

ROSATOM





**ROSATOM**



**ROSATOM**

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**PERFORMANCE OF STATE ATOMIC  
ENERGY CORPORATION ROSATOM  
IN 2017**

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**Public Annual Report**

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# Report Profile

The Public Report of State Atomic Energy Corporation Rosatom (hereinafter referred to as the Corporation or ROSATOM) for 2017 (the Report) has been prepared on a voluntary basis and is intended for a broad range of stakeholders. The Report focuses on ROSATOM's contribution to sustainable development; this topic has been selected by the top management and representatives of key stakeholders.

## Standards and regulatory requirements

The Report has been prepared in accordance with:

- 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 (GRI) Sustainability Reporting Standards (GRI SRS, Core option);
- AccountAbility's AA1000 Series of Standards;
- 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 and the International <IR> Framework). To identify material topics to be disclosed in the Report, a poll was carried out and two dialogues with stakeholders were held, including public consultations on the draft Report. The Report incorporates key recommendations and requests voiced by stakeholder representatives during these dialogues.

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

# 1.0. Our Achievements

## About ROSATOM

### ROSATOM Today

**No.1** IN THE WORLD IN TERMS OF THE NUMBER OF NPP POWER UNITS IN THE PORTFOLIO OF FOREIGN PROJECTS (33 POWER UNITS).

**No.1** IN THE WORLD IN TERMS OF URANIUM ENRICHMENT (36% OF THE GLOBAL MARKET).

**No.2** IN THE WORLD IN TERMS OF URANIUM RESERVES (523,900 TONNES IN RUSSIA AND 216,200 TONNES ABROAD) AND 14% OF GLOBAL PRODUCTION (8,019 TONNES).

**RUB billion 9.0** EXPENDITURE ON CORPORATE SOCIAL PROGRAMMES FOR EMPLOYEES IN 2017.

**RUB billion 1.1** EXPENDITURE ON CHARITY PROGRAMMES IN ROSATOM'S REGIONS OF OPERATION IN 2017.

**RUB billion 22.5** EXPENDITURE ON ENVIRONMENTAL PROTECTION IN 2017.

**18.9%** SHARE IN POWER GENERATION IN RUSSIA.

**247,300** EMPLOYEES **346<sup>1</sup>** ORGANIZATIONS AND ENTERPRISES WITHIN THE CORPORATION.

THE WORLD'S ONLY NUCLEAR-POWERED ICEBREAKER FLEET.

ROSATOM<sup>2</sup> is a diversified corporation owning assets and possessing competencies 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, etc.) ROSATOM carries out numerous large-scale international projects abroad and generates substantial overseas revenue.

ROSATOM is also developing new businesses outside its core production and process chain (electricity generation at large NPPs). These include projects in the sphere of nuclear medicine, wind power, composite materials, additive manufacturing, lasers, robotics, supercomputers, 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.

### Key Results in 2017

Indicator	2015	2016	2017	2017/2016
<b>Key performance indicators set by the Supervisory Board</b>				
Adjusted free cash flow of ROSATOM <sup>3</sup> , RUB billion	245.4	263.6	308.7	+17.1%
Increase in consolidated labour productivity vs 2011 (in current prices excluding the Nuclear Weapons Division), %	93.5	110.9	134.3	▲
Unit semi-fixed costs (as a percentage of revenue), %	29.2	27.0	24.9	▼
Power generation, billion kWh	195.2	196.4	202.9	+3.3%
Implementation of JSC Rosenergoatom Concern's investment programme, %	100	99	99	■
10-year portfolio of overseas orders, USD billion	110.3	133.4	133.5	■
10-year portfolio of orders for new products (outside the scope of the Corporation), RUB billion	403.3	692.8	814.1	+17.5%
Revenue from new products (outside the scope of the Corporation), RUB billion.	99.0	147.4	170.9	+15.9%
Integrated innovation KPI <sup>4</sup> , %	128.9	111.7	106.6	■
Fulfillment of government orders, %	100	100	100	■
Number of events rated at level 2 or higher on the INES scale	0	0	0	■

<sup>1</sup> Within the scope of consolidation of ROSATOM as of Q4 2017.

<sup>2</sup> ROSATOM's status, the goals of its establishment and operations, its functions and powers are determined by Federal Law No. 317-FZ on State Atomic Energy Corporation Rosatom dated December 1, 2007.

<sup>3</sup> 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.

<sup>4</sup> 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%.

# Key Events in 2017

- The state defence order was 100% fulfilled.
- Power unit No. 1 of Novovoronezh NPP-2 with a VVER-1200 reactor started full-scale operation. *Power*, a prestigious US energy magazine, ranked this power unit among the top three power plants of the world in 2017.
- The first criticality programme was completed at power unit No. 4 of Rostov NPP equipped with a VVER-1000 reactor and the innovative power unit No. 1 of Leningrad NPP-2 equipped with a generation 3+ VVER-1200 reactor.
- The start-up of power unit No. 3 at Tianwan NPP in China was completed.
- Electricity output at 35 power units of 10 operating NPPs totalled 202.9 billion kWh, reaching a new all-time high in the history of Russian nuclear power generation. The share of NPPs in Russia's energy mix totalled 18.9%.
- 11 intergovernmental agreements and 16 major interdepartmental agreements were concluded. These include 5 framework intergovernmental agreements concluded with the Kingdom of Cambodia, the Republic of Paraguay, the Republic of the Sudan, the Republic of Tajikistan and the Republic of Uzbekistan, which provide the foundation for bilateral cooperation between Russia and these countries in the sphere of nuclear technologies.
- A package of contracts for the construction of El Dabaa NPP with four power units in Egypt came into force.
- Russia and India signed a master framework agreement on the construction of power units No. 5 and 6 of Kudankulam NPP.
- Construction of the second stage of Bushehr NPP was launched in Iran.
- An official ceremony was held on the site of Akkuyu NPP to mark the start of construction and installation of the 'non-nuclear' part of the NPP as part of the preparatory stage of the project under a limited licence for construction issued by the Turkish Atomic Energy Authority.
- ROSATOM has been assigned the function of a Competence Centre as part of the government programme titled 'Digital Economy of the Russian Federation'. A digital transformation programme was launched in the industry.
- The portfolio of the Corporation's wind farms to be commissioned in Russia by 2022 increased to 970 MW (43% of the Russian wind power market). Wind farms will be built in the Krasnodar Territory, the Republic of Adygea, the Stavropol Territory and the Rostov Region.
- ROSATOM started to provide nuclear medicine services to local residents at regional healthcare institutions in the Chelyabinsk Region.
- Priority social and economic development areas were established in Sarov and Dimitrovgrad.
- No events rated at level 2 or higher on the international INES scale were detected at nuclear facilities (level 1 and 0 deviations do not pose a risk to employees operating the facilities, local residents or the environment).

## Address by the Chairman of the Supervisory Board



### *Dear colleagues,*

*In 2017, State Atomic Energy Corporation Rosatom celebrated 10 years since its founding. At the same time, the history of the Russian nuclear industry spans more than 70 years. We have come far. We have created a modern, rapidly developing company whilst drawing on the Soviet and Russian experience. This enables us to set new ambitious goals of making Russia a technological leader.*

*Looking back on the reporting year, I would like to start by examining the achievement of ROSATOM's key performance targets set by the Supervisory Board. In 2017, performance against the targets totalled 104.0%.*

*As usual, the state defence order was completely fulfilled. ROSATOM successfully continued to implement five federal target programmes and the state programme of the Russian Federation 'Development of the Nuclear Power and Industry Complex'.*

*The Corporation operates successfully on the international market. One of the key achievements in 2017 was the fact that a package of contracts for the construction of El Dabaa NPP with four power units in Egypt came into force. This project is implemented under the largest non-commodity export agreement in the modern history of Russia.*

*I would also like to highlight the progress made by ROSATOM in developing new products and promoting them on the market: in 2017, the 10-year portfolio of orders for new products (which includes only orders outside the scope of the Corporation) reached RUB 814.1 billion.*

*ROSATOM plays an important role in maintaining Russia's presence in the Arctic as it participates in projects that are strategically important for the country's economic development. ROSATOM's nuclear ice-breakers help vessels navigate along the Northern Sea Route. In 2017,*

*they escorted 492 vessels with a total gross tonnage of 7.2 million tonnes (up by 36% compared to 2016).*

*Ensuring the safety of people and the environment remains an absolute priority in the course of ROSATOM's operations. I am happy to say that in 2017, all nuclear facilities operated steadily and reliably.*

*It is also worth mentioning that ROSATOM is actively involved in the implementation of the government programme titled 'Digital Economy of the Russian Federation' and has already made significant progress on a number of promising projects.*

*I am convinced that these results have been achieved primarily due to the concerted efforts of employees of organizations and enterprises in the nuclear industry. I would like to thank you all most sincerely for your hard work!*

Chairman of the Supervisory Board  
of ROSATOM

**Sergey Kirienko**

# Address by the Director General



## Dear colleagues and partners,

*I would like to present to you ROSATOM's operating results for 2017. Our achievements reflect our contribution to efforts aimed at improving people's lives and creating new opportunities while conserving nature and protecting the environment.*

*We provide the world with clean, safe, affordable energy and innovations based on nuclear technology. In 2017, Russian nuclear power plants generated 202.9 billion kWh of electricity, or 18.9% of the total electricity output in Russia. The first criticality programme was completed at power unit No. 1 of Leningrad NPP-2 and power unit No. 4 of Rostov NPP. Power unit No. 1 of Novovoronezh NPP-2 started commercial operation.*

*Outside Russia, in 2017, the start-up of power unit No. 3 at Tianwan NPP in China was completed. First concrete was laid at power unit No. 1 of Rooppur NPP in Bangladesh and power units No. 3 and 4 of Kudankulam NPP in India. Overall, our overseas NPP construction project portfolio includes 35 power units in 11 countries around the world<sup>5</sup>. I would like to emphasize that NPP construction makes a significant contribution to macroeconomic growth both in the customer country and in the supplier country. Construction and operation of NPPs with two power units provides employment in the sphere of nuclear infrastructure for over 10,000 people and creates over 3,000 new jobs related to NPP operation. National companies are guaranteed capacity utilization for more than 70 years. Thus, a whole new innovative sector of the economy is created,*

*enabling the customer country to reach a new level of economic and technological development.*

*ROSATOM is also actively developing other sources of clean energy. We are a leader on the Russian wind power market: in 2017, the portfolio of ROSATOM's wind farms to be commissioned in Russia by 2022 increased to 970 MW (43% of the Russian wind power market). The Corporation will build wind farms in the Krasnodar Territory, the Republic of Adygea, the Stavropol Territory and the Rostov Region.*

*When developing new products, we seek to improve the quality of people's lives by introducing innovative technologies. Such innovative areas of our business already include nuclear medicine. Enterprises in the industry are developing new high-technology devices and instruments and new lines of radiopharmaceuticals based on isotopes produced in-house. They supply solutions for nuclear medicine centres comprising diagnostic and radiotherapy modules. In 2017, ROSATOM began providing nuclear medicine services to local residents at regional healthcare institutions in the Chelyabinsk Region. The Corporation started to develop a Russian radiotherapy facility based on a linear electron accelerator. The project is co-financed by the Ministry of Education and Science of the Russian Federation. ROSATOM won an international tender for the supply of a cyclotron complex with radiochemical laboratories to Thailand. The facility will be used for the production of radiopharmaceuticals.*

*The future development of society is inextricably linked with the introduction of state-of-the-art digital technologies, which will transform business models of organizations, consumption models and patterns of communication between people. In 2017, ROSATOM was designated a Competence Centre as part of the programme titled 'Digital Economy of the Russian Federation'. A digital transformation programme has been launched in the industry. Promising projects are underway in such areas as supercomputers, additive manufacturing and life cycle management of complex engineering facilities.*

*The development of new technologies and products relies to a great extent on scientific research. A large-scale innovative development and technological modernization programme is underway in the industry. Its aim is to enable ROSATOM to achieve its strategic goals. In 2017, over 70 technological projects were underway, and an industry-wide plan of research topics was being developed. Moreover, 2018 has been declared the Year of Science at ROSATOM.*

*In terms of priorities for 2018, I would like to highlight the importance of multilateral cooperation and partnership. We are open to constructive collaboration with governments, businesses, international organizations,*

*the general public and other stakeholders at both national and global levels. I am convinced that it is only by joining forces, combining and enhancing each other's capabilities that we will be able to achieve real progress in promoting the sustainable development of our planet!*

Director General of ROSATOM

**Alexey Likhachev**

<sup>5</sup> As of June 30, 2018.

# Address by a Stakeholder Representative



## Dear colleagues,

ROSATOM's public report for 2017 presents the key achievements and events in terms of their overall integrated outcomes, which include economic, environmental and social impacts. This provides direct evidence of ROSATOM's commitment to modern principles of corporate social responsibility and involvement in sustainable development processes, which are becoming increasingly important drivers of business growth and the capitalization of its reputation on an international level, on global and national markets. This is the view currently held by the international community of consumers, investors, experts and other stakeholders. This is how business leaders themselves (and ROSATOM is certainly one of them) increasingly often view and formulate their mission.

This report proves that the Corporation interprets the concept of sustainable development first and foremost in the context of its responsibility for any impact that it makes on the environment and society. This responsibility can be regarded as a value creation process whereby the use of resources, capital investments, technological development and profit generation take into account not only commercial benefits, but also the interests of people, the potential of the biosphere and our planet as a whole, the needs of both current and future generations of people, and the objectives

related to the development of the regions of operation. All these guiding principles are reflected in the Sustainable Development Goals set by the United Nations in 2015.

ROSATOM's report reflects its willingness to contribute to the achievement of the Sustainable Development Goals. This is a prerequisite for leadership, success and appreciation on the part of all stakeholders, including partners, peers and employees.

Chair of the Board of the Association National Network of the Global Compact (Global Compact Local Network in Russia)  
Managing Director of the Institutional Development  
Department of Vnesheconombank

**Larisa Ovchinnikova**

# Financial and Economic Results<sup>6</sup>

Table. Key financial results, RUB billion

	2015	2016 <sup>7</sup>	2017	2017/2016
Revenue	821.2	878.1	967.4	+10.2%
Assets	3,160.4	3,338.7	3,435.7	+2.9%
Intangible assets	55.9	117.6	103.5	-12.0%

In 2017, revenue increased by 10.2% year on year despite a fall in annual average exchange rates of major currencies and a decline in prices for uranium products. Revenue growth was driven by an increase in revenue from electricity sales on the domestic market, an increase in sales of nuclear fuel cycle front-end products on foreign markets, as well as growing revenue from NPP construction abroad. An increase in consolidated revenue was also driven by a 16% growth of revenue from new products (non-nuclear mechanical engineering, shipbuilding, security systems, etc.).

Table. Profitability ratios, %

	2015	2016	2017
Return on sales (ROS)	17.16	8.53	10.83
Return on assets (ROA)	4.46	2.24	3.05
Return on equity (ROE)	6.94	3.49	4.59

Profitability ratios increased in 2017 primarily due to a year-on-year increase in profits by a factor of 1.4.

<sup>6</sup> Data has been provided on the scope of IFRS consolidation of ROSATOM for publicly available information. For more information on the financial and economic performance of the Corporation's Divisions, see the 2017 annual reports of JSC Atomenergoprom, JSC Atomredmetzoloto, JSC TVEL, JSC TENEX, JSC Atomenergomash, JSC ASE EC and JSC Rosenergoatom Concern.

<sup>7</sup> Data for 2016 has been recalculated taking into account information on organizations whose status changed in 2017 (organizations that did not disclose information on their performance for the purposes of a public annual report).

