimitrovgrad and Novouralsk were related to a change in the calculation methodology.

Emissions of ozone-depleting substances decreased in 2019 as a result of a reduction in dichlorodifluoromethane emissions at JSC Chepetsk Mechanical Plant.

Substance	tonnes of chlorofluorocarbon-11 equivalent ⁸⁸		
	2017	2018	2019
EMISSIONS OF MAJOR OZONE-DEPLETING SUBSTANCES			
Chlorodifluoromethane (Freon 12)	74.84	75.04	72.24
Difluorochloromethane (Freon 22)	0.47	0.19	0.21
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	0.4	0	0
Chlorotrifluoromethane (Freon 13)	164.48	164.21	164.21
Tetrafluoromethane (Freon 14)	6.24	6.24	6.24
Total	246.43	245.68	242.9

⁸⁸ Data are presented taking into account the ozone depletion potential of substances under the Montreal Protocol on Substances that Deplete the Ozone Layer.

10.3.7. GREENHOUSE GAS EMISSIONS

Climate change is recognized as one of the biggest problems facing the international community, businesses and citizens. The Russian Government has ratified the Paris Agreement, whereby the participating countries take on a commitment to reduce greenhouse gas emissions.

A greenhouse gas emissions accounting system is being created in ROSATOM in order to fulfil international legal commitments of the Russian Federation on climate and mitigate risks associated with the operations of ROSATOM and its enterprises. In 2019, a framework high-level document in this area was developed and

approved: the Regulation on a System for Accounting for Greenhouse Gas Emissions Generated by ROSATOM's Organizations. Plans for 2020 include developing uniform industry-wide methodological guidelines on greenhouse gas emissions accounting for ROSATOM's organizations.

In 2019, gross greenhouse gas emissions totalled 5,770.36 tonnes, down by 6.4% year on year due to a decrease in natural gas consumption for heat generation. ROSATOM's organizations accounted for 0.04% of the total volume of greenhouse gas emissions in Russia (in CO₂ equivalent).

Substance	2017	2018	2019
GROSS GREENHOUSE GAS EMISSIONS BY ROSATOM'S ORGANIZATIONS, TONNES⁸⁹			
Carbon dioxide ⁹⁰	5,653.369	5,802.284	5,451.82
Methane	281.175	239.72	193.734
Nitrous oxide	0	0	0
Trifluoromethane	0	0	0
Perfluoromethane	124.841	124.806	124.806
Perfluoroethane	0	0	0
Sulphur hexafluoride	0	0	0
Total	6,059.385	6,166.81	5,770.36

Greenhouse gas emissions from ROSATOM are generated mainly by CHPPs in the towns and cities where ROSATOM's enterprises are located: Glazov (Udmurt Republic), Dimitrovgrad (Ulyanovsk Region), Krasnokamensk (Zabaikalsky Territory), Novouralsk (Sverdlovsk Region) and Seversk (Tomsk Region). These CHPPs

generate heat and electricity not only for ROSATOM's enterprises, but also for the population of the relevant towns and cities. In 2019, the installed capacity of the CHPPs totalled 929.3 MW. No new capacities are scheduled to be put into operation in the next three years.

⁸⁹ Quantitative estimates of greenhouse gas emissions are based on data obtained from statistical observation forms 2-TP (air).

⁹⁰ The data are presented using a coefficient of 1.57 calculated by converting CO to CO₂ based on molar mass.

CHPP location	2017	2018	2019
CO₂ EMISSIONS FROM CHPPS, TONNES⁹¹			
Novouralsk	346,938	374,350	371,876
Seversk	1,376,368	1,738,801	2,065,818
Glazov	354,388	363,251	373,147
Krasnokamensk	2,045,860	2,062,501	2,077,436
Dimitrovgrad	169,857	177,147	154,147
Total across the Corporation	4,293,411	4,716,050	5,042,424

An increase in CO₂ emissions from the CHPP in Seversk between 2017 and 2019 was due to a change in the fuel combustion structure (the coal/gas/fuel oil ratio).

CHPP location	2017	2018	2019
SPECIFIC CO₂ EMISSIONS FROM CHPPS, KG OF CO₂/MWH			
Novouralsk	2,379	2,370	2,095
Seversk	1,343	1,712	1,840
Glazov	2,054	2,024	1,468
Krasnokamensk	1,391	1,406	1,390
Dimitrovgrad	1,716	1,793	1,727

The decrease in specific CO₂ emissions from the CHPPs (except for the one located in the city of Seversk) was related to improved performance of steam boilers and a decrease in the specific consumption of fuel equivalent for heat generation.

10.3.8. INDUSTRIAL AND CONSUMER WASTE MANAGEMENT

In 2019, ROSATOM's organizations produced 24.8 million tonnes of industrial and consumer waste, which is 3.9 million tonnes (18.7%) more than in 2018. The increase in waste generation was caused by an increase in the volume of rock and loose overburden mined in the Mining Division (JSC Lunnoye and PJSC PIMCU).

Most of the waste was generated by PJSC PIMCU (17.3 million tonnes). 99.96% of all waste generated in the Corporation's organizations is class 4 and 5 waste (low-hazard and practically non-hazardous waste). In 2019, industrial and consumer waste generated by ROSATOM's organizations accounted for 0.3% of the total waste generation in Russia.

The weight of transferred waste totalled 2,138,700 tonnes, including 30,800 tonnes of solid municipal waste transferred to regional operators.

77.1% of the total amount of waste generated in ROSATOM's organizations and received from other organizations was recycled; 0.02% was treated.

Implementation of initiatives to reduce industrial and consumer waste generation in 2019:

- Atom mash branch of JSC AEM-Technology in Volgodonsk: mercury-containing light bulbs were replaced with LED light bulbs, which made it possible to reduce the annual generation of hazard class 1 waste by 25.9% against 2016 as the base year;
- JSC Dalur: mercury-containing light bulbs were replaced with LED light bulbs, which made it possible to completely prevent the generation of hazard class 1 waste.

In 2019, ROSATOM did not transport, import, export or process waste that is classified as 'hazardous' in accordance with Annexes I, II, III, and VIII to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.

Year	Amount at the beginning of the reporting year	Waste generated and received during the year	Recycling and treatment of generated and received waste		Transferred to third-party organizations	Storage in enterprises	Amount at the end of the reporting year
			Amount	%			
INDUSTRIAL AND CONSUMER WASTE MANAGEMENT, KT⁹²							
2017	399,497	27,963.4	23,229.1	83.1	153.9	58.7	404,019
2018	403,891.9	20,862.3	15,140.3	72.6	176.4	5,565.3	403,872.2
2019	408,868.7	24,782.2	19,120.7	77.2	2,138.7	2,332.7	412,391.5

⁹¹ Accounting is based on instructions and guidelines for quantifying the volume of greenhouse gas emissions by organizations carrying out economic and other activities in the Russian Federation, approved by Order No. 300 of the Ministry of Natural Resources of Russia dated June 30, 2015. Under the methodology, quantitative assessment of CO₂ emissions from stationary fuel combustion is carried out using a calculation method depending on fuel consumption.

⁹² In accordance with Order No. 766 of the Federal State Statistics Service dated December 12, 2019 on Approval of a Federal Statistical Observation Form and Instructions for Filling It Out for the Organization of Federal Statistical Observation of Industrial and Consumer Waste by the Federal Service for Supervision of Natural Resources, starting from 2019, the volume of waste at year-end also includes waste stored at facilities operated by the company in question.

Hazard class	Waste amount as at January 1, 2019	Waste generated and received in the reporting year	Recycling of generated and received waste		Treatment of generated and received waste		Transfer to third-party organizations	Waste storage at the sites operated by ROSATOM in the reporting year, kt		Amount in enterprises as at December 31, 2019
			kt	%	kt	%		Total	Including disposal	
INDUSTRIAL AND CONSUMER WASTE MANAGEMENT IN 2019 BY HAZARD CLASS, KT										
Hazard class 1	0.049	0.208	0	0	0.000001	0.0005	0.232	0.00006	0	0.025
Hazard class 2	0.034	1.509	0.000002	0.0001	1.113	73.76	0.39	0	0	0.04
Hazard class 3	4.449	7.231	0.000692	0.0096	0	0	7.717	0.012	0.012	3.963
Hazard class 4	21.871	82.107	0.008034	0.0098	1.32	1.61	74.871	5.204	4.493	27.779
Hazard class 5	408,842.3	24,691.154	19,116.187	77.4	2.028	0.008	2,055.516	2,327.485	2,142.847	412,359.727
Total	408,868.7	24,782.21	19,116.196	77.1	4.461	0.02	2,138.726	2,332.701	2,147.352	412,391.534

10.3.9. REHABILITATION OF DISTURBED AREAS

As at December 31, 2019, the area of land disturbed by ROSATOM's organizations totalled 6,400 ha (6,500 ha in 2018 and 5,100 ha in 2017).

This included land disturbed during the following operations

- Mining: 3,400 ha;
- Construction: 2,300 ha;
- Disposal of industrial waste (including construction waste) and solid household waste: 600 ha;
- Survey work: 4.2 ha;
- Other operations: 96.9 ha.

In 2019, ROSATOM's organizations implemented a set of measures to restore the productivity and economic value of disturbed land. In the reporting year, the area of restored land totalled 29.5 ha. The increase in the area of restored land compared to 2018 was due to the rehabilitation of forest areas by JSC Lunnoye (10.8 ha) and their subsequent inclusion in the forest estate as forest firebreaks.

Organization	ha per year		
	2017	2018	2019
LAND REHABILITATION IN ROSATOM'S ORGANIZATIONS			
JSC Lunnoye	47.6	0.2	10.76
PJSC ZiO-Podolsk	0	0.06	0.07
JSC SCP	9.6	4.8	11.3
FSUE Integrated Plant Elektrokhimpribor	0.05	0.04	1.63
FSUE Russian Federal Nuclear Centre – Academician E.I. Zababakhin All-Russia Research Institute of Technical Physics (RFNC VNIITF)	2.5	4.34	0
FSUE RFNC VNIIEF	0.1	0.1	5
FSUE PA Sever	0.02	0.03	0
Vilyuchinsk Division of FEC DalRAO (branch of FSUE RosRAO)	0	0	0.76
Total	59.83	9.57	29.52

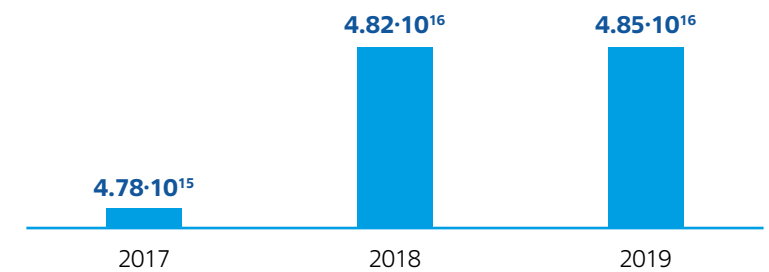
10.3.10. EMISSIONS AND DISCHARGES OF RADIONUCLIDES

EMISSIONS OF RADIONUCLIDES

In 2019, radiation burden on the environment was almost unchanged compared to 2018. The total activity of radionuclides released into the atmosphere by ROSATOM's organizations amount-ed to $4.85 \cdot 10^{16}$ Bq, with beta-emitting nuclides accounting for 99.22% of the total activity ($4.81 \cdot 10^{16}$ Bq).

In 2019, radionuclide emissions did not exceed permitted levels.

TOTAL ACTIVITY OF RADIONUCLIDES EMITTED INTO THE ATMOSPHERE, BQ



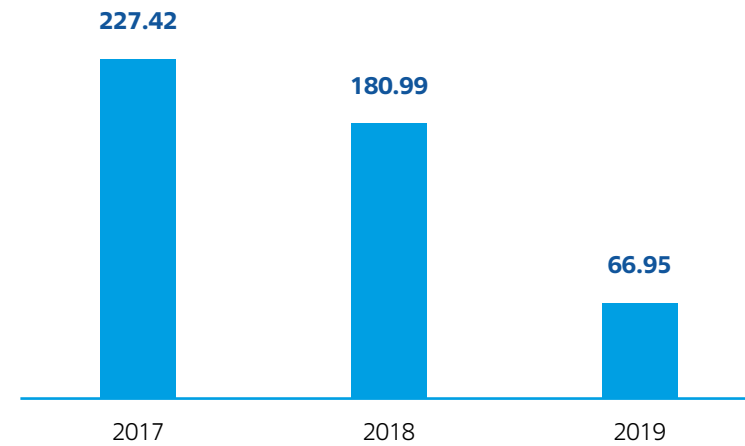
Radionuclide type	Permitted emission, Bq	Actual emission, Bq	% of the permitted level
PERMITTED AND ACTUAL EMISSIONS OF RADIONUCLIDES BY ROSATOM'S ORGANIZATIONS IN 2019			
Alpha-emitting	$1.95 \cdot 10^{15}$	$4.28 \cdot 10^{14}$	21.94
Beta-emitting	$1.90 \cdot 10^{18}$	$4.81 \cdot 10^{16}$	2.53

DISCHARGES OF RADIONUCLIDES

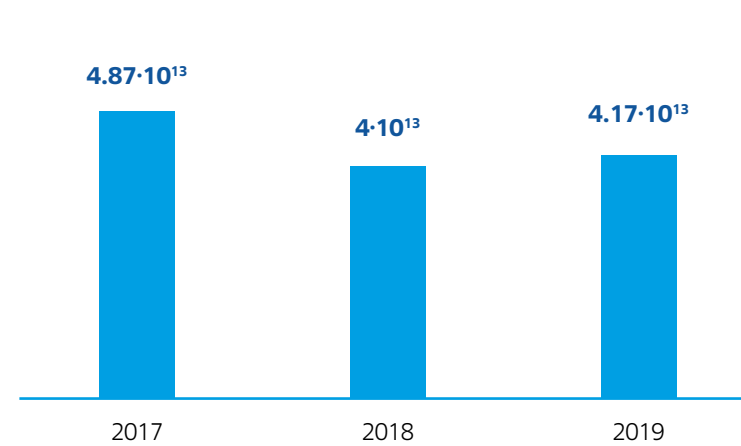
In 2019, ROSATOM's organizations discharged 66.95 million m³ of wastewater into surface water bodies (down by 63% year on year) with a total activity of 4.17·10¹³ Bq. A significant decrease

in the volume of wastewater was mainly due to a decrease in the number of discharge outlets at Novovoronezh NPP.

VOLUME OF WASTEWATER CONTAMINATED WITH RADIONUCLIDES, MILLION M³



TOTAL ACTIVITY OF RADIONUCLIDES DISCHARGED INTO THE OPEN DRAINAGE SYSTEM, BQ



In 2019, discharges of radionuclides did not exceed permitted levels.

Radionuclide type	Permitted discharge, Bq	Actual discharge, Bq	% of the permitted level
Alpha-emitting	1.79·10 ¹¹	2.83·10 ¹⁰	15.75
Beta-emitting	5.18·10 ¹⁵	4.17·10 ¹³	0.8

Natural uranium accounted for 64.54% of alpha-emitting radionuclides discharged into the open drainage system. Tritium ac-

counted for 99.76% of beta-emitting radionuclides discharged with wastewater into surface water bodies.

Gas and aerosol emissions from NPPs

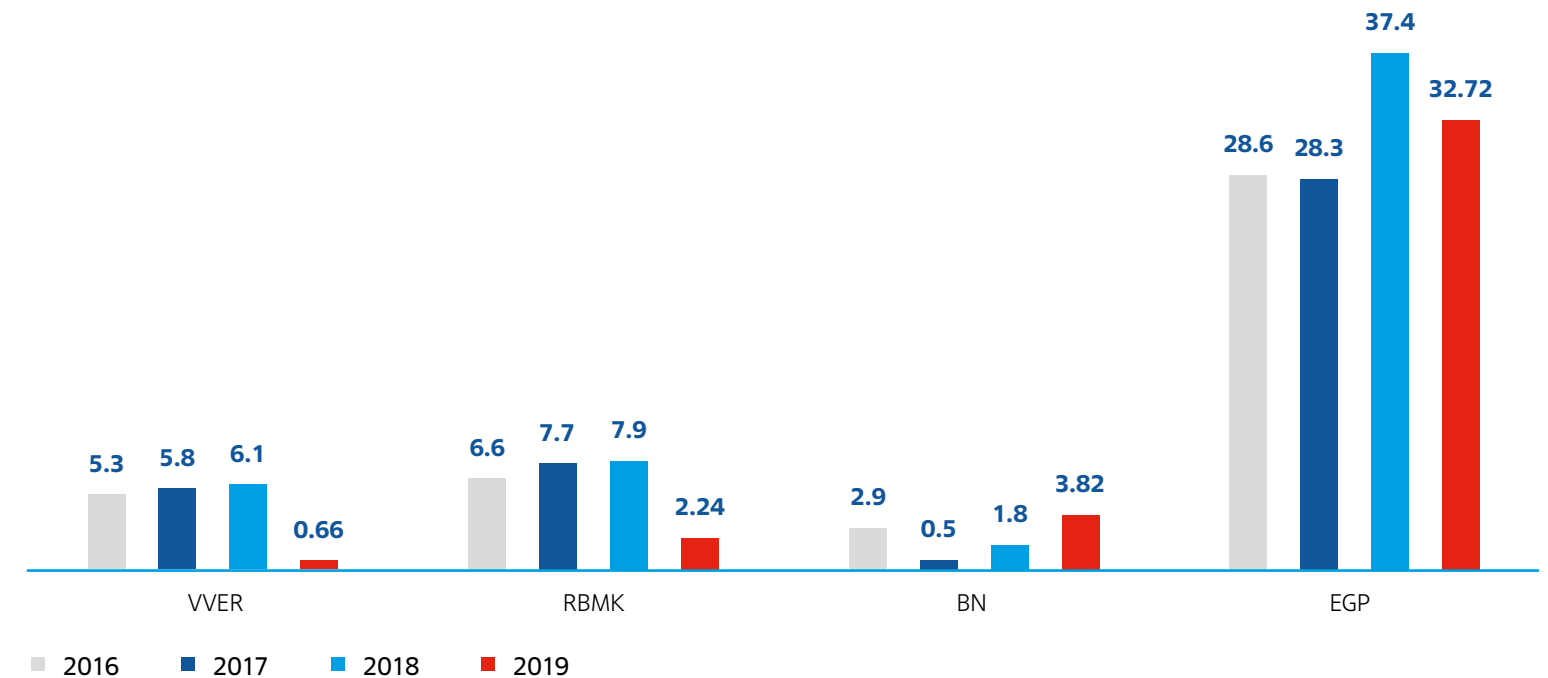
In 2019, as in previous years, gas and aerosol emissions from NPPs were significantly lower than the allowable limits set by Rostekhnadzor for emissions of radioactive substances into the atmosphere. Actual emissions of radioactive substances calculated under a conservative accounting procedure did not exceed:

- 33% of the permitted amount for inert radioactive gases;
- 19% of the permitted amount for carbon-14;
- 10% of the permitted amount for tritium.

Changes in gas and aerosol emissions following an increase in the capacity of power units

The activity of emitted radionuclides depends on the capacity at which a reactor is operating, on whether fuel cladding is leak-proof and on the condition of scrubber systems used for treating atmospheric emissions from an NPP power unit. During the operation of NPP power units at an increased capacity, no leaking fuel assemblies were found. The projected increase in radionuclide emissions (by no more than 6-7%) following an increase in the capacity of a power unit equipped with a VVER-1000 reactor to 104% is offset by effective operation of special scrubbers used for capturing gas and aerosol emissions. At the same time, the level of emissions remains significantly below the allowable limits.