# 2.0. Strategy for a Sustainable Future

## 2.1. Business Strategy until 2030

Igor Ermakov, Director of the Strategic Management Department



— In the near future, ROSATOM plans to update its business strategy and expand its horizon until 2050. What is the reason behind this, and what new guidelines will be incorporated into the document?

— Expansion of the planning horizon until 2050 is designed to reflect as fully as possible opportunities that emerge in new innovative areas of our business. As part of the strategy, we will update strategic objectives of ROSATOM's long-term development, set targets and define key measures for achieving them.

Historically, ROSATOM's goal has been to become and remain a leader in the global nuclear industry. Of course, this remains a priority in our development strategy. We will continue to expand our footprint on the Russian and international markets; we will improve our key product, namely NPPs with high-power VVER reactors, and develop advanced reactor technologies, including fast neutron reactors and small and medium-sized reactors.

At the same time, ROSATOM is gradually expanding its strategic vision: in addition to nuclear power, we intend to actively develop new knowledge-intensive and high-technology areas of business. Product diversification is a key focus of ROSATOM's business strategy until 2050.

— Could you characterize the most important markets in terms of product diversification and ROSATOM's competitive position?

— Both in Russia and globally, we are witnessing rapid development of new industries that were virtually unknown as recently as 15 to 20 years ago. For instance, a breakthrough in renewable energy, with investments in 2017 exceeding USD 300 billion, has been a game changer on the market. Experts differ in their opinions on the future structure of the global energy mix, but almost all of them agree that the share of renewable energy will grow. The use of our capabilities in the sphere of nuclear medicine enables us to enter a large market where there are no clear leaders yet. In the future, development in such segments as sales of isotope products, production of radiopharmaceuticals, equipment and services for diagnosis and therapy may drive the formation of one of ROSATOM's largest new businesses.

As the production cost of carbon composites decreases, the sphere of their application will expand to include a growing number of industries, while their consumption will grow until 2030 at a faster rate than conventional markets (by more than 7% per year).

There is a large number of such markets at present, and as part of the update to our strategy, we are analysing both opportunities that new trends offer to ROSATOM and challenges that they pose to our conventional businesses.

Nuclear power generation is a source of clean energy that provides considerable environmental benefits. During one year of operation, one 1 GW nuclear power plant (NPP) prevents emissions of 9 million tonnes of carbon dioxide, which is equivalent to annual emissions from 2 million vehicles.

Nuclear power generation is a source of clean energy that provides considerable environmental benefits. During one year of operation, one 1 GW nuclear power plant (NPP) prevents emissions of 9 million tonnes of carbon dioxide, which is equivalent to annual emissions from 2 million vehicles.

### 2.1.1. Context of ROSATOM's business

#### Trends in the development of the nuclear industry

The nuclear industry is influenced by a number of factors, including<sup>8</sup>:

- Global population growth from 7 billion to 10 billion people in the next 50 years;
- Steady increase in global GDP by about 3% per year;
- Growth of global electricity consumption. By 2030, global electricity consumption is expected to increase by 33% compared to 2016 and reach 32.9 trillion kWh. Asian countries will lead the growth, with electricity consumption increasing by a factor of 1.5 (from 10.8 trillion kWh to 16.4 trillion kWh). In Russia, electricity consumption is expected to grow by 1.3% per year until 2030;
- Increase in greenhouse gas accumulation. Global carbon dioxide emissions total about 32 billion tonnes per year and continue to grow. Carbon dioxide emissions are projected to exceed 34 billion tonnes per year by 2030. This drives active development of carbon-neutral electricity generation, which includes the nuclear power industry.

These factors, as well as limited fossil fuel reserves, contribute to the long-term demand for nuclear energy. The International Energy Agency, UxC consulting company and the World Nuclear Association expect to see an increase in the capacity of operating NPPs from 392 GW in 2017 to 468 GW, 446 GW and 445 GW respectively in 2030 under the base case scenario.

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 CO<sub>2</sub> emissions, which have a negative impact on the environment and drive up the cost of energy since many countries impose CO<sub>2</sub> emission fees. 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 position<sup>9</sup>

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 maintains global leadership in terms of research and development in reactor design, processing stages of the nuclear fuel cycle (NFC), NPP operation and the qualifications of NPP personnel. 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.

The high quality of products and services is confirmed by the success in international tenders for the supply of nuclear fuel and construction of NPPs in other countries. Currently, ROSATOM is the largest global market player in terms of the number of confirmed NPP construction projects: its portfolio of overseas orders comprises 33 power units (for more details, see the section 'International Business'). The current level of inflation in Russia has no significant impact on ROSATOM's financial position. According to inflation projections (about 4% per year), it should not have a significant impact on the Corporation's solvency.

Expected GDP growth rates in Russia constrain the growth of electricity consumption in the country and, consequently, limit the implementation of new NPP construction projects in Russia. Therefore, the Corporation gives priority to expanding its footprint on international markets and launching new business products outside of the core value chain.

#### 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 with the highest possible safety level;
- Assistance in securing project funding (including under the BOO scheme) and building project infrastructure (legal framework, employee training, community relations, etc.).

\* LCOE stands for levelized cost of electricity over the NPP life cycle.

### 2.1.2. Long-term strategic goals

ROSATOM's business strategy until 2030 was developed based on the goals set by the state for the civilian branch of the Russian nuclear industry and was approved by the Corporation's Supervisory Board in 2014.

ROSATOM's mission is to provide the world with clean, safe, affordable energy and innovations based on nuclear technology.

The Corporation's development is based on the long-term technological policy, which involves mastering new generation nuclear 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 and nuclear fuel enrichment services, etc.).

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

- **To increase its international market share.** To assert its leadership on the global nuclear power market, the Corporation 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, ROSATOM plans to boost labour productivity more than threefold between 2017 and 2030 and to reduce the duration of NPP construction and the levelized cost of electricity (LCOE<sup>10</sup>). For details, see the sections on the performance of the Divisions;
- **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 to 30% in 2030. For details, see the section 'Business Diversification'.

To achieve the strategic goals, the following objectives must be met:

- Ensuring safe use of nuclear energy;
- Non-proliferation of nuclear technologies and materials;
- Reducing the negative environmental impact to zero;
- 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 the fulfilment of all international commitments and full compliance with Russian legislation, including the Law on State Secrets.

#### Key strategy implementation risks

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

- Nuclear and radiation risks;
- Financial risks (including currency, interest rate and credit risks, risk of financing shortfalls);
- Commodity risks;
- Operational risks;
- Reputational risks;
- Political risks;
- Project risks;

<sup>8</sup> Data from the World Bank, the IEA World Energy Outlook 2017 (New Policy Scenario), EIU, the IAEA and McKinsey and the draft programme 'Development of the Russian Power Industry until 2035' have been used.

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

<sup>10</sup> LCOE stands for levelized cost of electricity over the NPP life cycle.

$$LCOE = \frac{\sum_t [(Capital_t + O\&M_t + Fuel_t + Carbon_t + D_t)(1+r)^{-t}]}{\sum_t MWh_t(1+r)^{-t}}$$

where:

Capital<sub>t</sub> is the total cost of capital construction in year t; O&M<sub>t</sub> is operating and maintenance costs in year t; Fuel<sub>t</sub> is the cost of fuel in year t; Carbon<sub>t</sub> is carbon dioxide emission charges in year t; D<sub>t</sub> is the cost of decommissioning and waste management in year t; MWh<sub>t</sub> is the total electricity generation at the facility, MWh; (1+r)<sup>-t</sup> is the discount rate in year t.

Source: Projected Costs of Generating Electricity/International Energy Agency & Nuclear Energy Agency, 2015.

- Technological risks (risk of shortcomings in technology);
- Risk of incorrect assessment of market needs and trends when promoting the product offering on the strategic time horizon;
- Risk of losing critical knowledge of existing and newly created products.

A detailed description and assessment of key risks for 2018 is provided in the section 'Risk Management'.

### 2.1.3. Contribution of the 2017 results to the achievement of strategic objectives and plans for 2018

Strategic goal	Results and key events of 2017	Targets and plans for 2018
Increase of the international market share.	The 10-year portfolio of overseas orders totalled USD 133.5 billion. The power start-up of power unit No. 3 at Tianwan NPP (China) was completed. On June 29, 2017, first concrete was laid at power unit No. 3 of Kudankulam NPP (India). In October 2017, first concrete was laid at power unit No. 4 of Kudankulam NPP. On November 30, 2017, first concrete was laid at power unit No. 1 of Rooppur NPP (Bangladesh). Contracts for NPP life cycle services (fuel supply, servicing and spent nuclear fuel management) were signed for El Dabaa NPP (Egypt). 11 intergovernmental agreements and 16 major interdepartmental agreements were signed; they will drive the future growth of ROSATOM's portfolio of overseas orders and revenue.	10-year portfolio of overseas orders totalling about USD 130 billion. Portfolio of overseas orders covering the entire NPP life cycle totalling about USD 200 billion. Plans: – Start of the first criticality programme at power unit No. 4 of Tianwan NPP (China); – Start of concreting at two power units (power unit No. 1 at Akkuyu NPP in Turkey and power unit No. 2 at Rooppur NPP in Bangladesh); – Signing of a strategic package of intergovernmental agreements and contracts with China, including intergovernmental protocols on the construction of new power units at Tianwan NPP and mass construction of power units at the new site, and an intergovernmental agreement on the construction of a demonstration fast neutron reactor in China.
Reduction of the cost of products and the lead time.	Adjusted free cash flow reached RUB 308.7 billion. Performance against the targets of the investment programme for the construction of nuclear power plants in Russia (the investment programme of JSC Rosenergoatom Concern) totalled 98.7%. The increase in consolidated labour productivity (in current prices) compared to 2011 (excluding the Nuclear Weapons Division) totalled 134.3%. The full cost of uranium production in Russian enterprises was reduced by 10% against the target.	The target for adjusted free cash flow has been set at RUB 309.4 billion. Performance against the targets of the investment programme for the construction of nuclear power plants in Russia is expected to total 100%. The increase in consolidated labour productivity (in current prices) compared to 2011 (excluding the Nuclear Weapons Division) should reach 150%.
New products for the Russian and international markets.	The 10-year portfolio of orders for new products (outside the scope of the Corporation) reached RUB 814.1 billion. Revenue from new products (outside the scope of ROSATOM) totalled RUB 170.9 billion. The road map for the launch of a new strategic technological area, Applied Superconductivity, was approved. ROSATOM won a tender for the construction of wind power plants in Russia with a total capacity of 360 MW. The development and assembly of a unique pilot multi-powder metal 3D printer was completed. A contract was concluded with the Russian Ministry of Education and Science for the launch of digitized production of high-precision healthcare products using additive manufacturing technologies (endoprostheses, implants and augments).	The 10-year portfolio of orders for new products (outside the scope of the Corporation) should reach RUB 880.0 billion. The target for revenue from new products (outside the scope of the Corporation) has been set at RUB 197.9 billion. Plans: – Start of operation of the first wind power plants in the south of Russia; – Start of commercial production of 3D printers at the site in Novouralsk (organizations forming part of the Fuel Division: JSC UECP and LLC RME Centrotech); – Start of construction of modern nuclear medicine centres comprising diagnostic and radiotherapy modules in Russian regions.

For details, see the section 'Business Diversification'.

## 2.2. Sustainable Development Agenda

ROSATOM's business contributes substantially to the sustainable development of society: the Corporation improves people's lives and creates new opportunities while protecting nature and the environment. ROSATOM's sustainable development initiatives take into account three significant contexts: international, national and corporate (industry).

### International context

The Corporation supports the 17 Sustainable Development Goals<sup>11</sup> (hereinafter referred to as the Goals) set by the United Nations in 2015. ROSATOM has prioritized the Goals taking into account the areas and nature of its business. Based on the results of polls and consultations with internal and external stakeholders, eight Goals were selected which are the most consistent with ROSATOM's strategic goals and to the achievement of which the Corporation contributes and/or will contribute substantially in the future.

### National context

In terms of Russia's long-term sustainable development, ROSATOM believes its main contribution to consist in achieving technological leadership in the country and abroad by implementing innovative projects (including in the field of import substitution), exporting high-technology products and services and participating in the development of the digital economy. For details, see the sections 'Research and Innovations', 'Business Diversification' and sections on the performance of the Divisions.

### Corporate (industry) context

Sustainable development is closely linked to ROSATOM's values, mission and long-term strategic goals (for details, see the section 'Business Strategy until 2030').

### ROSATOM'S VALUES



<sup>11</sup> <https://www.un.org/sustainabledevelopment/ru>.

### Priority Sustainable Development Goals for ROSATOM\*

Sustainable Development Goals	ROSATOM's contribution to achieving the Goals	Link to the Corporation's strategic goals**
<b>7</b> AFFORDABLE AND CLEAN ENERGY	Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all.  The Corporation is the global leader in zero-carbon power generation. NPPs account for almost 19% of the total electricity output in Russia (for details, see the sections 'Power Engineering Division' and 'Developing the Regions of Operation'). ROSATOM is also implementing projects in other areas of clean energy, such as wind power and mini HPPs (for details, see the sections 'Business Diversification' and 'Mechanical Engineering Division'). A long-term project titled Proryv (Breakthrough) is underway in the Russian nuclear industry. It is aimed at closing the nuclear fuel cycle. In the future, this will help to improve the efficiency of the use of nuclear fuel and solve the problem of radioactive waste accumulation (for details, see the section 'Research and Innovations'). ROSATOM participates in the international ITER project aimed at demonstrating the possibility of using thermonuclear fusion for producing energy on an industrial scale (for details, see the section 'Research and Innovations'). A number of projects related to energy storage devices for electric transport are being implemented in the Fuel Division (for details, see the section 'Fuel Division').	<b>1</b> <b>3</b>
<b>9</b> INDUSTRY, INNOVATION AND INFRASTRUCTURE	Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.  ROSATOM is an innovative high-technology company. A significant share of revenue is reinvested in R&D. A large-scale Innovative Development and Technological Modernization Programme is underway in the industry. The Corporation attaches great importance to the development of intellectual capital, including patenting and the knowledge management system (for details, see the section 'Research and Innovations'). ROSATOM has been assigned the function of a Competence Centre as part of the programme 'Digital Economy of the Russian Federation', and the digital transformation of the industry has been launched (one of the key projects is the Multi-D system in the Engineering Division) (for details, see the section 'Engineering Division'). In the course of its NPP construction projects, the Corporation makes an indirect positive economic impact on its regions of operation (see the section 'Developing the Regions of Operation' and the sections on the performance of the Divisions). The Corporation's nuclear-powered icebreaker fleet plays an important role in supporting the functioning of the Northern Sea Route (for details, see the section 'Nuclear-Powered Icebreaker Fleet').	<b>1</b> <b>2</b> <b>3</b>
<b>8</b> DECENT WORK AND ECONOMIC GROWTH	Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.  ROSATOM builds NPP power units in Russia and abroad on a commercial scale (its project portfolio comprises 8 power units in Russia and 33 power units abroad). NPP construction makes a significant contribution to macroeconomic growth both in the customer country and in the supplier country (for details, see the section 'International Business').	<b>1</b>

\* The Goals are listed in the order of priority. ROSATOM also supports other Sustainable Development Goals and makes a fair contribution to their achievement.

\*\* ROSATOM's strategic goals are as follows:

- 1** To increase its international market share;
- 2** To reduce production costs and lead time;
- 3** To develop new products for the Russian and international markets.

Sustainable Development Goals	ROSATOM's contribution to achieving the Goals	Link to the Corporation's strategic goals**
<b>12</b> RESPONSIBLE CONSUMPTION AND PRODUCTION	Goal 12. Ensure sustainable consumption and production patterns.  Every year, ROSATOM makes extensive efforts to ensure nuclear and radiation safety, minimize its environmental footprint and improve energy efficiency (for details, see Chapter 8 of the Report). The Corporation is implementing the Proryv (Breakthrough) Project aimed at developing fast neutron reactors and closing the nuclear fuel cycle. The 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. For details, see the section 'Research and Innovations'.	<b>2</b>
<b>11</b> SUSTAINABLE CITIES AND COMMUNITIES	Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable.  ROSATOM supports the social and economic development of the towns and cities of its operation by: – Establishing priority social and economic development areas; – Implementing charity projects, including in the sphere of culture; – Implementing the Smart City project; – Rolling out the best management technologies and workflow organization methods. For details, see the section 'Developing the Regions of Operation'.	<b>3</b>
<b>3</b> GOOD HEALTH AND WELL-BEING	Goal 3. Ensure healthy lives and promote well-being for all at all ages.  ROSATOM offers nuclear medicine technologies and services enabling timely diagnosis and effective treatment of a number of types of cancer (for details, see the section 'Business Diversification'). The Lean Polyclinic project is underway in closed administrative and territorial formations in the nuclear industry. It is aimed at improving the quality of healthcare services (for details, see the section 'Developing the Regions of Operation').	<b>3</b>
<b>4</b> QUALITY EDUCATION	Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.  The Corporation's HR policy prioritizes the development of competences and employee training. Every year, over 100,000 employees undergo training and retraining and complete professional development programmes (including in ROSATOM's Corporate Academy). Recruitment of young specialists and cooperation with universities is another significant area of work. In addition, the Corporation takes active steps to develop the export of Russian nuclear education to potentially attractive markets. For details, see the section 'Implementation of the HR Policy'.	<b>1</b> <b>3</b>
<b>6</b> CLEAN WATER AND SANITATION	Goal 6. Ensure availability and sustainable management of water and sanitation for all.  The nuclear industry is a large user of water in Russia (over 10%). The Corporation takes a responsible approach to water withdrawal and wastewater treatment and discharge. Every year it carries out initiatives aimed at reducing the Corporation's environmental impact on water sources. For details, see the section 'Environmental Safety'.	<b>2</b>

### 2.2.1. Regulatory documents on sustainable development

The Corporation has adopted a number of documents governing individual aspects of its sustainable development initiatives. Key documents include the following:

- The Uniform Industry-Wide Environmental Policy;
- The Uniform Industry-Wide Social Policy;
- The Code of Ethics and Professional Conduct;
- The Uniform Industry-Wide Anti-Corruption Policy;
- The Uniform Industrial Procurement Standard;
- The Uniform Industry-Wide Public Reporting Policy;
- The Industry-Wide Agreement on Nuclear Power, Industry and Science;
- Methodological Recommendations on Charity Work.

## 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, a wide range of stakeholders and the residents of its regions of operation. 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 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 capitals (see the section 'Effective Management');
- Operating results and their contribution to the long-term increase in capitals, which is measured by performance against the targets set in the strategy.

The business model gives special focus to the external environment because:

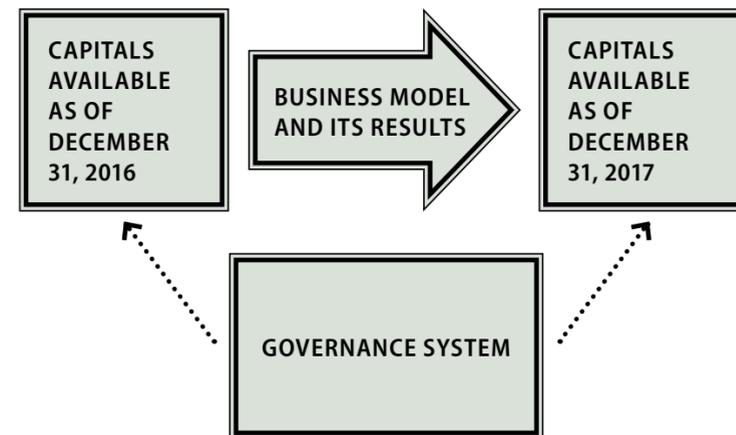
- some of ROSATOM's available capitals are obtained from the external environment, and many of its results are also related to it;
  - the external environment is a source of risks and opportunities.
- The scheme represents an integrated process of value creation. ROSATOM's business model is at the core 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.

### 2.3.1. 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.

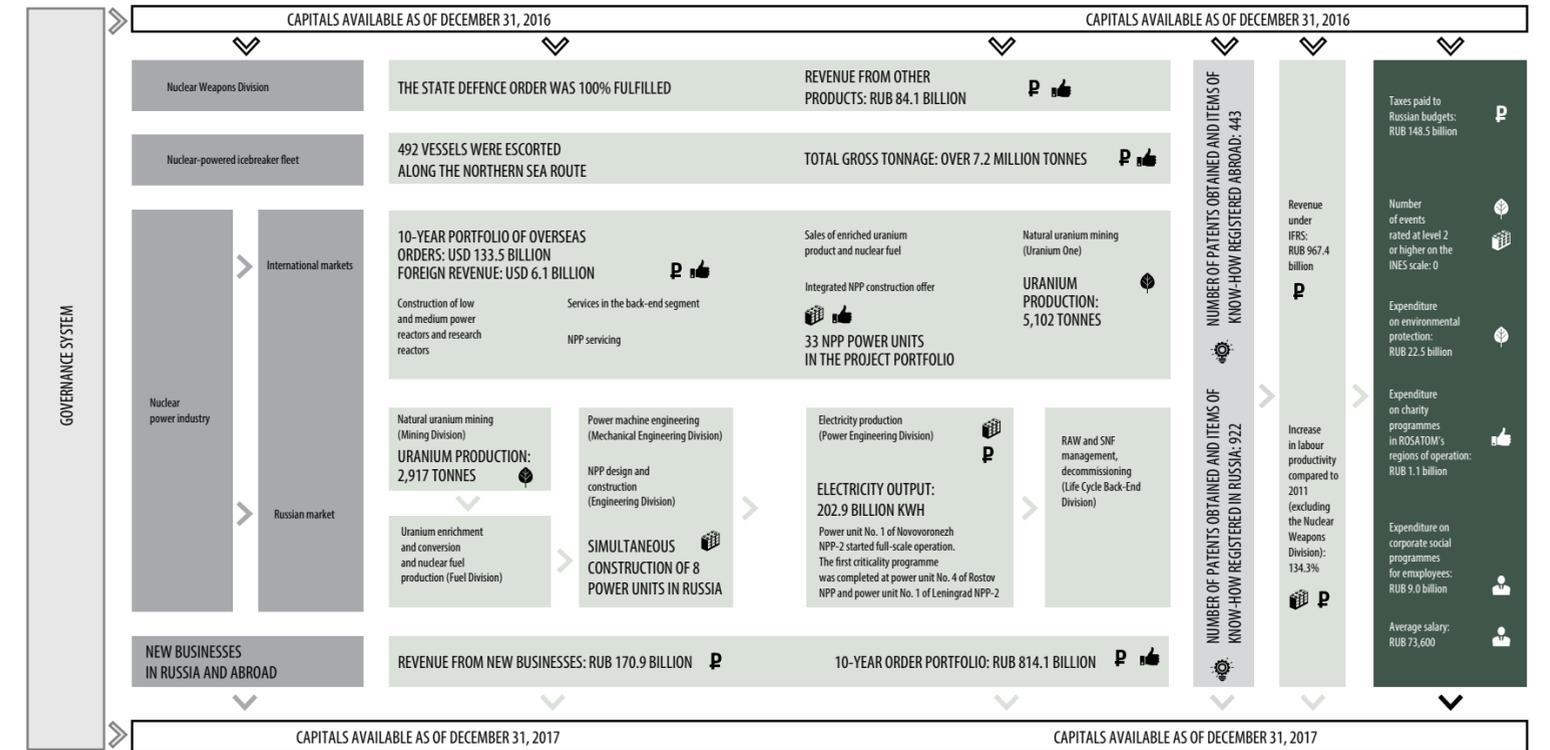
The Corporation defines capitals as specific resources (reserves) of tangible and intangible assets that ROSATOM uses in its operations. ROSATOM acknowledges that some of the available capitals are owned jointly with other stakeholders (e.g. natural resources or public infrastructure). Accordingly, it 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.

### Value creation process



### ROSATOM's business model\*

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



\* The diagram presents results for 2017 broken down by type of capital:

manufactured human social and relationship financial intellectual natural

### Table. Value creation results

Capital	Indicator	2016	2017	2017/2016
Financial	Adjusted free cash flow, RUB billion	263.6	308.7	+17.1%
	Assets under IFRS, RUB billion	3,338.7	3,435.7	+2.9%
Manufactured	Number of power units in operation, pcs.	35	35	—
	Capacity factor of Russian NPPs, %	83.1	83.3	↗
Intellectual	Intangible assets under IFRS, RUB billion	117.6	103.5	-12.0%
	Share of innovative products in revenue, %	13.6	13.5	↘
	Number of foreign patents obtained by ROSATOM, applications for foreign patents submitted and registered under the established procedure, registered trade secrets (know-how), cumulative total, pcs.	479	922	+92.5%
Human	Average number of employees, thousand people	249.9	247.3	-1.0%
	Employee engagement rate, %	77	83	↗
	Share of specialists aged under 35, %	31.9	31.3	↘
Social and relationship	Level of support for the nuclear industry in Russia, %	71.0	73.9	↗
	Number of countries in which foreign projects are being implemented	42	50	↗
Natural	Uranium resources (Russian assets), kt	517.9	523.9	+1.2%
	Uranium resources (foreign assets), kt	220.8	216.2	-2.1%

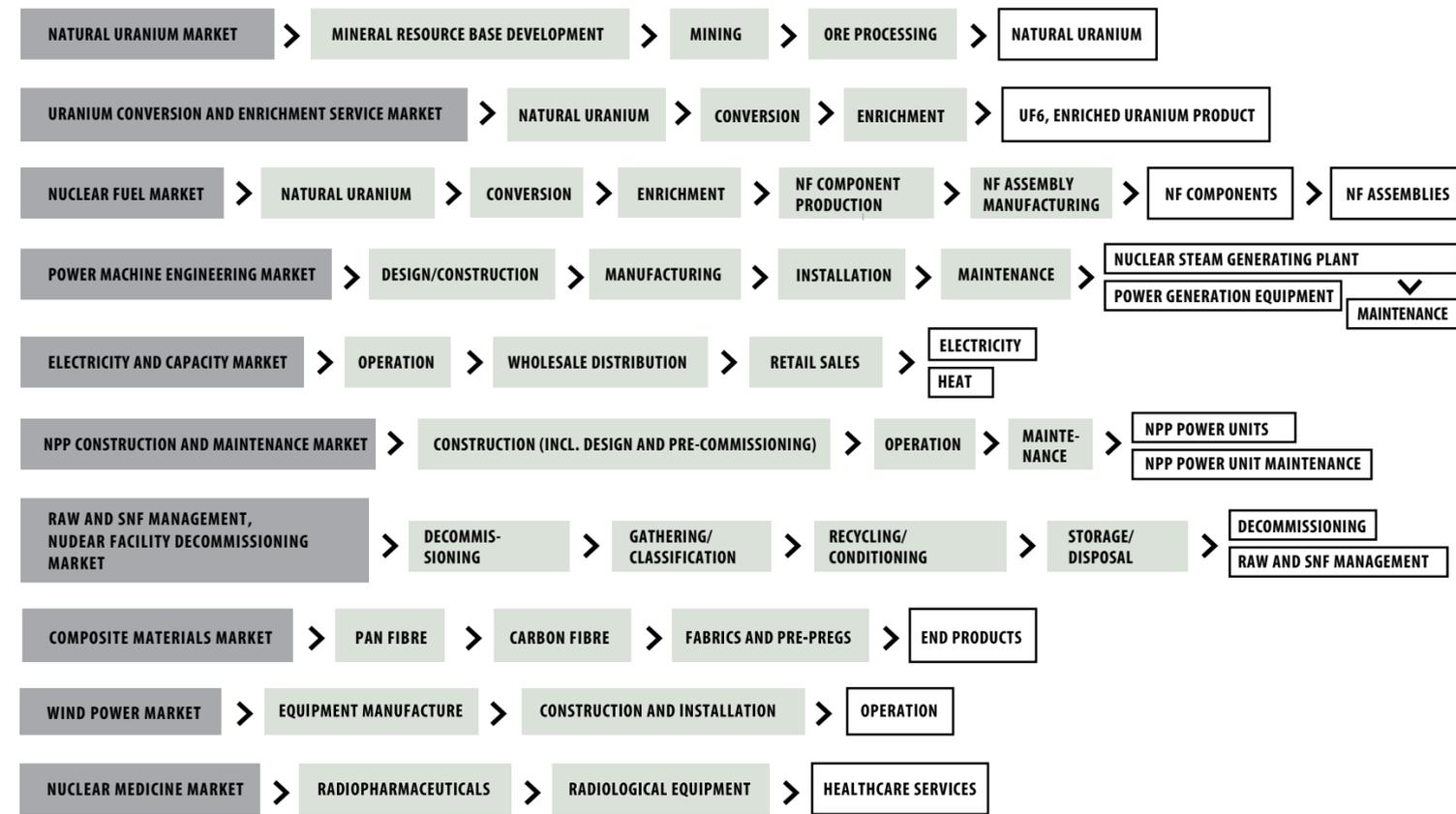
# 3.0. Contribution to Global Development

## 3.1. Markets Served by ROSATOM

In 2017, ROSATOM:

- ranked first in the world in terms of the number of NPP power units in the portfolio of foreign projects (33 power units);
- ranked first in the world in terms of uranium enrichment (36% of the market);
- held ~17% of the global nuclear fuel market;
- held 14% of the global natural uranium market.

Markets served by Rosatom



■ Markets ■ Value chain □ Products/services

### 3.1.1. Natural uranium market

#### Forecast for changes in uranium demand by 2030

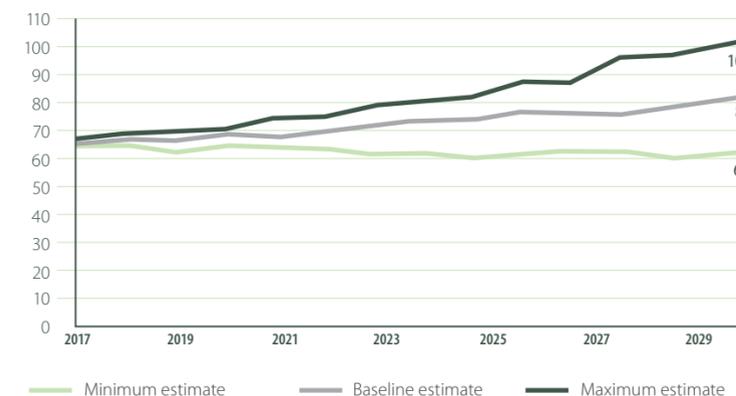
The Fukushima accident in Japan in 2011 led to a significant drop in prices on the nuclear fuel cycle front-end markets, including a decline in quotations for natural uranium.

Fig. Average annual spot market quotations for natural uranium, USD/lb of U<sub>3</sub>O<sub>8</sub>



However, market fundamentals remain strong, and natural uranium demand and prices are expected to recover in the medium and long term.

Fig. Forecast for changes in uranium demand by 2030, kt



Source: World Nuclear Association, 2017.