EMISSIONS OF INERT RADIOACTIVE GASES FROM NPPS BY TYPE OF REACTORS, % OF THE PERMITTED AMOUNT



10.3.11. RADIATION IMPACT ON THE POPULATION AND THE ENVIRONMENT

The radiation impact of nuclear facilities on the population and the environment is insignificant. The analysis of field data on the gamma radiation dose rate shows that gamma radiation doses in buffer and radiation control areas of all NPPs are within the limits of natural background radiation which was formed before the start-up of the nuclear power plants. This indicates that nuclear power plants have no impact on the areas where they are located.

Additional radiation exposure of the population due to the NPP operation is assessed by the relevant regional departments of the Russian Federal Biomedical Agency (FMBA) during radiation and hygienic certification of organizations. According to the findings of radiation and hygienic certification in the Russian Federation in 2018, additional radiation exposure of the population at the locations of nuclear enterprises associated with their day-to-day operation on average does not exceed 1.1% per person of the basic dose limits for the population set in the NRB-99/2009 Standard (1 mSv on average for any consecutive five years).

According to the Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing (Rospotrebnadzor), the key factors behind radiation exposure of the Russian population are natural (over 85%) and medical sources of ionizing radiation (about 14%). The contribution of enterprises using nuclear technology is estimated at a fraction of a percent. Over many years, this has been the case in all regions where large facilities posing radiation hazards are situated.

Environmentally relevant organizations in the nuclear industry regularly monitor radionuclide content in local agricultural products, in wild-growing foods (berries, mushrooms, etc.) and fodder in radiation control areas, as well as in fish and other aquatic organisms living in cooling ponds of NPPs. The specific activity of dose-forming radionuclides is monitored in food products. Regional offices of the Russian Federal Biomedical Agency (FMBA) carry out independent radiation monitoring of the environment and locally produced food products. Radiation monitoring of abiotic components of the environment is carried out by the Federal Service for Hydrometeorology and En-

Contribution to biodiversity conservation

JSC TENEX, an organization of ROSATOM, participates in projects to preserve rare and endangered species of animals in Russia. In 2019, charitable assistance was provided for:

- Upgrading the infrastructure of the Lazovsky Nature Reserve, the Zov Tigra National Park and the Sikhote-Alin Nature Reserve as part of the project to support environmental initiatives to study and conserve the Siberian tiger population;
- Creating a unique photographic monitoring network to assess the status and size of the leopard population as part of the project to support environmental initiatives aimed at preserving Amur leopards and creating an international molecular genetics database.

vironmental Monitoring. The results of many years of radiation monitoring indicate that the content of radioactive substances in different types of crops corresponds to the background radiation level, that species composition of the local flora and fauna is almost unchanged, and that the growth rate of the amount of dead wood is within permissible limits.

In addition, the close proximity of NPPs to nature reserves also provides evidence of conservation of biodiversity at their locations. The Lapland State Nature Reserve is located within a 30-kilometre radius of Kola NPP. 16 nature monuments and 33 wildlife sanctuaries are located within a 30-kilometre radius of Kalinin NPP. Kursk NPP neighbours the Tsentralno-Chernozemny Biosphere Reserve. Bilibino NPP is located in the vicinity of six wildlife sanctuaries and one natural park.

The man-made impact of NPP operation is felt mostly by natural ecosystems of cooling ponds. The discharge of warm water affects the life of aquatic organisms and may cause changes in species composition. According to the findings of observations and research, the diversity of aquatic organisms living in the area where warm water is discharged from an NPP may either de-

crease (e.g. in Koporye Bay in the Gulf of Finland) or increase (as in the Beloyarsk Reservoir through the relocation of fish species that prefer warmer temperatures, such as bream and zander).

Such changes can be observed at existing nuclear power plants using once-through and recycled process water supply systems with a cooling pond, which require large amounts of recycled water. In order to minimize this impact and maintain a stable and sustainable condition of ecosystems in the area where they are located, NPPs allocate considerable sums of money on environmental measures every year. The designs of modern nuclear power plants include modern closed-circuit cooling systems with evaporative cooling towers, which can significantly reduce the impact of nuclear power plants on water bodies in their vicinity.

10.3.12. FORECAST FOR THE ENVIRONMENTAL IMPACT OF ROSATOM AND ITS ORGANIZATIONS AND PLANS FOR CHANGING THE IMPACT AND ENSURING ENVIRONMENTAL SAFETY IN 2020 AND IN THE MEDIUM TERM

In 2020 and in the medium term, ROSATOM's organizations will continue to annually carry out large-scale work and implement a large number of measures to upgrade and build structures and systems for environmental protection (wastewater treatment facilities, dust collectors and gas scrubbers, waste disposal facilities, etc.).

Forecasts for the period until 2024 predict:

- A reduction in fixed asset investment related to environmental protection due to the completion of the construction of new power units at NPPs;

'Nuclear' fishing

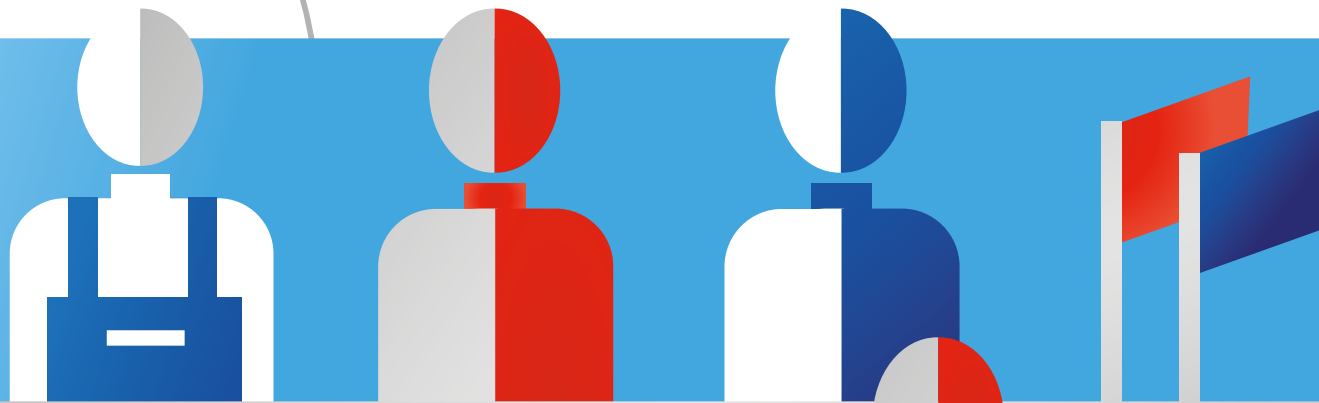
In 2019, an international fishing festival was held in the Gulf of Finland, in the vicinity of Leningrad NPP. It was attended by representatives of Russia and partner countries cooperating with ROSATOM on NPP construction projects (Hungary, Egypt, India, Bangladesh and Turkey).

The aim of the festival is to strengthen international cooperation and demonstrate the safety of NPPs for the flora and fauna in nearby water bodies. The event was attended by ecologists, who monitored radiation levels in fish caught by the participants.

- Contaminated wastewater discharge remaining at the current level (its share in the total volume of wastewater discharge by the Corporation's organizations is significantly lower than the national average);
- No major changes in emissions of harmful pollutants into the atmosphere;
- A continuing downward trend in the generation of hazard class 1 and 2 waste.

11

PARTNERSHIP FOR SUSTAINABLE DEVELOPMENT



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Key results in 2019

- ROSATOM's Public Annual Report for 2018 was awarded 5 stars (the highest rating) in the competition of annual reports held by the RAEX-Analytics agency.
- ROSATOM's Public Annual Report for 2018 was ranked in the top 10 in the annual corporate transparency ranking of the largest Russian companies compiled by the Russian Regional Integrated Reporting Network.
- ROSATOM was included in the top group in the Sustainable Development, Corporate Responsibility and Reporting Indices compiled by the Russian Union of Industrialists and Entrepreneurs (RSPP) (based on data provided in public reports).

11.1. PUBLIC REPORTING SYSTEM

Since 2009, ROSATOM has been developing a public reporting system whereby the Corporation prepares integrated annual reports. These reports are designed to give stakeholders a comprehensive picture of the Corporation's strategy, business sustainability, operating, financial and economic results of the reporting year, initiatives in the sphere of nuclear and radiation safety, environmental safety, contribution to the development of ROSATOM's regions of operation and other socially important aspects of its business. In addition, the Corporation annually submits a report to the Russian Government. Some of ROSATOM's organizations and enterprises prepare environmental reports⁹³.

ROSATOM prepares its public annual reports in accordance with the following international standards: the GRI Sustainability Reporting Standards, the International Integrated Reporting Framework and the AccountAbility AA1000 Series of Standards. They provide the basis for the Uniform Industry-Wide Public Reporting Policy and the Public Reporting Standard of ROSATOM and Its Organizations⁹⁴.

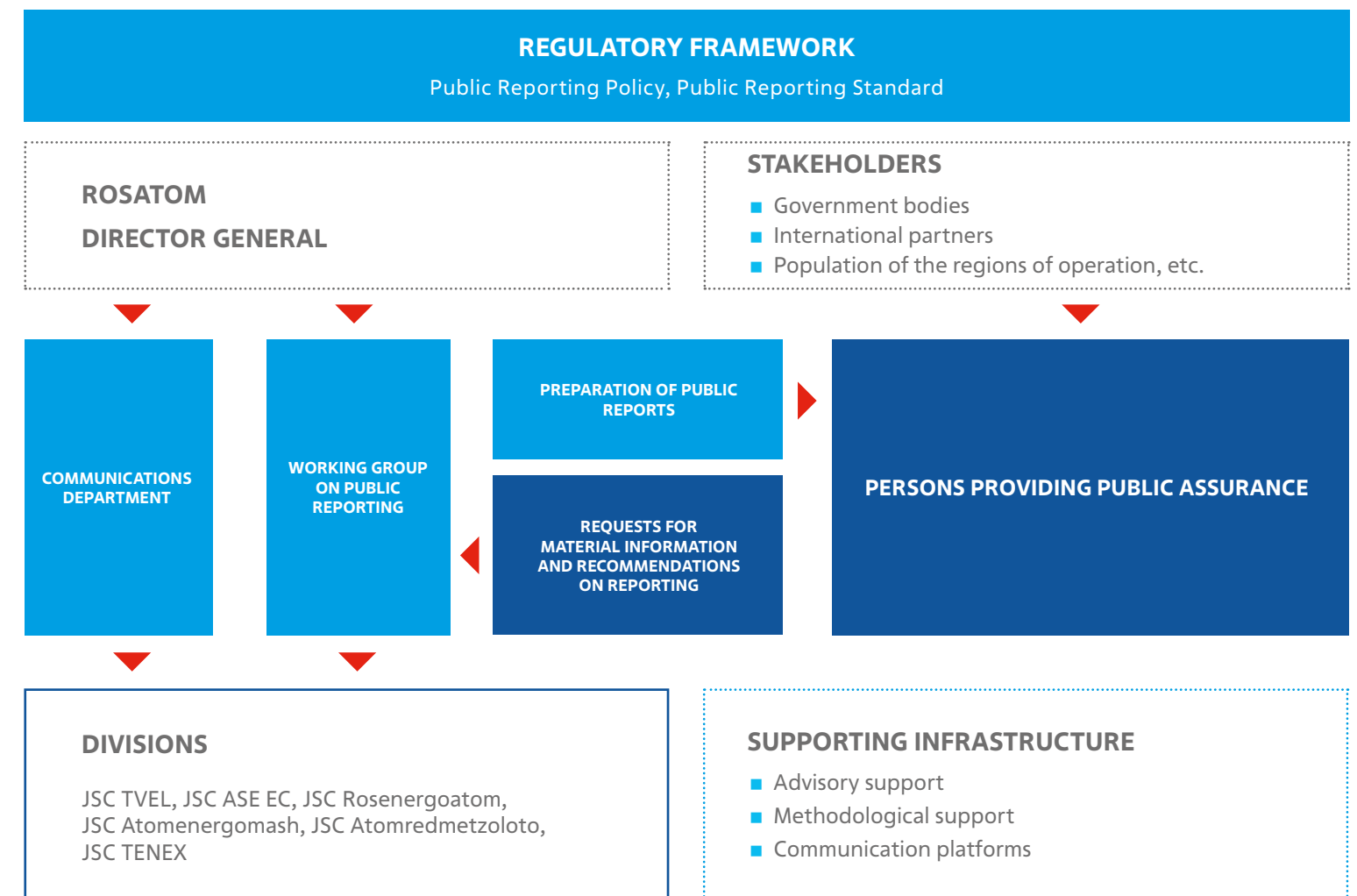
The overall goal of public reporting in the Russian nuclear industry is to improve ROSATOM's openness and transparency, strengthen its image and business reputation, make it more competitive and provide information support for the promotion of its products and services both in Russia and abroad.

In order to improve the public reporting system, in 2019, ROSATOM and its Divisions (JSC Atomredmetzoloto, JSC Atomenergomash, JSC ASE EC, JSC Rosenergoatom, JSC TVEL and JSC TENEX) made the decision to switch over to a single comprehensive reporting format. Starting from the 2019 reporting year, public reports will include the Public Annual Report on the Performance of State Atomic Energy Corporation Rosatom and reporting materials of the Divisions based on a standardized structure. All public reports on the performance of ROSATOM and its organizations (including reports for previous reporting periods) and information on the public reporting system will be posted on an integrated digital platform at www.report.rosatom.ru/en.

⁹³ <https://rosatom.ru/sustainability/environmental-management/>.

⁹⁴ <https://rosatom.ru/en/about-us/public-reporting/>.

PUBLIC REPORTING SYSTEM OF ROSATOM AND ITS ORGANIZATIONS



11.2. DIALOGUES WITH STAKEHOLDERS

In order to improve transparency and accountability at ROSATOM, representatives of key stakeholders are engaged in the preparation of the report through participation in discussions of socially important aspects of the Corporation's business and their reflection in the report to be prepared. In addition, stakeholder representatives also participate in public assurance of the report. Stakeholder engagement is one of the key requirements of international standards such as the Accountability AA1000SES standard, the Global Reporting Initiative Sustainability Reporting Standards (GRI SRS) and the International <IR> Framework. When preparing the previous report, ROSATOM assumed a number of obligations that were later fulfilled in the 2019 report.

To improve transparency and accountability at ROSATOM and to ensure compliance with international standards during the preparation of the Report, in May and June 2020, ROSATOM's Divisions held dialogues with stakeholders (in a remote format). During these events, stakeholder representatives voiced their requests and provided recommendations as to what information should be disclosed in the Report, and put forward

proposals for developing the public reporting system (minutes of the dialogues are included in the interactive version of the report)⁹⁵. The Corporation also conducted a special poll to identify material aspects of its business to be disclosed in the Report (*see Appendix 1 'Report Profile and the Process of Determining the Report Content and Materiality of Information'*).

In addition, in the second half of 2020, ROSATOM plans to give a presentation of the Report for 2019; during the presentation, stakeholder representatives will be given an opportunity to put forward their recommendations concerning the content of the Public Annual Report for 2020 and the development of the Corporation's public reporting system.

11.3. INCORPORATION OF STAKEHOLDERS' PROPOSALS

Stakeholders' proposals

Fulfilment of obligations by ROSATOM

FULFILMENT OF COMMITMENTS TAKEN ON BY ROSATOM DURING THE PREPARATION OF THE 2018 REPORT

To present ROSATOM's contribution to the implementation of Russia's national projects.

Incorporated in various sections of the Report.

To provide information on environmental benefits for a town or city and its residents from the implementation of the Smart City system.

To be incorporated in a subsequent Report (as the Smart City system is rolled out in Russian towns and cities).

To provide information not only on projects implemented by ROSATOM in 'nuclear' towns and cities, but also on their impact on the quality of people's lives (changes in the indicators and metrics reflecting the standard of living).

Partly incorporated in the section 'Developing the Regions of Operation'.

To provide an assessment of efficiency of measures implemented by ROSATOM from the perspective of those who these measures are targeted at (including the Lean Polyclinic project) and to include the findings of opinion polls conducted among residents of ROSATOM's regions of operation and their statements.

The request has been forwarded to the relevant divisions of ROSATOM. The information will be disclosed, to the extent possible, in a subsequent Report.

To add information on the market for the production of stable isotopes, where ROSATOM is a leader, and provide information on projects in this area.

Incorporated in the section 'Markets served by ROSATOM'.

⁹⁵ During the preparation of the Public Annual Report on the Performance of State Atomic Energy Corporation Rosatom in 2019, no dialogues with stakeholders were held. Minutes of dialogues with stakeholders held as part of the preparation of the Public Annual Report on the Performance of State Atomic Energy Corporation Rosatom for 2018 are available in the interactive version of the report (<https://report.rosatom.ru/708.html>).

11.4. STATEMENT OF PUBLIC ASSURANCE

BACKGROUND

ROSATOM has suggested that we assess its public annual report for 2019 (the Report). Our analysis and evaluation during the public assurance process focused on the materiality and completeness of information disclosed in the Report and on the Corporation's response to stakeholders' requests and proposals. Our conclusion is based on an analysis of the Report, additional materials provided to us (minutes of stakeholder

engagement events and tables reflecting the incorporation of stakeholders' proposals) and the feedback provided by ROSATOM's employees during public assurance of the Report.

We received no remuneration from ROSATOM for our participation in the public assurance procedure.

ASSESSMENTS, COMMENTS AND RECOMMENDATIONS

We are unanimous in the opinion that the Report is of high quality in terms of both its format and the scope of information that it provides. In our opinion, ROSATOM adheres to a consistent approach to ensuring the transparency and accountability of its business. During the preparation of the Report, the Corporation demonstrated strong commitment to ensuring that the development of nuclear technology is publicly acceptable and willingness to hold an open dialogue with stakeholders on various aspects of its operations.

In our view, the Report provides comprehensive information on all major aspects of the Corporation's operations, including those related to sustainable development. Through a detailed examination of the Corporation's business model, the Report clearly presents its complex value chain. It provides information on ROSATOM's governance system, strategic goals and management approaches, social, environmental and economic impacts,

challenges and plans for the medium and long term. Thus, the readers of the Report can obtain a complete picture of ROSATOM's operations, including their socially important aspects.

An indisputable advantage of the Report is the use of Russian and international corporate reporting standards during its preparation. These are, first and foremost, the Global Reporting Initiative Sustainability Reporting Standards (the Core 'in accordance' option). In addition, during the preparation of the Report, the Corporation traditionally used the International Integrated Reporting Framework, the AccountAbility AA1000 Series of Standards, the Conceptual Framework for the Development of Public Non-Financial Reporting in Russia, the Basic Performance Indicators of the Russian Union of Industrialists and Entrepreneurs (RSPP), the Uniform Industry-Wide Public Reporting Policy and the Public Reporting Standard of ROSATOM.

MATERIALITY OF INFORMATION

To incorporate stakeholders' requests as fully as possible, ROSATOM and its Divisions conducted a questionnaire survey among stakeholders to identify material topics to be disclosed in the Report (the information received was compared with the results of a questionnaire survey conducted among the Corporation's managers). We highly appreciate this initiative and recommend that ROSATOM should continue active collaboration with stakeholder representatives on this matter in the future as they represent the target audiences for the Corporation's public reports.

We believe that the prioritized topic of the Report, *History, Achievements and Long-Term Development Priorities of the Russian Nuclear Industry*, was selected appropriately, as the Report will be published in the year of the 75th anniversary of the Russian nuclear industry.

COMPLETENESS OF INFORMATION

We believe that the reporting information adequately covers all material aspects and enables readers to draw conclusions on the Corporation's performance in the reporting year.

RESPONSE TO STAKEHOLDERS' REQUESTS AND PROPOSALS

First of all, it should be pointed out that key proposals made by stakeholder representatives during the preparation of the Report for 2018 have been taken into account (the relevant information is provided in Chapter 11 of the Report).