Global demand for uranium for reactors totalled 65,000 tonnes in 2017, according to the baseline scenario of the World Nuclear Association (WNA). At the same time, global demand taking into account commercial and strategic stockpiling not intended for current consumption is estimated at 73,000 to 74,000 tonnes. Under this scenario, global demand for uranium will increase to 84,000 tonnes by 2030.

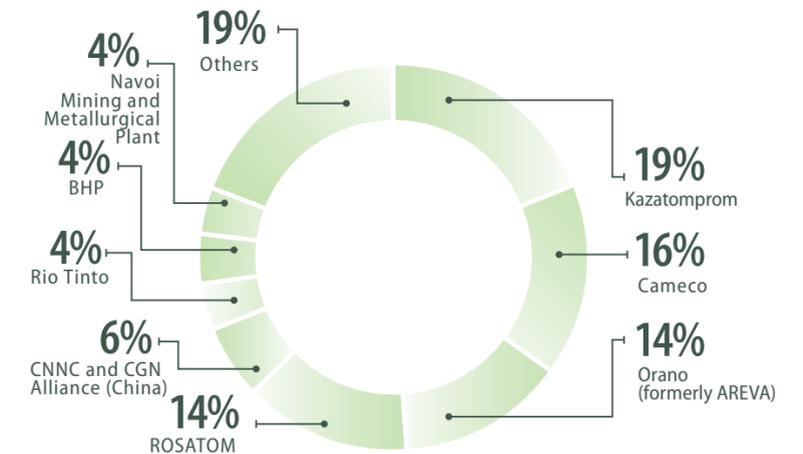
#### Natural uranium market overview

In 2017, global production of natural uranium decreased by 6% compared to 2016 and totalled about 58,000 tonnes. The decline in global production was caused by a continued fall in uranium prices in 2017. Supplies from secondary sources (inventories of energy companies and some states, reparation of depleted uranium hexafluoride, reprocessed uranium, etc.) are estimated at 17,000 tonnes of uranium equivalent.

Until 2030, global uranium production is expected to grow due to an increase in NPP installed capacity and, consequently, increased demand for natural uranium. In 2030, supply from secondary sources will total about 6,000 to 8,000 tonnes of uranium equivalent.

A settled group of leaders has now formed on the natural uranium market. At year-end 2017, the group comprised ROSATOM (14% of the global output), NAC Kazatomprom (Kazakhstan, 19%), Cameco (Canada, 16%), Orano<sup>12</sup> (France, 14%), an alliance of CNNC and CGN (China, 6%), Rio Tinto (Australia – United Kingdom), BHP Billiton (Australia – United Kingdom), and Navoi Mining and Metallurgical Plant (Uzbekistan) (4% each). The nine largest market players account for about 81% of the total uranium output.

Fig. Largest players on the natural uranium market in 2017



Due to persisting negative market trends, in the reporting year, major uranium producers continued to optimize costs and investments in the development of existing enterprises and promising projects, and started to limit production volumes. NAC Kazatomprom, Cameco, Orano and other companies announced the relevant measures aimed at restoring the market balance.

As a result, in 2017, the pace of development of most existing projects remained low. The Husab mine in Namibia (owned by the Chinese CGN) was an exception. In 2017, the enterprise operating in pilot mode produced about 850 tonnes of uranium.

Junior companies continued to optimize their key projects (in Canada, the US, Australia and some other countries) with a view to commissioning them when the uranium market starts to recover. Progress on most of these projects also remained slow due to difficulties with raising funds and arranging product sales.

### 3.1.2. Uranium conversion and enrichment market

Uranium enrichment is one of the main stages of the front end of the nuclear fuel cycle (NFC). Products sold on the market include enriched uranium product (EUP) and the uranium enrichment service measured in separative work units (SWU).

#### Forecast for changes in demand for uranium enrichment services by 2030

According to the World Nuclear Association's baseline scenario, the world demand for enrichment in 2017 totalled 50 million SWU. Given the current significant oversupply on the uranium enrichment market, spot market quotations declined by 19% during the year, while long-term quotations fell by 14%. Since the Fukushima nuclear power plant accident in 2011, quotations for enrichment have dropped by more than 70%.

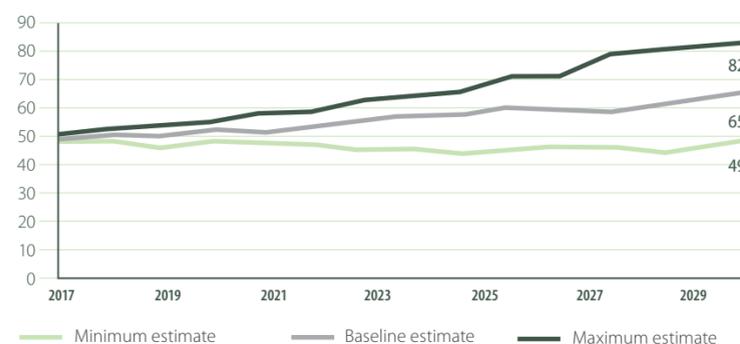
<sup>12</sup> In 2017, in the course of restructuring, the French company AREVA was divided into two companies: Orano (uranium production and enrichment, NPP engineering and decommissioning, nuclear medicine) and Framatome (nuclear fuel fabrication, nuclear mechanical engineering, NPP construction and maintenance). EDF became the main owner of Framatome.

Fig. Average annual quotations for enrichment, USD/SWU



The development of the nuclear industry until 2030 will have a positive impact on the market for natural uranium enrichment services. Global demand for enrichment will grow to 53 million SWU and 65 million SWU by 2020 and 2030 respectively, according to the baseline scenario of the WNA. Given the expected growth of demand in the future, the market is likely to become more balanced.

Fig. Forecast for changes in demand for uranium enrichment by 2030, million SWU



Source: World Nuclear Association, 2017.

### Uranium conversion and enrichment market overview

The main players on the global market for uranium enrichment services include ROSATOM (36% of the global enrichment market), URENCO (UK, Germany, Netherlands; 29%), Orano (France; 14%) and Chinese companies (9%). Together, they control about 90% of the market. All players use modern gas centrifuge technology for uranium enrichment. Given the market decline in 2017, foreign enrichment companies (except for Chinese companies) abstained from expanding the capacity of gas centrifuge enrichment plants.

### 3.1.3. Nuclear fuel fabrication market

According to ROSATOM, in 2017, the global nuclear fuel market capacity totalled about 12,000 tonnes of heavy metal (tHM). These include:

- fuel requiring uranium enrichment accounting for 8,000 tHM (including over 1,000 tHM of fuel for water-cooled water-moderated power reactors (VVERs));
- fuel for heavy-water reactors accounting for 4,000 tHM.

As the reactor fleet will be expanding, the demand for fabrication services may increase to 14,000 tonnes by 2030. Global suppliers on the fabrication market are Westinghouse, Framatome (formerly AREVA), Global Nuclear Fuel and ROSATOM.

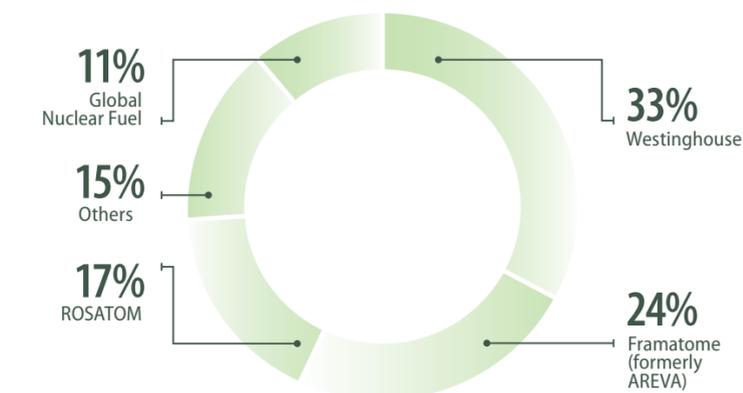
Westinghouse Electric Company (US) fabricates nuclear fuel for nearly all types of light-water reactors (LWRs). Its major markets are the US and Western European countries. Moreover, Westinghouse is actively seeking to enter the market for fuel for VVER reactors and gain a foothold there. The company is the largest player holding 33% of the market.

The French Framatome produces fuel for PWR and BWR reactors and holds 24% of the global fabrication market, with Western Europe being its main end market.

Global Nuclear Fuel (GNF) is a joint venture of GE (USA) and Hitachi (Japan). 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 11% of the market.

In 2017, Russian nuclear fuel fully met the demand of Russia, Iran, the Czech Republic, Slovakia, Hungary, Bulgaria and Armenia for reactor fuel. ROSATOM also partially met the demand of Ukraine (57%), Finland (36%), India (30%) and China (6%) for reactor fuel. The Corporation, in cooperation with Framatome, also supplies fuel and components to Western European nuclear power plants. In the reporting year, the Corporation's share on the nuclear fuel fabrication market totalled ~17%.

Fig. Shares of players on the nuclear fuel fabrication market



### Entering new nuclear fuel markets

In 2017, 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 major contract was concluded with Chinese partners: the Corporation signed a package of documents for fuel supply to Tianwan NPP worth over USD 1 billion. In addition, major contracts were concluded for fuel supply to the Belarusian NPP and El Dabaa NPP in Egypt. See also the section 'Fuel Division'.

In the future, the development of a new technological platform for the nuclear power industry based on fast-neutron reactors will result in an increase in demand for MOX fuel used in reactors of this type. Only two high-capacity fast-neutron power reactors are currently in operation in the entire world, both of which are located in Russia: BN-600 and BN-800. In addition, as part of the Proryv (Breakthrough) project, a fuel fabrication and refabrication module is being constructed for the BREST-OD-300 fast-neutron reactor. It will use mixed nitride uranium-plutonium (MNUP) fuel. See also the section 'Research and Innovations'.

### 3.1.4. 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 the trends in the development of the global electricity industry (improved energy efficiency, environmental programmes, etc.) and the commissioning of new generating capacities. In 2017, the volume of the global power machine engineering market totalled around 65 GW (excluding the gas and petrochemical industry). The market structure remained unchanged, with equipment in the thermal power industry accounting for about 60% of the global power machine engineering market, equipment in the gas and petrochemical industry for 25% and NPP equipment for 15%.

The Russian power machine engineering market depends on the global market trends and the rate of commissioning of generating capacities. In 2017, the market was estimated at around 4.3 GW. Given that the annual growth rate of the Russian power machine engineering market will average 1-2% due to the slowdown in energy consumption in the country, by 2030 it is expected to expand to 5.1 to 5.2 GW. Main trends are expected to include tougher competition between local producers, as well as a higher degree of import substitution for both power generation equipment and components for its production. JSC Atomenergomash (the Mechanical Engineering Division of ROSATOM) holds 29.5% of the Russian power machine engineering market.

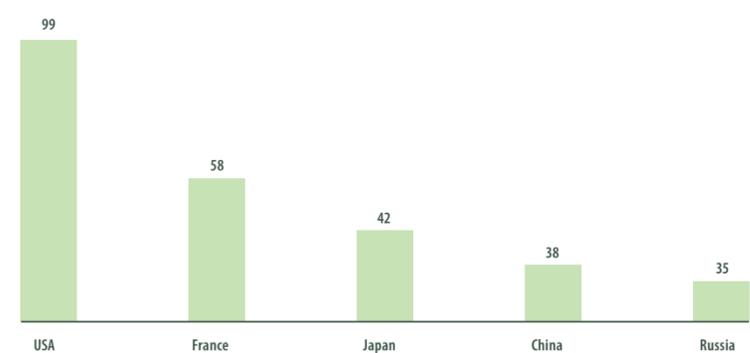
At year-end 2017, ROSATOM accounted for 27.9% of the global market for NSSS<sup>13</sup> equipment (production and supply) at NPPs under construction. Equipment produced by the Corporation's enterprises has been installed in over 20 countries at 15% of NPPs globally and 40% of thermal power plants in Russia.

### 3.1.5. NPP construction and operation market

In 2017, the nuclear power industry accounted for about 11% of the global electricity supply. According to the IAEA, in 13 states, more than a quarter of the electricity demand is met by nuclear power generation. Countries with the largest share of NPPs in electricity generation include France (72.3%), Slovakia (54.1%), Ukraine (52.3%), Belgium (51.7%) and Hungary (51.3%).

According to the IAEA, as of December 31, 2017, 448 power reactors were in operation with a total capacity of 391.7 GW (including the suspended Japanese reactors). Another 59 reactors were under construction. ROSATOM ranked second among global generating companies in terms of installed NPP capacity (27.9 GW), surpassed only by the French EDF.

Fig. Leading countries by the number of operating NPP power units



Currently, demand for NPP construction comes primarily from Asian countries, which is due to rapidly growing demand for electricity 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 orders.

For details, see the section 'International Business'.

### 3.1.6. Market for radioactive waste and spent nuclear fuel management and decommissioning of nuclear facilities (back end)

#### Market for RAW and SNF management, processing and disposal

According to ROSATOM's estimates, in 2017, the market for radioactive waste (RAW) management, processing and disposal totalled USD 8.7 billion. In the future, until 2030, the market volume will range between USD 9 billion and USD 11 billion. Major market players include ROSATOM, Energy Solutions (USA), Orano (formerly AREVA), Studsvik (Sweden), Onet Technologies (France), Veolia (Kurion) (France) and Steag (Germany). The market for spent nuclear fuel (SNF) management, processing and disposal is expected to be the most dynamic segment of the nuclear fuel cycle back end market with an average annual growth rate of ~6% until 2030. According to ROSATOM, in 2017, this market was estimated at USD 4.3 billion. The market will reach USD 5.4 billion in 2020 and USD 9 billion by 2030. Major players include ROSATOM, Orano (formerly AREVA), JNFL (Japan), CNNC (China), SKB (Sweden), Holtec (USA), GNS (Germany) and Skoda (Czech Republic).

#### NPP decommissioning market

According to the Corporation's estimates, in 2017, the global NPP decommissioning market totalled USD 2.5 billion. The market may double by 2022, as a large number of reactors are expected to be decommissioned. Between 2023 and 2030, the market will grow at an average annual rate of around 4%. Major players include ROSATOM, Energy Solutions, URS (USA), Bechtel (USA), GE-Hitachi, EWN (Germany), Ch2M Hill (USA), Westinghouse, Cavendish Nuclear (UK), Amec (UK) and Nuvia UK. ROSATOM holds about 1% of the global market for NPP decommissioning, with the target market share by 2030 totalling 15%. The Corporation expects to increase its market share by developing competences in the sphere of decommissioning of Russian-design NPPs in Russia and abroad and subsequently expanding into the segment of decommissioning of foreign-design NPPs.

See also the section 'International Business'.

### 3.1.7. Composite materials

The development of production and sales of composite materials is one of the main contributors to the achievement of ROSATOM's strategic goal of developing new products for the Russian and international markets.

The global carbon composite market is currently estimated at USD 3.1 billion (with the Russian market totalling USD 70 million) and has the potential to double every five years.

Key characteristics of the carbon composite market include the following:

- Fabrics and pre-pregs account for 75% of end use by producers of finished products;
- Carbon composites are strategic materials to which special export controls apply;
- Key consumer industries include aerospace, wind power, the automotive industry, and the sports and leisure industry.

The consumption of carbon composites is steadily increasing due to their unique properties. Further increase in global demand is forecast due to the replacement of conventional materials and expansion of the areas of application.

The steadily growing market opens up opportunities for new players. By 2025, consumption is expected to increase by a factor of 2.5 to 161,000 tonnes of carbon fibre.

For details, see the section 'Business Diversification'.

### 3.1.8. Wind power

Wind power is an important new business for the Corporation, enabling it to make a more substantial contribution to zero-carbon power generation.