We took part in determining material topics to be disclosed in the Report and the reporting materials of ROSATOM's Divisions (presented in appendices to the Report). We also participated in public consultations on draft reporting materials of the Divisions. At the request of stakeholder representatives, corrections were made and additional information was included in the final versions of the reporting materials of the Divisions (or substantiated explanations were provided as to why the requested information could not be disclosed).

We are willing to take part in subsequent events aimed at discussing the Report and formulating proposals concerning the Report for 2020 and the development of ROSATOM's public reporting system.

To summarize, we would like to point out that in recent years ROSATOM has made significant progress in public reporting and, consequently, continues to improve confidence in its business. We hope that ROSATOM will continue to consistently implement the principles of responsible business conduct in the future, work systematically on the sustainable development agenda and disclose information on its performance in this context.

PERSONS WHO TOOK PART IN THE PUBLIC ASSURANCE OF ROSATOM'S PUBLIC ANNUAL REPORT FOR 2019

ALEXANDER AGEEV

Director General of the Institute for Economic Strategies of the Social Sciences Division of the Russian Academy of Sciences



SERGEY BARANOVSKY

President of the Inter-Regional Environmental Non-Governmental Organization Green Cross, Deputy Chairman of ROSATOM's Public Council



LEONID BOLSHOV

Director of the Nuclear Safety Institute of the Russian Academy of Sciences




MARINA VASHUKOVA

Executive Director of the Association National Network of the Global Compact



ANDREY VETLUZHSKIKH

Member of the State Duma Committee on Economic Policy, Industry, Innovation and Entrepreneurship



NATALIA DAVYDOVA

Director of the Environmental Projects Consulting Institute, member of ROSATOM's Public Council



KONSTANTIN DOLGOV

Deputy Chairman of the Committee on Economic Policy of the Federation Council of the Federal Assembly of Russia



GENNADY SKLYAR

Member of the State Duma Committee on Energy



ELENA FEOKTISTOVA

Managing Director for Corporate Responsibility, Sustainable Development and Social Entrepreneurship of the Russian Union of Industrialists and Entrepreneurs (RSPP)



IGOR FOMICHEV

Chairman of the Russian Trade Union of Nuclear Power and Industry Workers



REGINA YURYEVA

Director of the Regina Yuryeva Foundation



APPENDICES

APPENDIX 1. REPORT PROFILE AND THE PROCESS OF DETERMINING THE REPORT CONTENT AND MATERIALITY OF INFORMATION

The Public Annual Report on the Performance of State Atomic Energy Corporation Rosatom for 2019 has been prepared on a voluntary basis and is intended for a broad range of stakeholders.

The Report has been prepared in an integrated format and provides a comprehensive picture of the following:

- The implementation of ROSATOM's strategy, including contribution to the sustainability of the Corporation's business in the reporting year, as well as short-, medium- and long-term plans;
- Significant financial, economic and operating results of the Corporation's core businesses;
- Results achieved in the sphere of nuclear and radiation safety, environmental protection, contribution to the development of the regions of operation, implementation of social policy and other aspects of sustainable development;
- The economic, environmental and social impact on the external and internal environment;
- The approach of ROSATOM's executives to managing various aspects of its business.

STANDARDS AND REGULATORY REQUIREMENTS

The Report has been prepared in accordance with the following documents:

- The Public Reporting Policy and the Public Reporting Standard of ROSATOM and its organizations;
- The International Integrated Reporting Framework (International <IR> Framework);
- The Global Reporting Initiative Sustainability Reporting Standards (GRI SRS, Core option)⁹⁶;

The Report focuses on the history, achievements and long-term development priorities of the Russian nuclear industry; this topic has been prioritized by the top management and representatives of key stakeholders. Information on the selection of material topics to be disclosed in the Report is provided below in the sections 'Process for determining the Report content' and 'Ranking map of material topics to be disclosed in the Report'.

ROSATOM's internal regulations stipulate an annual reporting cycle; the previous annual report was published in August 2019. The Report covers the Corporation's operations during the period from January 1, 2019 through December 31, 2019.

- The AccountAbility AA1000 Series of Standards (AA 1000 AP 2018, AA1000 SES 2015);
- The Conceptual Framework for the Development of Public Non-Financial Reporting in Russia;
- The Recommendations of the Russian Union of Industrialists and Entrepreneurs (RSPP) for Use in Governance Practice and Corporate Non-Financial Reporting (basic performance indicators).

STAKEHOLDER ENGAGEMENT

To improve transparency and accountability and to determine the materiality of information to be disclosed, the Report was prepared in cooperation with stakeholders in accordance with the AA1000SES international standard. The Corporation conducted a survey to identify material aspects to be disclosed in

the Report, while ROSATOM's Divisions/key organizations held dialogues with stakeholders (in a remote format). The Report incorporates key requests voiced by stakeholder representatives during the dialogues.

VERIFICATION OF REPORTING INFORMATION

The reporting information was certified as reliable by:

- An independent auditing organization which certifies IFRS financial statements;
- An independent auditing organization which certified the Report's compliance with the GRI SRS Standards (the Core option) and the International Integrated Reporting Framework and ROSATOM's compliance with the AA1000 AP principles (see Appendix 3).

ROSATOM's Internal Audit Department conducted an internal audit of the business process 'Public Reporting Procedure in ROSATOM' (see Appendix 2).

Representatives of key stakeholders provided public assurance of the Report in accordance with the AA1000SES standard, which confirmed the materiality and completeness of the disclosed information and the Corporation's responsiveness to stakeholders' requests when preparing the Report (see the section 'Statement of Public Assurance').

REPORT BOUNDARIES

The Report covers the operations of ROSATOM and its organizations in Russia and abroad.

The Report covers several scopes of consolidation (the list of organizations within various scopes of consolidation is provided in the interactive version of the Report⁹⁷. Integrated performance indicators are disclosed for the Corporation's organizations within the scope of budget consolidation as at December 31, 2019 (195 organizations)⁹⁸. GRI disclosures that belong to the Social Category are reported for organizations within the scope of budget consolidation; GRI disclosures that belong to the Environmental Category are reported for all significant organizations within ROSATOM which provide information on their en-

vironmental performance using corporate reporting forms (113 organizations). Financial and economic indicators in the section 'Financial and Economic Results' are disclosed for organizations included in the part of the scope of ROSATOM's consolidated IFRS financial statements for which information is publicly available (199 organizations).

In accordance with international standards, some disclosures in the Report and related performance indicators (international cooperation, ROSATOM's activities in its regions of operation, environmental protection, etc.) include information on the operations of ROSATOM's key partners, counterparties and other stakeholders.

⁹⁶ The GRI Content Index and information on correspondence to the RSPP basic performance indicators are provided in the interactive version of the Report (www.report.rosatom.ru/1628.html).

⁹⁷ <https://www.report.rosatom.ru/1628.html>.

⁹⁸ Hereinafter, not including State Atomic Energy Corporation Rosatom.

PROCESS FOR DETERMINING THE REPORT CONTENT

ROSATOM traditionally attaches great importance to determining the materiality of information to be disclosed in a public report. The 2019 Report was prepared in accordance with international reporting standards: the Global Reporting Initiative Sustainability Reporting Standards (GRI SRS) and the International Integrated Reporting Framework. Both standards require that material topics to be disclosed in the Report should be determined.

The materiality of information was determined through the following process:

- A working group compiled a list of material topics related to ROSATOM's operations (GRI Reporting Principles: Sustainability Context, Materiality);
- The Corporation's management, members of the Working Group preparing the Report and representatives of major

stakeholder groups prioritized material topics (based on the assessment of materiality of each of the proposed aspects taking into account the materiality of ROSATOM's impacts and its influence on stakeholders' opinions and decisions) (GRI Reporting Principles: Stakeholder Inclusiveness, Materiality);

- Following the 'two-stage filtering', a list of material topics to be disclosed in the Report was compiled (GRI Reporting Principles: Completeness, Materiality).

As a result, a ranking map of material topics to be disclosed in the Report was prepared. The decision to include various GRI performance indicators and performance indicators stipulated in ROSATOM's Public Reporting Standard was based on the materiality of the topics to which the indicators are related. The boundaries of information disclosure on various aspects were determined by the Working Group.

Highest materiality (a score of 2.5 points or higher)	High materiality (a score of 2 points or higher)	Medium materiality (a score of 1.5 points or higher)	Low materiality (a score lower than 1.5 points)
----------------------------------------------------------	-----------------------------------------------------	---------------------------------------------------------	----------------------------------------------------

RANKING MAP OF MATERIAL TOPICS TO BE DISCLOSED IN THE REPORT⁹⁹

1. Outcomes of implementation of ROSATOM's strategy and contribution of performance in the reporting year to the achievement of strategic goals	3. ROSATOM's performance in the sphere of international business and international cooperation (including building relationships with customers and partners and obtaining feedback)	15. Implementation of ROSATOM's Innovative Development Programme	36. Performance of the Nuclear Weapons Division
2. Ensuring nuclear and radiation safety during the operation of nuclear facilities (including international cooperation in this sphere) (GRI 416: Customer Health and Safety) ¹⁰⁰	4. ROSATOM's presence on the markets for nuclear technologies and services (markets for natural uranium, uranium conversion and enrichment, nuclear fuel, NPP construction, etc.) and the markets for new non-nuclear businesses, and the development prospects of these markets	16. Emissions, waste and effluents (GRI 305: Emissions, GRI 306: Effluents and Waste)	37. Work of ROSATOM's Public Council
	5. ROSATOM's financial and economic performance (GRI 201: Economic Performance)	17. ROSATOM's impact on local communities (social programmes, philanthropy, volunteering) (GRI 413: Local Communities)	38. ROSATOM's knowledge management system and protection of ROSATOM's intellectual property
	6. Development and implementation of technologies and practices reducing the environmental footprint	18. Compliance of ROSATOM's organizations with national and international environmental and technical standards (GRI 307: Environmental Compliance)	39. Key personnel characteristics (including personnel costs)

⁹⁹ The map has been prepared based on the findings of a questionnaire survey conducted among internal and external stakeholders of ROSATOM in December 2019 and taking into account opinions obtained from stakeholders between 2016 and 2018.