Between 2018 and 2025, up to 3.4 GW of capacity will be commissioned in Russia (ROSATOM has already won tenders for the commissioning of 1 GW of capacity and plans to continue to participate in tenders). The Corporation intends to become a leader on the wind turbine market in Russia, with its market share expected to exceed 30%.

For details, see the section 'Business Diversification'.

### 3.1.9. Nuclear medicine

Nuclear medicine is a high-priority business area for ROSATOM. The market comprises the following segments:

- healthcare services;
- radiological equipment;
- radiopharmaceuticals.

Healthcare services are the largest segment of the nuclear medicine market. In 2017, its global volume totalled ~USD 78 billion (~USD 0.8 billion for Russia). By 2030, the segment is expected to grow to USD 90 billion (to USD 2 billion in Russia).

In 2017, the global radiological equipment segment exceeded USD 8 billion. The segment is expected to grow to USD 17 billion by 2030. In 2017, the Russian radiological equipment market totalled ~USD 37 million.

In 2017, the global volume of the radiopharmaceuticals segment totalled around USD 6 billion and is expected to expand to USD 15 billion by 2030. The Russian radiopharmaceuticals market totals around USD 16 million.

Key drivers of the nuclear medicine market growth include the increase in cancer morbidity by 2-3% per year, population growth, population ageing and active development of the nuclear medicine market in emerging economies.

Key customers for the construction of large multi-specialty healthcare facilities in Russia include regional administrations, regional and federal executive authorities and healthcare institutions (federal, regional, industry-sponsored and private).

ROSATOM has accumulated technical and production capabilities in nuclear medicine, which are a prerequisite for expansion on this market.

See also the section 'Business Diversification'.

<sup>13</sup> Nuclear steam supply system.

## 3.2. International Cooperation

Key results in 2017:

- 11 intergovernmental agreements and 16 major interdepartmental agreements were concluded. These include 5 framework intergovernmental agreements concluded with the Kingdom of Cambodia, Paraguay, Sudan, Tajikistan and Uzbekistan, which provide the foundation for bilateral cooperation between Russia and these countries in the sphere of nuclear technologies.
- A legal and contractual framework was established for the start of construction of stage 3 of Kudankulam NPP in India.
- A legal framework was established at the intergovernmental level for the construction of a Nuclear Research and Technology Centre in Zambia.
- The International IAEA Conference on Fast Reactors and Related Fuel Cycles took place in Ekaterinburg on June 26-29, 2017.
- Under the agreement with the IAEA, the Agency launched the first ever technical cooperation projects to develop nuclear infrastructure in the countries in which ROSATOM implements its projects.

Nikolay Spasskiy, Deputy Director General for International Relations



— How would you assess the international political environment for ROSATOM in 2017? What impact did it have on the Corporation's business?

— The current international environment is certainly extremely challenging. As far as I remember, the last time international political tension was so high was in the 1980s. I am confident that these challenges will make us, as an organization which basically consolidates the entire nuclear industry of Russia, stronger, more dynamic and capable of achieving success in the harsh conditions of the 21<sup>st</sup> century. And these positive consequences should by no means be confined to an expansion of import substitution. The key here is to expand into new markets and redesign conventional markets with new products.

From this point of view, the best example is a strategic package of seven documents agreed with China, including the joint construction of a demonstration fast neutron reactor. The package was signed in 2018, but the preparation was mostly done in 2017. Work on this project was

one of the main focus points of the entire year. It is the first ever package agreement of this kind in our practice in terms of scale, comprehensiveness and detailed examination of legal aspects. And, as far as I know, it is the first in the world as well.

— How does ROSATOM intend to reduce political risks for its business? What tools will be used to mitigate the unfavourable foreign policy environment (including the risk of sanctions)?

— This is of course the right question, but I would phrase it differently. Focusing on the defensive mode undermines our chances of success, even though we certainly need to take steps to minimize the risks. What needs to be done? I would like to point out several things that are quite obvious and simple.

Firstly, we need to enter the international market with an offer which none of our competitors would make (in terms of price, quality and time). To be irreplaceable is the best insurance against any discriminatory measures.

Secondly, it is crucial to perform all the obligations you have assumed regardless of the political situation. This factor is becoming even more significant today, when a number of countries openly misuse political bans and restrictions on international economic cooperation. Nothing is harder to earn and easier to lose than the reputation of a reliable partner. We do have this reputation, and it is vital for us to maintain and strengthen it. Let me give you an example. The fact we have managed to complete the construction of power unit No. 1 of Bushehr NPP in Iran despite enormous external pressure has boosted our credibility, not only in countries that are our allies but also among our competitors and opponents.

Thirdly, we must strictly comply with all international requirements that govern relations between countries in the area of peaceful use of nuclear power. This applies, first and foremost, to nuclear non-proliferation and export control, as well as nuclear safety and security requirements.

Fourthly, when launching a new international project, especially if it is

a long-term and large-scale project such as the construction of an NPP or a Nuclear Research and Technology Centre, we must properly and clearly formulate our mutual obligations. Without false modesty, I can say we have learned to do this. Of course, framework intergovernmental agreements and intergovernmental agreements on specific projects form the basis for the rest of the legal framework in the form of framework contracts and executive agreements.

To conclude, I would like to highlight the importance of ongoing and close cooperation between all the participants of the Russian interdepartmental community. No major international project can be carried out successfully in today's environment without such cooperation and mutual support. This is especially true for the sensitive high-technology area related directly to national security that is the peaceful use of nuclear power.

On a global scale, ROSATOM aims to create 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.

### Cooperation with key partners in strengthening the international legal framework

<p><b>Cambodia</b> </p> <p><b>Paraguay</b> </p> <p><b>Sudan</b> </p> <p><b>Tajikistan</b> </p> <p><b>Uzbekistan</b> </p>	<p>Framework IGAs were signed to establish a legal framework for cooperation in the field of nuclear technologies with Cambodia, Paraguay, Sudan, Tajikistan and Uzbekistan. Conditions were provided for promoting Russian nuclear technologies in these countries and implementing specific nuclear projects.</p>
<p><b>Zambia</b> </p>	<p>An IGA on the construction of a Nuclear Research and Technology Centre (NRTC) in Zambia was signed. The NRTC will provide opportunities for conducting radiobiological research and starting radioisotope production in Zambia for extensive application in cancer diagnosis and treatment. The NRTC will train highly qualified personnel for the country's nuclear industry.</p>
<p><b>Bangladesh</b> </p>	<p>An IGA on the import of spent nuclear fuel from Rooppur NPP into Russia was signed. The agreement provides the necessary conditions for NPP construction and operation. It fully complies with Russian legislation and at the same time sets a precedent for discussing this topic as part of international cooperation, which is important and relevant to Russia.</p>
<p><b>Kazakhstan</b> </p>	<p>Two intergovernmental documents were signed on the sidelines of the IAEA General Conference in Vienna on September 19, 2017:</p> <ul style="list-style-type: none"> <li>– A protocol to the IGA on cooperation and mutual settlements during nuclear ammunition disposal dated January 20, 1995. The protocol stipulates the completion of mutual settlements between Russia and Kazakhstan and the transfer to the Kazakh party of natural enriched uranium hexafluoride obtained from highly enriched uranium extracted from nuclear weapons and stored in Russia;</li> <li>– An IGA on cooperation in scientific research and development in the field of nuclear energy. The IGA takes Kazakh-Russian scientific and technical cooperation on the peaceful use of nuclear energy to a whole new level.</li> </ul>
<p><b>Armenia</b> </p> <p><b>Sweden</b> </p>	<p>Interdepartmental protocols were signed with Armenia and Sweden on the implementation of practical measures for fulfilling the obligations under IGAs on early notification of nuclear accidents and exchange of information on nuclear and radiation safety. The documents establish the notification procedure and measures for accident notification and rapid exchange of information in case of nuclear accidents; they also establish procedures for joint actions in conducting emergency response exercises.</p>

### 3.2.1. Strengthening the legal and contractual framework for international cooperation

In 2017, expansion of the international legal framework for cooperation continued in order to promote Russian nuclear technologies in the world. 11 intergovernmental agreements (IGAs) and 16 major interdepartmental arrangements were signed (8 and 20 in 2016, 8 and 16 in 2015 respectively).

<p><b>Algeria</b> </p> <p><b>Laos</b> </p> <p><b>Sudan</b> </p> <p><b>Uganda</b> </p> <p><b>Uzbekistan</b> </p> <p><b>Philippines</b> </p> <p><b>Ethiopia</b> </p>	<p>The following interdepartmental agreements were signed:</p> <ul style="list-style-type: none"> <li>– Memoranda of cooperation in the peaceful use of nuclear energy with Sudan, Uganda, Uzbekistan, the Philippines (separately with the Department of Science and Technology and the Department of Energy) and Ethiopia;</li> <li>– A memorandum on personnel education and training in the nuclear power industry and other related fields with Algeria;</li> <li>– A road map for cooperation in the field of nuclear technologies with Laos.</li> </ul> <p>The signing of these documents will enable the development of nuclear power infrastructure in these countries.</p>
<p><b>Vietnam</b> </p>	<p>A Cooperation Programme in the Peaceful Use of Nuclear Energy and a Memorandum on the Construction of a Nuclear Research and Technology Centre were signed. The Programme is aimed at fostering bilateral cooperation in all strategic areas in a new environment that emerged after the Vietnamese government decided to suspend the national nuclear energy programme in late 2016, with a focus on accelerating the construction of the Nuclear Research and Technology Centre in Vietnam. The Memorandum sets specific deadlines and outlines specific steps for implementing this high-technology project based on a Russian-design research reactor.</p>
<p><b>Iran</b> </p>	<p>The Road Map for Implementing the Memorandum on the Development of Cooperation in the Peaceful Use of Nuclear Energy dated November 11, 2014 and the Memorandum on Transportation of Nuclear Materials were signed. The Road Map provides for cooperation with Iranian partners on fuel fabrication for research reactors. The Memorandum provides for the opening of a new route for transporting nuclear materials between Russia and Iran via the Caspian Sea and construction of the required infrastructure in Iran.</p>
<p><b>France</b> </p>	<p>Administrative arrangements were signed with the French Atomic Energy and Alternative Energy Sources Commission under the IGA on cooperation in the operation of research reactors dated November 18, 2015.</p>
<p><b>Japan</b> </p>	<p>A memorandum of cooperation on incineration (transmutation) of minor actinides was signed. The document aims to examine the possibilities for cooperation in reducing the amount of high-level waste, its radiotoxicity and radiation hazard level.</p>

### 3.2.2. Support for long-term international projects

In 2017, ROSATOM continued to provide political support for major projects, particularly for the construction of NPPs and Nuclear Research and Technology Centres abroad.

#### ■ Belarusian NPP construction project

ROSATOM provided support for the Belarusian NPP construction project in cooperation with the Ministry of Energy, the Ministry of Emergency Situations and other government bodies of the Republic of Belarus. Regular working consultations were held on current issues related to the project, including as part of cooperation with the IAEA.

#### ■ Cooperation with China

ROSATOM continued to cooperate closely with the Atomic Energy Authority and the National Energy Administration of the PRC. The latest meeting of the Subcommittee on Nuclear Issues was held as part of the Commission for the Preparation of Regular Meetings of the Heads of State of Russia and China, and meetings of specialized working groups were conducted.

An agreement was reached on the simultaneous signing of documents in high-priority areas of cooperation: an intergovernmental protocol and a framework contract for the construction of power units No. 7 and 8 of Tianwan NPP, an intergovernmental protocol and a framework contract for the mass production of VVER-type power units on the new site in the PRC, an intergovernmental protocol and a framework contract for the construction of a 600 MW demonstration fast neutron reactor, and a contract for the supply of heat generation units to the PRC for the national lunar exploration programme.

#### ■ Kudankulam NPP construction project (India)

Documents for the construction of power units No. 5 and 6 of Kudankulam NPP were signed. A number of issues were discussed with Indian partners as part of strategic cooperation between Russia and India in the peaceful use of nuclear power. These included selecting a new site for NPP construction, launching mass production of Russian-design power units in India and increasing the degree of localization, and cooperation in third countries.

#### ■ Rooppur NPP construction project (Bangladesh)

The landmark event was the start of the main stage of construction of Rooppur NPP: on November 30, 2017, an official ceremony was held to mark the start of concreting of the foundation slab of the reactor building. The ceremony was attended by the Prime Minister of Bangladesh Sheikh Hasina. The concreting works were preceded by the issuance of a licence for NPP construction by the Bangladesh Atomic Energy Regulatory Authority (BAERA).

#### ■ Bushehr NPP construction project (Iran)

On October 31, 2017, an official ceremony was held in Bushehr to mark the start of practical work on the construction of power units No. 2 and 3 of Bushehr NPP. The ceremony was attended by heads of nuclear agencies of Russia and Iran.

#### ■ Akkuyu NPP construction project (Turkey)

On December 2, 2017, an official ceremony was held to mark the start of concreting of the foundation slab. The ceremony was attended by ROSATOM's executives and representatives the Ministry of Energy and Natural Resources of the Republic of Turkey.

#### ■ Hanhikivi 1 NPP construction project (Finland)

ROSATOM provided legal and political support for the Hanhikivi 1 NPP construction project. During regular contacts, including at the governmental level, practical aspects of implementation of the project were discussed.

#### ■ El Dabaa NPP construction project (Egypt)

On December 11, 2017, the acts on enacting the package of contracts for the NPP construction were signed in the presence of the President of Russia Vladimir Putin and the President of Egypt Abdel el-Sisi. The current contracts cover the entire life cycle of the NPP, including the supply of fuel, maintenance and SNF handing.

#### ■ Nuclear Research and Technology Centre construction project in Bolivia

One of the highlights of the year was a framework contract for the construction of a Nuclear Research and Technology Centre in Bolivia, which was signed on the sidelines of the 61<sup>st</sup> session of the IAEA General Conference in Vienna in September 2017. The document enables the start of the implementation of practical measures related to the construction of the Centre at the previously selected location.

#### ■ Cooperation with Zambia

As a follow-up to the IGA on the Construction of a Nuclear Research and Technology Centre in Zambia signed on June 18, 2017, a package of contracts for assessing the nuclear infrastructure of Zambia and conducting a pre-construction survey at the future construction site was signed on the sidelines of the 9<sup>th</sup> ATOMEXPO International Forum.

#### ■ Cooperation with Vietnam

ROSATOM continued to implement the project to build a Russian-design Nuclear Research and Technology Centre (NRTC) in Vietnam. In May 2017, a working group was established by ROSATOM and the Vietnamese Interdepartmental Committee to enable prompt discussion of the current cooperation issues. The working group held two meetings, which resulted in the signing of protocols outlining specific solutions and setting implementation deadlines, first and foremost for the NRTC project.

*See also the section 'International Business'.*

### 3.2.3. Implementation of the Joint Comprehensive Plan of Action on Iran’s nuclear programme

On January 19, 2017, a contract was signed with the Iranian party for front-end engineering design on the project to modify two cascades at the Fordow Fuel Enrichment Plant to produce stable isotopes. In accordance with the Joint Comprehensive Plan of Action on Iran’s nuclear programme (JCPOA), the project is being implemented by Iran in cooperation with Russia. Under the contract, Iranian gas centrifuge mock-ups were tested, and a standalone test facility for conducting tests in Iran was assembled. In late December 2017, the standalone test facility and all the materials and equipment for the tests were delivered to Iran.

In late January and early February 2017, Russian natural uranium was delivered to Iran in exchange for heavy water which had been delivered by Iran to Russia in September 2016. Together with this material, the first batch of fuel kernels for the Tehran Research Reactor and targets put in temporary storage in Russia were returned (by agreement with the IAEA).

On October 17-18, 2017, a Russian-Iranian seminar titled ‘25 Years of Cooperation between Russia and Iran on the Peaceful Use of Nuclear Power: New Prospects in Accordance with Annex 3 to the Joint Comprehensive Plan of Action’ was held by ROSATOM and the Russian Ministry of Foreign Affairs in Moscow. Apart from the Russian and Iranian parties, the event was attended by representatives of the P5+1 (the UK, Germany, China, the USA and France) and representatives of the European Commission and the IAEA Secretariat.

### 3.2.4. Cooperation with international organizations

#### ■ International Atomic Energy Agency (IAEA)

ROSATOM participated in all sectoral international conferences and meetings held under the auspices of the IAEA, including the 61<sup>st</sup> session of the IAEA General Conference, the Ministerial Conference on Nuclear Power in the 21<sup>st</sup> century and the 7<sup>th</sup> Review Meeting of the Contracting Parties to the Convention on Nuclear Safety. Resolutions adopted at these events, as well as resolutions approved by the policy-making bodies of the IAEA, reflect Russia’s stance and accommodate the interests of the national nuclear industry.

The International IAEA Conference on Fast Reactors and Related Fuel Cycles took place in Ekaterinburg on June 26-29, 2017. The conference was attended by over 600 delegates from 28 countries and six international organizations. Five technical tours to Beloyarsk NPP were organized for the participants. Over 150 experts took part in them.

The Russian Federation paid extra-budgetary contributions to the IAEA in full.

Pursuant to the Junior Professional Officer Agreement between the IAEA and the Russian Federation, internships and other forms of training of young Russian specialists for the IAEA continued. R&D and training courses as part of the projects financed from Russia’s contributions to the IAEA’s Nuclear Security Fund, as well as training events in Russia as part of the IAEA Programme of Action for Cancer Therapy continued.

Three Russian regional projects (in the sphere of nuclear safety infrastructure of VVER reactors, environmental remediation of uranium legacy sites and climate change) were implemented as part of the IAEA Technical Cooperation Programme. Practical cooperation was initiated on the development of a nuclear infrastructure in the countries

where ROSATOM is implementing its projects. An agreement was signed with the IAEA Secretariat on the extra-budgetary contribution for implementing technical cooperation projects to develop nuclear power infrastructure. In 2017, six training courses were organized and were attended by over 100 experts, primarily from the countries which are potential partners to the Corporation.

ROSATOM arranged the fifth introductory visit to Leningrad NPP for a group of Permanent Representatives of the IAEA Member States in Vienna.

As part of the industry-wide target programme to train Russian specialists for the IAEA Secretariat, a three-stage selection of applicants was carried out; individual development programmes were implemented for the members of the expert pool, and the second workshop was held for Russian experts in cooperation with the Division of Human Resources of the IAEA.

### In 2017, a visit of the Director General of the IAEA Yukiya Amano to Russia was organized.

The IAEA Secretariat conducted a physical inventory verification and design information verification at JSC IUEC pursuant to the Agreement between the Russian Government and the IAEA on the Establishment of a Physical Reserve of Low-Enriched Uranium in Russia. The IAEA inspectors confirmed that the physical inventory and design were in line with Russia’s statements and the operator’s data.

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

Russian participation was ensured in seven international projects of the OECD NEA aimed at improving the safety of Russian NPPs and designing new-generation nuclear reactors.

In 2017, Russia became a member of the Nuclear Education, Skills and Technology (NEST) Framework of the OECD NEA.

A framework agreement was concluded between ROSATOM and the OECD NEA on the translation of the Agency’s selected materials and their publication in the Russian language. This will enable Russian organizations to regularly receive information on new initiatives, projects and programmes from the OECD NEA.

The Director General of the OECD NEA William D. Magwood made two visits to Russia. During these visits, he participated in the 9<sup>th</sup> ATOMEXPO International Forum and the Russian Energy Week and visited JSC SSC RIAR and Beloyarsk NPP.

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

In 2017, two IGAs were signed on cooperation with the CIS:

– An agreement on the joint use of the experimental facility based on the Kazakh Tokamak for Material Testing. Its signing provided a legal framework for the joint use of a unique experimental facility in Kazakhstan by the CIS scientists for a wide range of research;

– An agreement on the harmonization of approaches to legal and technical regulation in the sphere of the peaceful use of nuclear energy. It is aimed at aligning mandatory requirements for products and processes related to ensuring the safety and security of facilities in the sphere of the peaceful use of nuclear energy being constructed as part of cooperation of the CIS member countries.

Initiatives in nuclear medicine and isotope production were developed for application in the CIS:

– Pre-clinical trials of a radiopharmaceutical based on PSMA ligand for PET/CT diagnosis of prostate cancer;

– Use of generator systems for obtaining the yttrium-90 product and the start of manufacture of medical products based on it.

### 3.2.5. Outcomes of the efforts to strengthen the nuclear non-proliferation regime; export control

The Russian-US programme to import highly-enriched uranium (HEU) fuel for Russian-design research reactors from third countries into Russia continued.

In 2017, spent nuclear fuel from the VVR-K research reactor of the Institute of Nuclear Physics in Almaty (Kazakhstan) was delivered to Russia for reprocessing. It took three flights to deliver 47.3 kg of HEU SNF. The nuclear fuel was delivered to FSUE Mayak Production Association.

The 5<sup>th</sup> CTBT Science and Technology 2017 Conference was held under the auspices of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO Prep Com). The participants of the conference discussed the potential of the CTBT verification regime and new technologies which could find practical use in the work of the CTBTO. The Conference gave special focus to the need to enact the CTBT as soon as possible and turn it into a full-fledged international legal mechanism in order to fully benefit from the use of the

control mechanism, including, first and foremost, onsite inspections.

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

### 3.2.6. Developing the network of ROSATOM’s representative offices affiliated with embassies and trade missions abroad

As of December 31, 2017, ROSATOM’s representative offices affiliated with Russian embassies and trade missions were in operation in 10 countries around the world: Argentina (a representative of the Corporation was sent there in 2017), Bangladesh, Belarus, Hungary, Vietnam, India, Iran, Kazakhstan, China and Turkey, and under the Permanent Mission of the Russian Federation to International Organizations in Vienna (Austria).

### 3.2.7. Major challenges in the international arena

In 2017, Russian nuclear power technologies had to be promoted on the global markets in a challenging international environment. ROSATOM’s competitors used not only significant financial resources and state support, but also the capabilities of NGOs and private businesses. A number of states increasingly often used international platforms in an attempt to change the existing and emerging international rules and guidelines on nuclear energy, which could adversely affect the Russian nuclear industry.

ROSATOM’s efforts to create a favourable international environment for developing the Russian nuclear power sector are focused on close cooperation with the relevant ministries and agencies of the Russian Federation.

The Corporation strengthens the credibility of the Russian nuclear industry at an international level through unconditional fulfilment of its obligations, including the supply of fuel, equipment and services regardless of the current political situation and relations with individual countries.

### 3.2.8. Objectives for 2018 and for the medium term

In 2018, ROSATOM will continue to expand the international legal framework for cooperation for the benefit of industry organizations and enterprises.

New priorities include the conclusion of IGAs aimed at dealing with spent nuclear fuel at Russian-design NPPs built abroad and ensuring physical security of these NPPs.

The Corporation plans to intensify cooperation in personnel training, making nuclear power more acceptable for society and fostering public demand for it.

In the course of its international activities, ROSATOM is guided by the UN Sustainable Development Goals. The Corporation seeks to contribute to sustainable development by providing the benefits of environmentally friendly nuclear energy to countries at any level of economic development. At the same time, ROSATOM will give special focus to non-energy applications of the ‘peaceful atom’.

To do so, it will continue bilateral cooperation and activities on the platforms of specialized international organizations, as extensive international cooperation is a prerequisite for the long-term, sustainable and safe development of nuclear power.

## 3.3. International Business

Key results in 2017:

- The 10-year portfolio of overseas orders totalled USD 133.5 billion (USD 133.4 billion in 2016).
- Revenue from overseas orders reached USD 6.1 billion (USD 5.6 billion in 2016).
- The overseas NPP construction project portfolio included 33 power units in 12 countries around the world.
- Projects were being implemented in over 50 countries worldwide.

**Kirill Komarov**, First Deputy Director General for Corporate Development and International Business



— **What were the most important achievements in 2017 in the international business?**

— It was an important year for the international business in terms of both building the portfolio of our orders and fulfilling the agreements concluded earlier. A number of our ongoing overseas projects reached important milestones. First of all, I would like to say that on December 30, we launched power unit No. 3 at Tianwan NPP in China. This is an extremely significant milestone for us: only six years after the signing of the contract for constructing the third power unit of this NPP, it has been put into operation, which is a unique lead time for the global nuclear industry. Meeting project deadlines is a sensitive topic in the global nuclear industry, and I am happy to say that ROSATOM sets the pace here.

In addition, our NPP construction projects in Turkey and Bangladesh entered the active stage in 2017. We also continued the construction of stage 2 of Bushehr NPP in Iran. Cooperation with India is developing successfully as well: we started the concreting at power unit No. 3 of Kudankulam NPP and signed a package of framework documents for the construction of stage 3 of the NPP. Finally, in late 2017, we signed commercial contracts for the construction of

the first NPP in Egypt, El Dabaa NPP, whose total value is estimated at dozens of billions of US dollars. This is an unprecedented deal in the history of the global nuclear industry and the largest non-commodity export agreement in Russia's entire history.

— **Today, ROSATOM is actively developing new products for both the Russian and international markets. How do you select products to be promoted on the market, and which do you think are the most promising?**

— Over more than 70 years, our enterprises have built up a huge potential, which we can and should use today to diversify ROSATOM's product portfolio. When selecting a specific product to be promoted, we not only consider market volatility and the customers' changing needs but also rely on our experience. Therefore, ROSATOM does not invest indiscriminately, but focuses on the products and solutions which are best aligned with our technical, technological and research capabilities.

This is why we have started to actively implement the wind power project. We have won a number of tenders, and as a result, ROSATOM's current portfolio comprises orders for capacities totalling almost 1 GW, and the total value of our wind power projects is about USD 2 billion.

However, we are not confining ourselves to the wind power sector. Technologies for water desalination and purification, 3D printing, nuclear medicine, radiation technologies and composite materials are only some of the areas that are currently in demand on the market and in which we see business opportunities. This provides clear evidence that the knowledge accumulated in the nuclear power industry has a wide range of applications. For example, late last year, the Mechanical Engineering Division expanded into a market that is new for us, namely processing waste into energy. Waste recycling is relevant not only to Russia; it is a burning issue for a number of other countries as well. And ROSATOM is well equipped to tackle this issue by using those competences that we already have in our portfolio. Under the contract, JSC Atomenergomash will produce main equipment for four waste-to-energy plants in the Moscow Region.

Another example is our composite materials division, UMATEX, which operates in the Alabuga special economic zone and is implementing an investment project to produce PAN fibre, which is widely used in aircraft and

instrumentation engineering, healthcare, construction and numerous other industries.

Overall, ROSATOM's total revenue from new products has been growing steadily for the last three years. In 2017, it increased by almost 16% year on year. These results prove that the goal of increasing the share of revenue from new products in ROSATOM's portfolio of orders to 30% by 2030 is definitely achievable.

— **The extensive portfolio of orders and tough competition on the markets necessitate continuous improvement in the Corporation. A great number of organizational changes took place in 2017. What are they aimed at, and what has already been achieved?**

— Our goal is to learn to promptly respond to the changing market environment and adjust our experience, competences and governance model accordingly. Therefore, we are constantly searching for both new types of interaction and new management tools to improve our performance. The world is changing rapidly, and we need to keep abreast of the changes. And the best way to do this is to be ahead of the curve. It is only natural that a governance model that fully met the requirements a few years ago now needs to be adjusted to the current challenges.

We have set several priorities for improving our governance model. Firstly, we are working to improve the efficiency of cooperation both within our Divisions and between them. The best example is the conclusion of contracts. In this area, for example, we are forming interdivisional coordination platforms for the representatives of the Corporation's interested divisions, where enterprises in the industry can directly address pressing issues and align the stance of all the participants of the negotiation process. Another tool is the reduction in the number of internal transactions which affect the duration and the cost of performing contracts. For example, a number of organizational decisions in the Mechanical Engineering Division helped halve the amount of time required to conclude standard contracts.

Secondly, we are learning to work together towards a shared goal. We need to see clearly not only our own functional tasks but also the bigger picture, how we interact with each other and whether the interaction is efficient in terms of achieving the industry's overall goals. This is reflected in our KPIs, which we now set for managers and organizations. We are actively introducing team-based KPIs in order to foster an environment that will encourage working together towards a shared goal.

I would like to emphasize that we are not searching for a single appropriate form of cooperation. The idea is to build the logic behind interactions which will enable us to promptly respond to new tasks. We might need to revise our structure again in another two or three years. If there are new challenges and new tasks, we will introduce changes. And they are bound to arise, and we need to be prepared for that.

### 3.3.1. Global technological leadership of ROSATOM

ROSATOM achieves technological leadership on international markets for nuclear technology and services by providing a unique integrated offer. The Corporation offers a set of products and services from Russian nuclear power organizations which provides full support to the national nuclear programme of the customer country at all stages. The Corporation's integrated offer provides the customer with access to the entire range of products and services from one supplier throughout the NPP life cycle.

Nuclear power is one of the key components of 'green' energy. Together with solar, wind and hydropower, nuclear power forms the 'green square' which will provide the basis for the world's future zero-carbon balance. Accordingly, ROSATOM not only develops nuclear technologies but also implements projects related to renewable energy.

Today, the Corporation is actively promoting Russian nuclear power technologies 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).

A foreign regional network managed by Rusatom International Network has been established in order to increase international sales and promote the products of the Russian nuclear power industry. As of December 31, 2017, the foreign regional network comprised 11 regional centres that operated in more than 60 countries around the world.

Rusatom International Network regularly supports international multilingual camps for children of employees of partner organizations in the countries where the Corporation does business. The camps' programme includes educational, sports and artistic events which enable the participants to deepen their knowledge of various areas of science and culture, perfect their cross-cultural skills and learn about the traditions and history of other countries. Special emphasis is placed on teaching foreign children about Russia, its traditions and its rich cultural heritage.

175 children from 12 countries attended multilingual camps in 2017.

### 3.3.2. Contribution of NPP construction projects to economic development

NPP construction makes a significant contribution to macroeconomic growth both in the customer country and in the supplier country. Construction and operation of NPPs with two power units provides employment in the sphere of nuclear infrastructure for over 10,000 people and creates over 3,000 new jobs related to NPP operation. National companies are guaranteed capacity utilization for more than 70 years.

Various sectors of industry are involved in NPP construction. This creates positive synergies and produces a multiplier effect. Due to these technological links, each dollar invested in an NPP construction project translates into an increase in revenue in related industries in the receiving country by a factor of two or more.

NPP construction has a positive impact on the budget by boosting tax revenue both in the customer country and in the supplier country. ROSATOM ranks among the ten largest taxpayers in Russia: in 2017, it paid RUB 148.5 billion to budgets of all levels.

### Fostering global partnership

In 2017, ROSATOM continued to build relations with key partner companies on the global nuclear power and industry market.

The following documents were signed:

- A memorandum of understanding with AREVA NP (France);
- A cooperation programme for 2017-2019 with ENGIE (France);
- A memorandum of understanding with the Emirates Nuclear Energy Corporation (ENEC) (UAE);
- A memorandum of understanding with Eletrobras (Brazil);
- A memorandum of understanding with MVM (Hungary).