During the survey, stakeholders were asked to assess the materiality of topics provisionally selected by the working group preparing the report using the following scale:

0 – disclosure of this information in the report is immaterial (the information should not be disclosed in the report).

1 – it is recommended that this information should be disclosed in the report (the report should contain key information on the topic or references to other sources of information, such as the online version of the report, the corporate website, reports of ROSATOM's organizations, etc.).

2 – it is important to disclose this information in the report (the information should be disclosed in the report in detail).

3 – it is very important to disclose this information in the report (the information should be disclosed in a separate section/presented at the beginning (in the first chapter) of the report).

Topics are considered to be material for information disclosure in accordance with the GRI Standards if they were given a score of 1.5 points or higher during the assessment.

¹⁰⁰ Due to the absence of an official Russian translation of the GRI Standards, the titles of the Standards and the names of indicators are provided in English in the Russian version of the report.

Highest materiality (a score of 2.5 points or higher)	High materiality (a score of 2 points or higher)	Medium materiality (a score of 1.5 points or higher)	Low materiality (a score lower than 1.5 points)
	<p>7. Prospects for the development of the nuclear power industry in Russia and globally. Forecasts for the needs of the energy system in Russia and the energy systems of foreign countries</p> <p>8. Radiation impact on the environment (including on biodiversity) (GRI 304: Biodiversity, GRI 305: Emissions, GRI 306: Effluents and Waste)</p> <p>9. Contribution to the economic development of the regions of operation (contribution to economic value creation and distribution in the regions of operation, contribution to the energy security of Russian regions, tax payments to the budgets of various levels, investments in infrastructure, job creation, etc.) (GRI 203: Indirect Economic Impacts)</p> <p>10. Provision of access to energy (projects to provide power supply in remote areas, provision of financial support to developing countries, customer relations, joint projects with non-profit organizations and the UN)</p> <p>11. RAW and SNF management and addressing 'nuclear legacy' issues</p>	<p>19. Development of the Northern Sea Route</p> <p>20. Emergency preparedness</p> <p>21. Digitization of the industry, contribution to the digitization of the Russian economy and development of digital products</p> <p>22. Performance of ROSATOM's Divisions</p> <p>23. Implementation of the Pro-ryv project and progress on the development of a new technological platform and transition to a closed nuclear fuel cycle in the nuclear power industry</p>	<p>40. Respect and exercise of human rights (including non-discrimination, respect of employment rights by subcontractors, elimination of forced, compulsory and child labour) (GRI 405: Diversity and Equal Opportunity)/(GRI 408: Child Labour)/(GRI 409: Forced and Compulsory Labour)</p> <p>41. Outcomes of import substitution initiatives</p> <p>42. External communication projects (exhibitions, nuclear energy information centres, online communication, etc.)</p> <p>43. Improvement of corporate governance mechanisms, including the implementation of the Corporate Governance Code recommended by the Bank of Russia</p> <p>44. Performance of the ROSATOM Production System (RPS)</p>

Highest materiality (a score of 2.5 points or higher)	High materiality (a score of 2 points or higher)	Medium materiality (a score of 1.5 points or higher)	Low materiality (a score lower than 1.5 points)
	<p>12. ROSATOM's performance in the sphere of business diversification (wind power, nuclear medicine, composite materials, irradiation centres, non-nuclear mechanical engineering; NPP servicing, etc.)</p> <p>13. Key business risks and opportunities</p> <p>14. Environmental measures and expenses and their efficiency (GRI 307: Environmental Compliance)</p>	<p>24. Participation in international mega research projects (ITER, FAIR, etc.)</p> <p>25. Environmental stewardship (energy efficiency) (GRI 302: Energy, GRI 303: Water)</p> <p>26. Management of disturbed and contaminated areas</p> <p>27. Occupational health and safety (including injury rates) (GRI 403: Occupational Health and Safety)</p> <p>28. Cooperation with universities and recruitment of young professionals</p> <p>29. Implementation of the social policy with regard to employees (GRI 401: Employment)</p> <p>30. Financial management and implementation of ROSATOM's investment programme</p> <p>31. Prevention of corruption and other offences (GRI 205: Anti-Corruption)</p> <p>32. Career and performance management (equal opportunities, training and development, talent pool, assessment systems) (GRI 404: Training and Education)</p>	<p>45. Labour/management relations (including the ability of employees to influence managerial decision-making, measures to safeguard the legal rights of employees, the collective agreement) (GRI 402: Labour/Management Relations)</p> <p>46. Communication projects aimed at increasing employee engagement, recognition and motivation</p> <p>47. Development of the corporate culture and horizontal cooperation among employees</p> <p>48. Organizational change management (responsible change management measures (personnel rotation, retraining, downsizing, etc.)</p> <p>49. Approaches to determining remuneration for employees and executives</p> <p>50. Industry media coverage</p>

Highest materiality
(a score of 2.5 points or higher)

High materiality
(a score of 2 points or higher)

Medium materiality
(a score of 1.5 points or higher)

Low materiality
(a score lower than 1.5 points)

33. Performance of government functions by ROSATOM: law drafting, implementation of federal target programmes and government programmes, provision of public services (GRI 415: Public Policy)

34. Development of closed administrative and territorial formations (CATFs) and areas where NPPs are located

35. Procurement and supply chain management (including sustainability requirements for suppliers and contractors and measures to prevent unfair competition) (GRI 204: Procurement Practices)

DISCLAIMER

The Report contains information about ROSATOM's medium- and long-term objectives and initiatives. The objectives are forward-looking, and their actual achievement depends, among other things, on a number of economic, political and legal factors beyond ROSATOM's control (the global financial, economic

and political environment; situation on the key markets; amendments to the tax, customs and environmental legislation, etc.). Therefore, actual performance in the future years may differ from the forward-looking statements contained herein.

APPENDIX 2. REPORT OF THE INTERNAL AUDIT DEPARTMENT OF STATE ATOMIC ENERGY CORPORATION ROSATOM

REPORT

of the Internal Audit Department of ROSATOM
on the findings of internal audit of the business process
'Public Reporting Procedure in ROSATOM'

Internal audit of the business process 'Public Reporting Procedure in ROSATOM' has been performed pursuant to the Consolidated Monitoring Plan of Specialized Internal Control Bodies of ROSATOM for the Second Half of 2020 signed off by the Director General of ROSATOM and approved by the Chairman of the Supervisory Board of ROSATOM.

The audit has involved:

- An assessment of efficiency of internal controls in the public reporting process;
- An assessment of compliance of the public reporting procedure with applicable legislation, international standards and internal regulatory requirements for public reporting;
- Producing recommendations for improving internal controls in public reporting and enhancing the efficiency of this process.

It should be pointed out that, starting from this year, ROSATOM's public report includes reporting materials on the performance of ROSATOM's Divisions, which are attached to the report as appendices.

The findings of the audit lead to the conclusion that the business process 'Public Reporting Procedure in ROSATOM' complies with applicable legislation, international standards and internal regulatory requirements governing the public reporting process. At the same time, the auditors would like to point to the need for more detailed disclosure of information required by individual provisions of the GRI Sustainability Reporting Standards.

Head of the audit team

A.P. Ivanova

Member of the audit team

I.Yu. Stepuk

APPENDIX 3. INDEPENDENT AUDITOR'S REPORT ON THE NON-FINANCIAL REPORT OF STATE ATOMIC ENERGY CORPORATION ROSATOM



INDEPENDENT PRACTITIONER'S LIMITED ASSURANCE REPORT [TRANSLATION FROM RUSSIAN ORIGINAL]

To the management of State Atomic Energy Corporation Rosatom

We have undertaken a limited assurance engagement of State Atomic Energy Corporation Rosatom (hereinafter referred to as ROSATOM) stakeholder engagement in the course of sustainability activities implementation compliance with the principles of the AA1000 Accountability Principle 2018 (hereinafter referred to as AA1000 AP 2018) as well as of the accompanying Public Annual Report "Performance of State Atomic Energy Corporation Rosatom in 2019" (hereinafter referred to as the Report) compliance with the requirements of GRI Sustainability Reporting Standards to the report prepared in accordance with the Core option and with the requirements of the International Integrated Reporting Framework.

Responsibility of ROSATOM

ROSTATOM is responsible for its compliance with the principles of AA1000 AP 2018 in stakeholder engagement in the course of sustainability activities implementation as well as for preparation of the Report in compliance with the requirements of GRI Sustainability Reporting Standards to the report prepared in accordance with the Core option and with the requirements of the International Integrated Reporting Framework. This responsibility includes the design, implementation and maintenance of internal control relevant to the preparation of the Report that is free from material misstatement, whether due to fraud or error.

Our Independence and Quality Control

We have complied with the independence and other ethical requirements of the Rules of Independence of the Auditors and Audit Organizations and The Code of Professional Ethics of the Auditors, which are in accordance with International Code of Ethics for Professional Accountants (including International Independence Standards) issued by the International Ethics Standards Board for Accountants, which is founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality and professional behavior, and we have fulfilled our other ethical responsibilities in accordance with these requirements.

The firm applies International Standard on Quality Control 1, Quality Control for Firm that Perform Audits and Reviews of Financial Statements, and Other Assurance and Related Services Engagements, and accordingly maintains a comprehensive system of quality control including documented policies and procedures regarding compliance with ethical requirements, professional standards and applicable legal and regulatory requirements.

Our Responsibility

Our responsibility is to express a limited assurance conclusion on ROSATOM stakeholder engagement in the course of sustainability activities implementation compliance with the principles of AA1000 AP 2018, as well as on the Report compliance with the requirements of GRI Sustainability Reporting Standards to the report prepared in accordance with the Core option and with the requirements of the International Integrated Reporting Framework based on the procedures we have performed and the evidence we have obtained. We conducted our limited assurance engagement in accordance with International Standard on Assurance Engagements 3000 (Revised), Assurance Engagements Other than Audits or Reviews of Historical Financial Information, as well as in accordance with AA1000 Assurance Standard 2008 (type 2, as defined by AA1000AS 2008). These standards require that we plan and perform this engagement to obtain limited (moderate as defined by AA1000AS 2008) assurance about whether ROSATOM stakeholder engagement in the course of sustainability activities implementation complies with the principles of AA1000 AP 2018 and whether the Report is free from material misstatement.

A limited assurance engagement undertaken in accordance with these standards involves assessing the following criteria (hereinafter referred to as Criteria):

- Compliance of ROSATOM stakeholder engagement in the course of sustainability activities implementation with the principles of AA1000 AP 2018 - inclusivity, materiality, responsiveness and impact.
- Compliance of the Report with the requirements of GRI Sustainability Reporting Standards to the report prepared in accordance with the Core option.
- Compliance of the Report with the requirements of the International Integrated Reporting Framework.

TRANSLATION NOTE: Our report has been prepared in Russian and in English. In all matters of interpretation of information, views or opinions, the Russian version of our report takes precedence over the English version.



A limited assurance engagement is substantially less in scope than a reasonable assurance engagement in relation to both the risk assessment procedures, including an understanding of internal control, and the procedures performed in response to the assessed risks.

The procedures we performed were based on our professional judgment and included inquiries, inspection of documents, analytical procedures, evaluating the appropriateness of quantification methods and reporting policies, and agreeing or reconciling with underlying records.

Given the circumstances of the engagement, in performing the procedures listed above we have performed the following activities:

- Study and selective testing of systems and processes implemented by ROSATOM to ensure and analyze the compliance of the activities with AA1000 AP 2018 principles; collection of evidence confirming practical implementation of these principles.
- Interviewing the management and employees of ROSATOM and obtaining documentary evidence.
- Study of information available on the website of ROSATOM related to its activities in the context of sustainable development.
- Study of public statements of third parties concerning economic, environmental and social aspects of ROSATOM activities, in order to check validity of the declarations made in the Report.
- Analysis of non-financial reports of companies working in the similar market segment for benchmarking purposes.
- Analysis of the current system of internal audit of public annual reporting in ROSATOM.
- Selective review of documents and data on the efficiency of the management systems of economic, environmental and social aspects of sustainable development in ROSATOM.
- Study of the existing processes of collection, processing, documenting, verification, analysis and selection of data to be included into the Report.
- Analysis of information in the Report for compliance with the requirements of Criteria.

The procedures were performed only in relation to data for the year ended 31 December 2019.

The evaluation of reliability of the information on performance in the Report was conducted in relation to compliance with the requirements of Standards to the report prepared in accordance with the Core option and information referred to in the annex to the Report "GRI Content Index and Correspondence to the RSPP Basic Performance Indicators", as well as in relation to compliance with the requirements of the International Integrated Reporting Framework. In respect to this information assessment of its conformity to external and internal reporting documents provided to us was performed.

The procedures were not performed in relation to forward-looking statements; statements expressing the opinions, beliefs and intentions of ROSATOM to take any actions related to the future; as well as statements based on expert opinion.

The procedures were performed in relation to the version of the Report subject to sending to Global Reporting Initiative in order to notify it of the use of the Standards in the Report preparation.

The procedures were performed in relation to the Russian version of the Report, which includes information to be published in a hard-copy form as well as in digital form on the ROSATOM website.

The procedures performed in a limited assurance engagement vary in nature and timing from, and are less in extent than for, a reasonable assurance engagement. Consequently, the level of assurance obtained in a limited assurance engagement is substantially lower than the assurance that would have been obtained had we performed a reasonable assurance engagement. Accordingly, we do not express a reasonable assurance opinion about compliance, in all material respects, with the requirements of Criteria.

Limited Assurance Conclusion on compliance of ROSATOM stakeholder engagement in the course of sustainability activities implementation with the principles of AA1000 AP 2018

Based on the procedures performed and evidence obtained, nothing has come to our attention that causes us to believe that ROSATOM stakeholder engagement in the course of sustainability activities implementation has not complied, in all material aspects, with the criteria of AA1000 AP 2018 in respect to adherence to the principles (Inclusivity, Materiality, Responsiveness and Impact).

TRANSLATION NOTE: Our report has been prepared in Russian and in English. In all matters of interpretation of information, views or opinions, the Russian version of our report takes precedence over the English version.



Limited Assurance Conclusion on Compliance of the Report with the requirements of the International Integrated Reporting Framework

Based on the procedures performed and evidence obtained, nothing has come to our attention that causes us to believe that the Report has not complied, in all material aspects, with the guiding principles of the International Integrated Reporting Framework and with requirements to the structure of content elements of integrated reports.

Basis for Limited Assurance Qualified Conclusion on Compliance of the Report with the GRI Sustainability Reporting Standards (Core option)

GRI Disclosure 102-8 has been reported without breakout of total number of employees by employment contract (including by gender and region) as well as by employment type (including by gender).

Limited Assurance Qualified Conclusion on Compliance of the Report with the GRI Sustainability Reporting Standards (Core option)

Based on the procedures performed and evidence obtained, except for the effect on the matter described in the 'Basis for Limited Assurance Qualified Conclusion on Compliance of the Report with the GRI Sustainability Reporting Standards (Core option)' section of our report, nothing has come to our attention that causes us to believe that the Report has not complied, in all material aspects, with requirements of GRI Sustainability Reporting Standards to the report prepared in accordance with the Core option.

Recommendations

Based on the results of the limited assurance engagement we recommend:

- Include a statement on compliance of the report with the requirements of the International Integrated Reporting Framework in the statement from those charged with governance.
- It is reasonable to disclose GRI indicators in relation to target values and plans for the future.
- In case of disclosure with omissions due to absence of a recording system, provide more specific information about plans to obtain data in future.

The recommendations are not intended to detract from the practitioner's conclusions. Our conclusions are not modified in respect of the matters referred to in the recommendations.



FBK, LLC

Practitioner
Partner
acting under Power of Attorney No. 76/18 of December 17, 2018

The Russian Federation, Moscow
September 02, 2020



TRANSLATION NOTE: Our report has been prepared in Russian and in English. In all matters of interpretation of information, views or opinions, the Russian version of our report takes precedence over the English version.

LIST OF ABBREVIATIONS

APCS	automated process control system
ARMS	automated radiation monitoring system
CATF	closed administrative and territorial formation
CNFC	closed nuclear fuel cycle
EUP	enriched uranium product
FAIR	Facility for Antiproton and Ion Research
FMBA	Federal Biomedical Agency
FTP	federal target programme
HEU	highly enriched uranium
HLW	high-level waste
IAEA	International Atomic Energy Agency
IARMS	Industry-Wide Automated Radiation Monitoring System
IGA	intergovernmental agreement
ILW	intermediate level waste
INES	International Nuclear Event Scale
INPRO	International Project on Innovative Nuclear Reactors and Fuel Cycles
INS RAW	Integrated National System for Radioactive Waste Management
IP	intellectual property
IRAW	individual risk assessment workstation
ISRS	Integrated Standardized Remuneration System
ITER	International Thermonuclear Experimental Reactor

IUEC	International Uranium Enrichment Centre
KPI	key performance indicator
LCBE	life cycle back-end
LEU	low-enriched uranium
LLW	low-level waste
NF	nuclear facility
NFA	nuclear fuel assembly
NFE	nuclear fuel element
NPP	nuclear power plant
NRS	nuclear and radiation safety
NS	nuclear submarine
OECD NEA	Nuclear Energy Agency of the Organization for Economic Cooperation and Development
R&D	research and development
RAW	radioactive waste
RBMK	high-power channel-type reactor
ROSATOM, Corporation	State Atomic Energy Corporation Rosatom
Rostekhnadzor	Federal Service for Environmental, Technological and Nuclear Supervision
RSPF	Russian Union of Industrialists and Entrepreneurs
SNF	spent nuclear fuel
WPP	wind power plant

GLOSSARY

AA1000 Stakeholder Engagement Standard (AA1000SES)	A regulatory framework for designing, implementing, evaluating, communicating and assuring the quality of stakeholder engagement, including as part of reporting and accountability processes of organizations
Becquerel (Bq)	A unit of nuclide activity in a radiation source equal to nuclide activity where one nucleus decays per second
BOO (Build – Own – Operate) contract	A contract imposing obligations related to the construction, ownership and operation of a facility
Capacity factor	The ratio of actual electricity output of a reactor unit during its operation to electricity output that would have been produced during its operation at full nameplate capacity without shutdowns
Closed nuclear fuel cycle	A nuclear fuel cycle in which spent nuclear fuel is processed in order to extract uranium and plutonium for nuclear fuel refabrication
Corporate business model	A model comprising key business processes used by the organization to create and maintain its value in the short, medium and long term
Corporate social responsibility	A concept whereby an organization takes into account stakeholder requests. It is a set of obligations voluntarily assumed by the organization's executives to take into account the interests of employees, shareholders, local communities in the organization's regions of operation, government bodies and municipal governments and other stakeholders. These obligations are funded mainly from the organization's own funds and are aimed at implementing significant internal and external social (in a broad sense) programmes whose outcomes help develop the organization, improve its reputation and image, and enable constructive stakeholder engagement
Depleted uranium	Uranium with a lower content of the U-235 isotope than natural uranium (e.g. uranium in spent fuel from reactors fuelled with natural uranium)
Dialogue with stakeholders (as part of reporting processes)	An event held in accordance with the international AA1000 Series of Standards to facilitate communication between the organization and representatives of key stakeholders when preparing and promoting its public reports
Digitization	A systematic approach to the use of digital resources in order to improve labour productivity, gain a competitive advantage and promote overall economic development
Enrichment (isotopic)	a) The amount of atoms of a specific isotope in a mixture of isotopes of the same element if it exceeds the share of this isotope in a naturally occurring mixture (expressed as a percentage); b) a process resulting in an increase in the content of a specific isotope in a mixture of isotopes
EPC (Engineering – Procurement – Construction) contract	A contract imposing obligations related to the turnkey construction of a facility, i.e. obligations related to the engineering, procurement and construction of a facility. Unlike a BOO contract, it does not provide for ownership of the facility to be built
EPCM (Engineering – Procurement – Construction – Management) contract	A contract imposing obligations related to the turnkey construction (engineering, procurement and construction) and management of a facility. Unlike a BOO contract, it does not provide for ownership of the facility to be built