### 3.3.3. Changes in the portfolio of overseas orders and revenue from overseas orders

In the reporting year, ROSATOM continued to build up its portfolio of overseas orders, which reached USD 133.5 billion.

Table. Portfolio of overseas orders, USD billion

	2015	2016	2017
<b>10-year portfolio of overseas orders, including:</b>	<b>110.3</b>	<b>133.4</b>	<b>133.5</b>
Construction of NPPs abroad	75.9	97.6	97.0
Uranium products	21.1	19.9	15.0
Nuclear fuel assemblies and other activities	13.3	15.9	21.5

At year-end, overseas revenue totalled USD 6.1 billion (USD 5.6 billion in 2016).

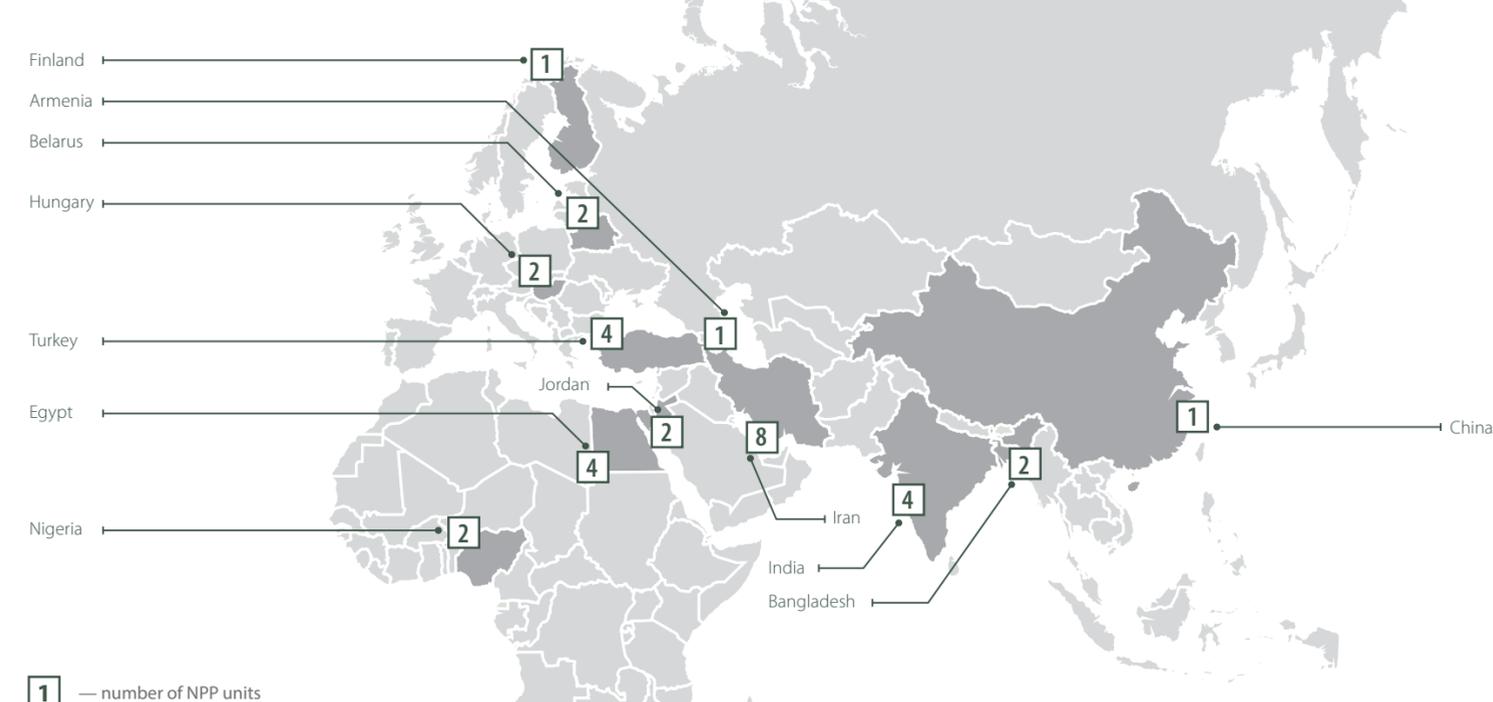
Table. Overseas revenue, USD million

	2015	2016	2017
<b>Overseas revenue, including:</b>	<b>6,259</b>	<b>5,576</b>	<b>6,102</b>
Construction of NPPs abroad	1,565	1,554	2,458
Uranium products	2,667	2,046	1,724
Nuclear fuel assemblies and other activities	2,026	1,976	1,920

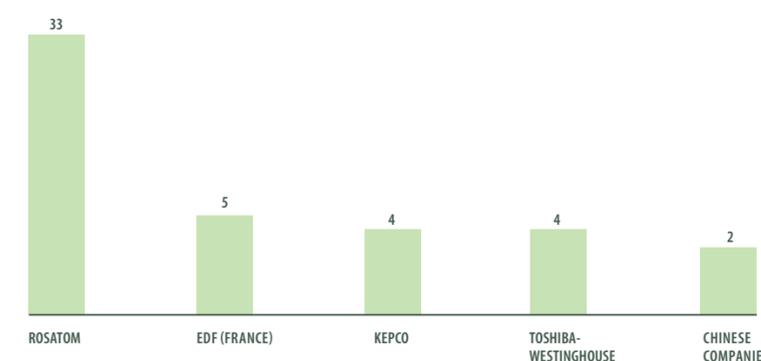
### 3.3.4. Construction of NPPs abroad

At year-end 2017, the NPP construction project portfolio of ROSATOM included 33 power units in 12 countries around the world.

Overseas NPP construction projects of ROSATOM



Portfolio of overseas orders for NPP construction by global market player, power units



Key results of NPP construction projects in 2017

NPP, country	Results
<b>Asia</b>	
Rooppur NPP, Bangladesh	A licence for the design and construction of power unit No. 1 was obtained; concreting was started at the site.
Kudankulam NPP, India	Concreting was started at power units No. 3 and 4. The Master Framework Agreement on the construction of power units No. 5 and 6 was signed.
Tianwan NPP, China	Power start-up of power unit No. 3 was completed. Cold tests of power unit No. 4 were completed.
<b>Europe</b>	
Paks II NPP, Hungary	The European Commission approved the construction of new power units of Paks II NPP in Hungary; the possibility of starting the construction was officially confirmed. The Hungarian Atomic Energy Agency (HAEA) approved the application for a licence for the construction site.
Belarusian NPP, Belarus	Equipment of the reactor island of power units No. 1 and 2 was installed.
Hanhikivi 1 NPP, Finland	Preparatory construction work continued at the NPP site. A workers' camp for 1,000 people, administrative and amenity buildings continued to be built.
<b>Middle East and North Africa</b>	
El Dabaa NPP, Egypt	Acts on enacting commercial contracts for NPP construction were signed, including life cycle contracts (provision of fuel, servicing and SNF handling).
Akkuyu NPP, Turkey	An official ceremony was held to mark the start of construction and installation of the 'non-nuclear' part of the NPP as part of the preparatory stage of the project under the limited licence for construction issued by the Turkish Atomic Energy Authority.
Bushehr-2 NPP, Iran	Works of the second stage were started on the construction site, and the main part of engineering designs of the NPP were handed over to the customer.

ROSATOM also continued to take measures to secure new orders for NPP construction abroad:

– Preparation was underway for the signing of a package of intergovernmental and contract documents for the construction of power units No. 7 and 8 of Tianwan NPP, mass construction of Russian-design NPPs at a new site in China and delivery of equipment for a Chinese-design fast neutron NPP;

– An Agreement on the Development of an NPP Construction Project and a Road Map for Cooperation were signed by JSC Rusatom Overseas and the Nigeria Atomic Energy Commission;

– An Agreement on the Development of an NPP Construction Project was signed by JSC Rusatom Overseas and the Ministry of Water Resources, Irrigation and Electricity of the Republic of the Sudan.

In addition, ROSATOM filed its proposal for participation in a competitive tender for an NPP construction project in Saudi Arabia.

*See also the sections 'International Cooperation' and 'Engineering Division' and the annual report of JSC ASE EC for 2017.*

### 3.3.5. Uranium mining abroad

In 2017, uranium mining enterprises of Uranium One implemented the annual production programme in full. They produced 5,102 tonnes of uranium, and Uranium One retained the leading position on the global market in terms of production costs.

<b>Country</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>
<b>Mineral resource base, including:</b>	<b>4,794</b>	<b>4,919</b>	<b>5,102</b>
Kazakhstan	4,749	4,896	5,063
USA	45	23	39

In 2017, the estimated mineral resource base of Uranium One enterprises under international reporting standards totalled 216,200 tonnes.

<b>Category of reserves</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>
<b>Mineral resource base including:</b>	<b>213.1</b>	<b>220.8</b>	<b>216.2</b>
Measured + Indicated	127.6	132.0	127.4
Inferred	85.5	88.8	88.8

\* The mineral resource base and uranium production include the 100% share in Mantra Resources Pty Limited.

In 2017, the Corporation established cooperation with 22 new counterparties (energy companies, traders and other market participants) on the supply of natural uranium until 2032, including deliveries to the USA, Europe, China, Japan and Brazil. 35 new contracts were concluded. As of December 31, 2017, the portfolio of overseas orders totalled USD 2.3 billion.

#### Table. Overseas geography of natural uranium supplies by Uranium One enterprises in 2017

<b>Region</b>	<b>Share</b>
<b>Middle East and North Africa</b>	<b>1%</b>
South America	4%
North America	9%
Western Europe	27%
East Asia	28%

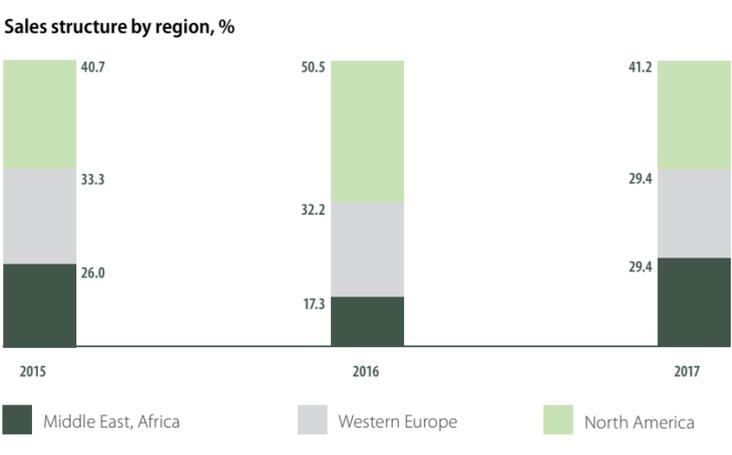
*See also the annual report of JSC Atomredmetzoloto for 2017.*

Uranium One participates in the development of its regions of operation, including Tanzania, where it plans to implement a promising uranium mining project, Mkuju River. In 2017, as part of a joint project with READ International aimed at providing children with access to educational resources in Tanzanian secondary schools, unused classrooms of the Korido secondary school in the Namtumbo District were transformed into well-equipped libraries. Moreover, Uranium One actively assists Tanzanian authorities in their fight against poachers in order to preserve the population of elephants and other wild animals in the Selous Game Reserve.

### 3.3.6. Export of uranium products and natural uranium enrichment services

In 2017, 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 current contracts were fulfilled. The annual sales volume totalled about USD 1.7 billion. Uranium products were supplied to 27 customers from 12 countries.

28 deals worth a total of ~USD 3.3 billion were concluded with 19 customers from nine countries. The portfolio of overseas orders of JSC TENEX totalled USD 17 billion.



*See also the annual report of JSC TENEX for 2017.*

### 3.3.7. Export of nuclear fuel

At year-end 2017, the portfolio of overseas orders of JSC TVEL totalled USD 10.8 billion, while foreign revenue reached USD 1.2 billion.

<b>Table. Export revenue, 10-year portfolio of export orders, USD billion</b>			
	<b>2015</b>	<b>2016</b>	<b>2017</b>
<b>Overseas revenue</b>	<b>1.6</b>	<b>1.4</b>	<b>1.2</b>
<b>Portfolio of overseas orders</b>	<b>10.3</b>	<b>10.1</b>	<b>10.8</b>

In 2017, an NFA delivery contract was signed for the newly commissioned VVR-SM research reactor of the Institute of Nuclear Physics (INP) under the Academy of Sciences of Uzbekistan with the option of further regular supplies and the implementation of an improved uranium-molybdenum fuel.

Contract documents for nuclear fuel supply were signed with CJSC Armenian NPP. Under this contract, an NFA stockpile will be formed.

Fuel supply contracts were signed for Akkuyu NPP (Turkey), Kozloduy NPP (Bulgaria) and the Belarussian NPP.

A package of contract documents for the supply of fuel and components and the provision of engineering services was signed for stage 1 and stage 2 power units of Tianwan NPP (China).

An engineering service contract was signed for the use of modernized second-generation fuel assemblies with an optimized water/uranium rate at the operating power units of Paks NPP (Hungary).

A number of contracts were signed with overseas partners for the testing of zirconium components of fuel and for the supply of fuel components for Western-design research reactors.

The contract for fuel supply for the China Experimental Fast Reactor (CFR) came into force.

ROSATOM continued to promote TVS-KVADRAT fuel for Western-design PWR 17×17 power reactors.

*See also the section 'Fuel Division' and the annual report of JSC TVEL for 2017.*

### 3.3.8. New products for foreign markets

#### Construction of Nuclear Research and Technology Centres abroad, nuclear infrastructure and personnel training

As part of its efforts to promote new products on the global market, ROSATOM has launched projects in the Nuclear Research and Technology Centres (NRTC) segment, offering a product solution based on a research reactor and a set of additional elements for developing nuclear technologies for scientific research and practical applications.

NRTC development projects are aimed at both creating nuclear power capabilities in the customer country and developing nuclear medicine and radiation technologies for the national economy.

In 2017, the first contract was signed in this product segment; it provides for the construction of an NRTC in El Alto (Bolivia).

The Corporation signed a project development agreement and contracts for assessing nuclear infrastructure and conducting preliminary engineering surveys in Zambia, which is a first step towards implementing the project to construct an integrated NRTC in the country.

ROSATOM signed an agreement on the development of an NRTC construction project with the Nigeria Atomic Energy Commission (NAEC).

### Maintenance services

In 2017, JSC Rusatom Service concluded package maintenance service contracts for El Dabaa NPP (Egypt) and Akkuyu NPP (Turkey).

Following the completion of the project to extend the life of power unit No. 5 of Kozloduy NPP, the Bulgarian Nuclear Regulatory Agency issued a licence for the operation of the power unit for the next ten years.

A contract was concluded with MVM Paks NPP for the provision of advisory services related to maintenance and scheduled support of repairs of the main circulating pumps of Paks NPP.

A contract was signed for maintenance, repairs and maintenance personnel training for Bushehr NPP.

### Foreign operations in the nuclear fuel cycle back-end

The Corporation continued to promote reference back-end products, works and services (in the sphere of RAW and SNF management, and decommissioning of facilities posing nuclear and radiation hazards) on the global market.

Mitsubishi Research Institute (Japan) engaged a consortium comprising JSC TENEX and Federal State Unitary Enterprise RosRAO to carry out a feasibility study for the development of a small neutron detector for accurate search and identification of fuel fragments at Fukushima NPP (Japan).

Solid radioactive waste processing and storage facilities were delivered to Ignalina NPP in Lithuania for conducting hot tests.

*See also the section 'Business Diversification'.*

### 3.3.9. Plans for 2018

In 2018, ROSATOM intends to consistently implement the concluded contracts.