ESG principles	Principles underlying an organization's operations and taking into account environmental (E), social (S) and governance (G) factors. The term 'ESG' is widely used by the investment community; the ESG principles are essentially similar to sustainability principles
Fast neutrons	Neutrons whose kinetic energy exceeds a certain limit. This limit varies within a broad range and depends on the application (reactor physics, protection or radiation monitoring). In reactor physics, this limit is usually set at 0.1 MeV
First criticality	A stage in the commissioning of an NPP which involves loading nuclear fuel into the reactor, achieving first criticality and performing required physical experiments at a power level at which heat is removed from the reactor through natural heat losses
Fuel assembly	A set of fuel elements (rods, bars, plates, etc.) held together with spacer grids and other structural elements that are transported and irradiated in the reactor in one piece. Fuel assemblies are loaded into the reactor core
Global Reporting Initiative (GRI)	An international system for reporting on economic, environmental and social performance based on the Sustainability Reporting Standards
Global Reporting Initiative (GRI) Sustainability Reporting Standards	The Standards outline the Principles for defining report content and ensuring the appropriate quality of reporting information; disclosures comprising performance indicators related to an organization's economic, environmental and social impacts, approaches to managing these impacts and other characteristics
Industry-wide emergency prevention and response system (IEPRS)	A functional subsystem for emergency prevention and response in organizations within the jurisdiction of ROSATOM
Integrated report	A report consolidating all material data on the organization's strategy, corporate governance, performance indicators and prospects to present a comprehensive picture of its economic, social and environmental status. The report gives a clear idea of value creation in the organization at present and in the future
International Integrated Reporting Council (IIRC)	An international organization responsible for promoting and updating the International Integrated Reporting Framework. The objective of the IIRC is to develop universal approaches to corporate reporting in order to promote sustainable development of the global economy
International Standard on Assurance Engagements (ISAE) 3000 (Revised), Assurance Engagements Other Than Audits or Reviews of Historical Financial Information	An international standard for the audit of non-financial reports
Natural background radiation	Ionizing radiation including cosmic radiation and ionizing radiation from naturally distributed natural radionuclides (on the surface of the Earth, in the air, food, water, the human body, etc.)
Non-financial reporting	Reports provided by an organization on its performance beyond its core operational and financial activities (and the management of this performance). Examples of non-financial reports include sustainability reports, corporate social responsibility reports, environmental reports, reports on philanthropy, etc.

NPP safety	The ability of an NPP to ensure radiation safety for personnel, the general public and the environment within required limits during normal operation and in the event of an accident
Nuclear fuel	Material containing fissionable nuclides which, after being placed in a nuclear reactor, enables a nuclear chain reaction
Nuclear fuel cycle (NFC)	A sequence of manufacturing processes aimed at ensuring the operation of nuclear reactors, ranging from uranium production to radioactive waste disposal
Nuclear power	A branch of power engineering that uses nuclear energy for electricity and heat generation
Nuclear safety	The ability of nuclear facilities to prevent nuclear accidents and radioactive leaks
Operator	An organization that has obtained a permit from a regulator for the operation of an NPP or another nuclear facility
Pilot operation	A stage in the commissioning of a nuclear power plant from the power start-up to acceptance of the power plant for commercial operation
Power start-up	A stage in the commissioning of an NPP at which the NPP starts to generate energy, and the operation of the NPP is tested at various power levels, up to the level specified for commercial operation
Radiation burden	A sum of individual doses of radiation received or planned in the course of operation, maintenance, repairs, replacement or dismantling of equipment at a nuclear facility
Radiation monitoring	Measures for obtaining information on radiation levels in the organization and in the environment and on human exposure to radiation (including dosimetry and radiometric monitoring)
Radiation safety	Protection of the current and future generations and the environment against the harmful impact of ionizing radiation
Radioactive discharge	Controlled release of radionuclides into industrial reservoirs as a result of the operation of a nuclear facility
Radioactive release	Controlled atmospheric emission of radionuclides by a nuclear facility
Radioactive waste	Materials and substances unsuitable for further use, as well as equipment and products with a radionuclide content above prescribed levels
Radioactive waste disposal	Safe placement of radioactive waste in repositories or any places that rules out waste withdrawal or a possibility of radioactive leaks into the environment
Radioactive waste processing and conditioning	Process operations aimed at ensuring that the physical form and condition of radioactive waste are appropriate for its disposal
Recommendations of the Russian Union of Industrialists and Entrepreneurs (RSPP) for Use in Governance Practice and Corporate Non-Financial Reporting (basic performance indicators)	A system of economic, social and environmental performance indicators for non-financial reports developed by the RSPP in order to facilitate the adoption of responsible business principles. It is based on a number of framework documents developed by UN organizations (including the UN Global Compact) and the Global Reporting Initiative, as well as methodological and procedural guidelines of the Federal State Statistics Service of the Russian Federation and guidelines developed by the RSPP (the Social Charter of Russian Business, Recommendations on the Preparation of Non-Financial Reports 'Five Steps Towards Social Sustainability of Companies', etc.)

Research reactor	A nuclear reactor designed for use as an object of research to obtain data on reactor physics and technology required in order to design and develop similar reactors or components thereof
Separative work unit (SWU)	A measure of efforts expended on the separation of a given amount of material with a specific isotopic composition into two fractions with different isotopic compositions; separative work is measured in kilograms, and enrichment and energy costs are calculated per kilogram of separative work performed
Spent nuclear fuel processing	A set of chemical engineering processes for removing fission products from spent nuclear fuel and for regeneration of fissionable material for reuse
Stakeholder assurance of the report	A procedure organized in accordance with the AA1000SES international standard whereby representatives of principal stakeholders provide assurance for the report by confirming the materiality and completeness of information disclosed in the report, and whereby the organization responds to requests and proposals from stakeholders. The outcome of stakeholder assurance is a Statement of Public Assurance signed by representatives of principal stakeholders and included in the report
Stakeholders	Individuals and/or legal entities and groups of individuals or entities that make an impact on the organization's operations through their actions and/or are affected by the organization. An organization may have different stakeholders (national and international regulatory (supervisory) authorities, shareholders, consumers of goods and services, business partners, suppliers and contractors, civil society organizations, local communities, trade unions, etc.) with differing and conflicting interests
Sustainable development	A process of economic and social change whereby the exploitation of natural resources, allocation of investments, the focus of scientific and technical development, personal development and institutional changes are aligned with each other and strengthen the present and future potential for meeting human needs and aspirations
Sustainable Development Goals	17 interdependent goals set in the 2030 Agenda for Sustainable Development adopted by 193 countries at the session of the UN General Assembly in 2015. The goals include eradicating poverty in all its forms, reducing inequality and addressing climate change
Uranium conversion	A chemical engineering process involving the transformation of uranium-containing materials into uranium hexafluoride
Uranium hexafluoride	A chemical compound of uranium and fluorine (UF_6), which is the only highly volatile uranium compound (when heated to 53°C, uranium hexafluoride changes directly from the solid state into the gaseous state); it is used as feedstock for the separation of uranium-238 and uranium-235 isotopes using gaseous diffusion or the gas centrifuge method and for production of enriched uranium
Uranium ore enrichment	A combination of processes for primary treatment of uranium-containing mineral resources in order to separate uranium from other minerals contained in the ore
Water-cooled water-moderated power reactor (VVER)	A power reactor in which water is used as both a coolant and moderator. Russian NPPs typically use two versions of VVER reactors: VVER-440 and VVER-1000



FEEDBACK FORM

Dear reader,

You have read the public annual report of ROSATOM, which is intended for a wide range of stakeholders. We attach great importance to the opinion of the readers of our report. We would appreciate it if you helped improve the quality of the Corporation's reports by completing the questionnaire below.

Please return the completed form by mail to the Communications Department at 24 Bolshaya Ordynka Street, Moscow, 119017 and/or by email (SSGolovachev@rosatom.ru).

1. PLEASE ASSESS THE REPORT USING THE FOLLOWING CRITERIA:

Accuracy and objectivity

Excellent Good Satisfactory Poor

Was your opinion influenced by the independent auditors' report and the statement of public assurance included in the report?

Yes No

Completeness and relevance of information

Excellent Good Satisfactory Poor

Report structure, ease of reference, wording

Excellent Good Satisfactory Poor

2. PLEASE SPECIFY WHICH SECTIONS OF THE REPORT YOU HAVE FOUND TO BE RELEVANT AND USEFUL.

3. WHICH TOPICS DO YOU THINK SHOULD BE COVERED IN THE NEXT REPORT?

4. YOUR RECOMMENDATIONS AND ADDITIONAL COMMENTS:

5. PLEASE SPECIFY WHICH STAKEHOLDER GROUP YOU REPRESENT:

- | | |
|-------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| <input type="checkbox"/> Employee of ROSATOM | <input type="checkbox"/> Representative of a customer/consumer of goods and services |
| <input type="checkbox"/> Employee of an organization of ROSATOM | <input type="checkbox"/> Representative of a business partner |
| <input type="checkbox"/> Representative of the federal government | <input type="checkbox"/> Representative of a non-governmental organization |
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| <input type="checkbox"/> Representative of a contractor/supplier | <input type="checkbox"/> Other (please specify) _____ |

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<https://zakupki.rosatom.ru/en/>

Official group on VKontakte:

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Official blog on Twitter:

<https://twitter.com/rosatomglobal>

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