<b>NPP, country</b>	<b>Planned work</b>
<b>Asia</b>	
Tianwan NPP, China	Start of warranty operation and preliminary acceptance of power unit No. 3. Start of the first criticality stage (loading of the first batch of fuel) at power unit No. 4. Connection of power unit No. 4 to the power grid (power start-up)
Rooppur NPP, Bangladesh	Start of main construction works at power unit No. 1. Obtaining the licence for the design and construction of power unit No. 2, start of concreting.
Kudankulam NPP, India	Final acceptance of power unit No. 2. Shipment of main equipment for power unit No. 3. Start of performance of the contract for the delivery of long-lead equipment and preparation of a report on the characteristics of the site for power units No. 5 and 6.
<b>Europe</b>	
Belarussian NPP, Belarus	Start of the inspection stage at power unit No. 1. Preparation for the flushing of the open reactor of power unit No. 2.
Paks II NPP, Hungary	Start of on-site work, construction of facilities forming part of the construction and installation base. Development of the Engineering Design and a Preliminary Safety Case, handover of documents to the customer for licensing.
Hanhikivi 1 NPP, Finland	Handover of the bulk of licence documents to the customer.
<b>Middle East and North Africa</b>	
Akkuyu NPP, Turkey	Obtaining the construction licence for power unit No. 1. Start of construction and installation works forming part of the main stage of the 'nuclear' part of the NPP (start of concreting). Start of the licensing procedures. Soil reinforcement under the main buildings of power unit No. 2.
Bushehr-2 NPP, Iran	
El Dabaa NPP, Egypt	Completion of the fourth stage of engineering surveys and acceptance of reports by the customer. Acceptance by the customer of top-priority detailed designs for preparatory construction and installation works. Submission of documents for the construction licence for power units No. 1 and 2. Provision of the site by the customer for the start of the NPP construction.

### Construction of Nuclear Research and Technology Centres, nuclear infrastructure

ROSATOM plans to start construction and installation and preparatory works at the site of the Nuclear Research and Technology Centre in Bolivia. In addition, the Corporation intends to conclude a contract for developing the nuclear infrastructure in Bolivia.

ROSATOM also plans to continue negotiations with over 10 countries on cooperation in constructing NRTCs on their territories.

### Maintenance services, employee training

ROSATOM plans to sign service contracts for the following:

- Technical support for operation, and assistance in maintenance of Rooppur NPP (Bangladesh);
- Technical support and assistance in operation of power units No. 1 and 2 of Kudankulam NPP (India). The Corporation intends to conclude contracts for employee training and education for Hanhikivi 1 NPP (Finland), El Dabaa NPP (Egypt) and Paks II NPP (Hungary) and to start employee training for Rooppur NPP (Bangladesh) and Akkuyu NPP (Turkey).

### Uranium mining abroad

- Fulfilment of all obligations to customers in terms of natural uranium sales;
- Development of commercial infrastructure and increase in the share on the global market for natural uranium;
- Maintaining cost leadership and improving operational efficiency.

### Export of nuclear fuel

- Strengthening the position on the traditional nuclear fuel markets;
- Performing current contracts and implementing the annual programme for nuclear fuel deliveries to overseas customers;
- Developing cooperation with overseas energy companies and industrial partners in promoting TVS-KVADRAT fuel on the target markets;
- Expanding the product range and geographical reach of supplies of fuel and its components for research reactors, including foreign-design models.

### Supply of uranium products and back-end solutions and services

- Negotiations with energy companies on the conclusion of new and renewal of current contracts for the supply of uranium products;
- Improvement of transport and logistics support;
- Promotion of Russian back-end solutions and technologies on the global market.

# 4.0. Clean Energy Generation

## 4.1. Mining Division<sup>14</sup>

Key results in 2017:

- Uranium resources totalled 523,900 tonnes.
- 2,917 tonnes of uranium were produced (the production programme was 100% completed).
- Pilot production of scandium oxide was launched at JSC Dalur.

The Mining Division (the holding company is JSC Atomredmetzoloto) consolidates uranium mining enterprises in Russia<sup>15</sup>, at different stages of the life cycle, from geological exploration to intensive commercial development of deposits.

Strategic priorities of the Division:

- To guarantee that ROSATOM's demand for Russian uranium is met;
- To maintain a competitive cost of uranium production;
- To enable sustainable development of the Division, including through business diversification.

Fig. Link between the Division's goals and the strategic goals of ROSATOM

### INCREASING THE SHARE ON INTERNATIONAL MARKETS

Implemented indirectly (by making ROSATOM's offer on the NFC market more competitive)

- Guaranteeing that the demand for Russian uranium will be met
- Maintaining a competitive cost of uranium production

### NEW PRODUCTS FOR THE RUSSIAN AND INTERNATIONAL MARKETS

Implemented directly:

- Ensuring sustainable profitability, including through business diversification

### REDUCTION OF THE COST OF PRODUCTS AND THE LEAD TIME

Implemented directly:

- Maintaining a competitive cost of uranium production
- Ensuring sustainable profitability, including through business diversification

### 4.1.1. Results in 2017

Table. Mineral resource base and uranium production

	2015	2016	2017
Mineral resource base, kt	521.2	517.9	523.9
Uranium production, t, including:	3,055	3,005	2,917
PJSC PIMCU	1,977	1,873	1,631
JSC Dalur	590	592	592
JSC Khiagda	488	540	694

Table. Achievement of key performance indicator targets

Indicator	2015	2016	2017 target value	2017 actual value
Adjusted free cash flow of the Division, RUB billion	1.7	5.3	1.5	2.1
Labour productivity, RUB million per person	2.6	3.1	3.1	2.8*
Full cost, RUB billion	Not set	15.3	15.9	15.6
LTIFR <sup>16</sup>	0.23	0.44	0.54	0.28
Number of events rated at level 2 or higher on the INES scale	0	0	0	0

\* The target for labour productivity was not achieved mainly due to external factors beyond the Division's control: a decrease in the USD exchange rate and lower uranium prices.

<sup>14</sup> For details about the Division's results, see the report of JSC Atomredmetzoloto for 2017.

<sup>15</sup> Uranium is mined abroad by Uranium One, an organization of ROSATOM (see the section 'International Business').

<sup>16</sup> Hereinafter, the Lost Time Injury Frequency Rate (LTIFR) is the number of lost time injuries against the total hours worked in the reporting year normalized to 1 million man-hours.

### Operating results

In 2017, the Division produced 2,917 tonnes of uranium. The Division's uranium mining enterprises completely fulfilled the production plan. Between 2015 and 2017, the Division reduced the share of high-cost uranium production (underground mining) and increased production using less costly uranium mining technologies (drillhole in-situ leaching).

PJSC PIMCU, the Division's key uranium mining enterprise, managed to remain breakeven for the second year in a row. The start of financing of the construction of Mine No. 6 in PJSC PIMCU was one of the key results of the reporting year: the first tranche was allocated for infrastructure construction. The launch of the new mine will promote the development of the enterprise and the town of Krasnokamensk.

JSC Khiagda completed the physical start-up of the local sorption unit forming part of the mining complex and auxiliary infrastructure facilities at the Vershinnoye deposit. Pilot operation was conducted at the Istochnoye deposit.

JSC Dalur started to prepare for the development of a new uranium deposit, Dobrovolnoye. Its commissioning will help to maintain uranium output at the current level in the long term. This is one of the most significant projects for the social and economic development of the region.

In 2017, there were no fatalities at the enterprises of the Division.

### The Division's digital economy projects

JSC Khiagda is developing smart in-situ leaching process simulation methods as part of the Smart Mine project. An IT system is being developed based on a 3D model map of the ore field. The system will model and track mining processes in real time using video surveillance and smart sensors.

The system will make it possible to:

- Promptly and precisely identify ore location in the deposit, ore body characteristics, the best uranium mining method, etc.;
- Model well performance;
- Plan mining operations and the equipment maintenance schedule.

A promising area of development of the Smart Mine project is the Smart Hard Hat, a system making it possible to monitor an employee's physical condition, location, heart rate and body temperature.

### Contribution to the implementation of ROSATOM's strategy

#### ■ Increase of the international market share

The Division continued to expand its footprint on international markets. In 2017, a 'pilot' batch of uranium and coal produced by PJSC PIMCU was delivered to China.

#### ■ Reduction of the cost of products and the lead time

In 2017, the Division reduced the unit cost of uranium production by 2% compared to 2016 by increasing the share of uranium mining at enterprises using the drillhole in-situ leaching technique. Further efforts were undertaken to improve performance. Overall savings from operational efficiency improvement measures (including the use of the tools forming part of ROSATOM's Production System) totalled RUB 1.3 billion.

#### ■ New products for the Russian and international markets

In 2017, JSC Dalur commenced pilot production of high-purity scandium oxide. As part of the construction of a mining and processing plant at the Pavlovskoye lead and zinc deposit on the island of Novaya Zemlya, engineering field surveys were completed; design work was commenced, and preliminary product sale agreements were signed with anchor customers. In addition, in the reporting year, ROSATOM approved the Division's initiatives on the production of titanium, lithium and other rare metals.

Fig. Geography of projects of new businesses

Road map for the launch\* of projects:



\*Date when the project will start to generate revenue

- 1 Improving the processing depth of the mineral resource base and industrial waste:
  - Sized coal
  - Scandium
  - Pyrite cinders
- 2 Implementation of large-scale partner greenfield projects:
  - Pavlovskoye
  - Lithium
  - Titanium
  - Severnoye (gold)



## Contribution to sustainable development

JSC Atomredmetzoloto does business as a socially responsible company, whose sustainable development promotes the well-being of the territories in which it operates.

The Division's sustainable development goals are as follows:

- To participate in maintaining the sustainability of the global uranium market, national and regional economies and a balance between stakeholders' reasonable expectations and interests;
- To minimize the negative environmental impact of the industry, use mineral resources efficiently, conserve resources and comply with international environmental standards;
- To assume social responsibility for the safety, health and professional development of personnel, social and economic well-being of the population in the regions of operation, support local communities and engage in charity.

The Corporation made an important contribution to the development of its regions of operation by implementing a large-scale joint project with PJSC Rostelecom to build fibre optic links (FOLs) in the Bauntovsky and Yeravninsky districts (Republic of Buryatia). The project allowed the Division's organization JSC Khiagda to increase the speed of communication between the production site in the Bauntovsky district and the office in the city of Chita. In addition, the 218 km long FOLs provided a number of towns and villages in the Republic of Buryatia with high-speed connectivity.

## 4.2. Fuel Division<sup>17</sup>

Key results in 2017:

- Mass production of modernized generation 9+ gas centrifuges was launched.
- A number of contracts were signed for the supply of nuclear fuel for Russian-design NPPs that are in operation and under construction (China, Ukraine, Bulgaria, Egypt, Turkey and Belarus).
- Single industry integrators were established for new businesses: Energy Storage Systems and Additive Manufacturing Technologies.

The Fuel Division is responsible for uranium enrichment, development and manufacture of gas centrifuges and associated equipment, development, fabrication and sale of nuclear fuel and non-nuclear products. The Division's holding company is JSC TVEL.

The Division supplies nuclear fuel for:

- 72 power units in Russia and 13 countries in Europe and Asia;
- 15 research reactors around the world;
- all propulsion reactors in the Russian nuclear-powered fleet.

One in every six reactors in the world currently use the fuel produced by the Division.

The Division's strategic goals until 2030:

- To increase its share on the markets for uranium enrichment and nuclear fuel fabrication services (in particular, to 22% on the fabrication market) by producing traditional products with high consumer properties and expanding to new nuclear markets;
- To double revenues in comparable terms against 2014;
- To boost revenue from non-nuclear businesses (including newly created businesses) more than tenfold in comparable terms against 2014;
- To increase labour productivity almost threefold in comparable terms against 2014.

### 4.1.2. Plans for 2018

The Division's key objectives:

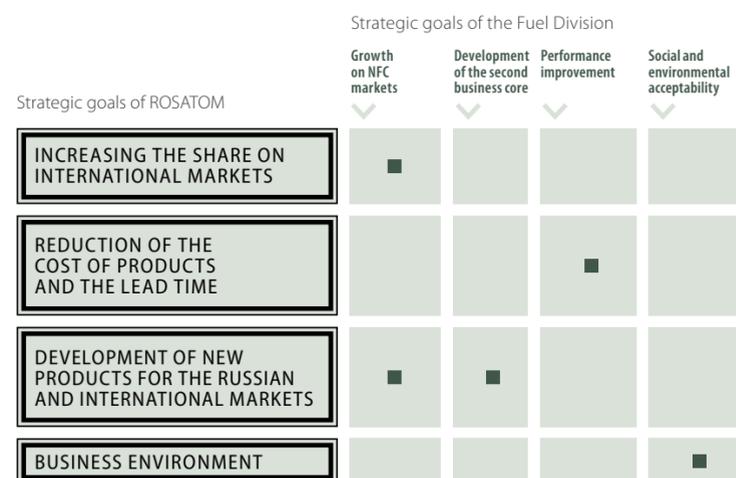
- To continue to implement the cost management programme;
- To implement the programme to build Mine No. 6 in PJSC PIMCU;
- To increase scandium oxide output in the interests of Russian high-technology enterprises (as part of business diversification);
- To maintain a zero fatality rate across the Division's enterprises.

Table. Key performance indicators for 2018

Indicator	Target value
Adjusted free cash flow in the nuclear fuel cycle front end (NFC FE ACFE), RUB billion	120.7*
Full cost, RUB billion	15.4
Labour productivity, RUB million per person	2.35
Nuclear fuel cycle front-end inventories, RUB billion	109
LTIFR / decrease in the severity of injuries at production sites of enterprises, including contractors, %	0.49/30
Number of events rated at level 2 or higher on the INES scale	0

\* Starting from 2018, the total ACFE is calculated for JSC Atomredmetzoloto, JSC TVEL, JSC TENEX and Uranium One Group.

Fig. Link between the Division's goals and the strategic goals of ROSATOM



<sup>17</sup> For details about the Division's results, see the report of JSC TVEL for 2017.

### 4.2.1. Results in 2017

Table. Achievement of key performance indicator targets

Indicator	2015	2016	2017 target value	2017 actual value
Adjusted free cash flow of the Division, RUB billion	86.6	83.9	67.1	76.4
Semi-fixed costs, RUB billion	35.9	36.9	38.5	36.4
Labour productivity, RUB million per person	8.4	8.25	8.5	8.5
10-year portfolio of overseas orders, USD billion	10.3	10.1	10.1	10.8
Revenue from overseas orders, USD million	1,609	1,415	1,029	1,200
The Division's revenue from new products (outside the scope of the Corporation <sup>18</sup> ), RUB billion	4.0	7.0	8.7	6.1
The Division's 10-year portfolio of orders for new products (outside the scope of the Corporation), RUB billion	10.3	10.1	4.9	7.2
LTIFR	0.14	0.09	0.30	0.06
Number of events rated at level 2 or higher on the INES scale	0	0	0	0

#### Operating results

PJSC KMZ and LLC RME Centrotech started mass production of modernized generation 9+ gas centrifuges. The modernized gas centrifuge significantly outperforms previous models in terms of productivity and has a lower production cost.

As part of the Proryv project, preliminary tests were successfully conducted on a unique carbothermal nitride synthesis complex built at the request of JSC SCC. JSC SCC performed acceptance tests of the 16<sup>th</sup> experimental NFA with mixed nitride uranium-plutonium fuel, and the assembly was installed in the BN-600 reactor core. See also the section 'Research and Innovations'.

#### Contribution to the implementation of ROSATOM's strategy

##### ■ Increase of the international market share

At year-end 2017, the 10-year portfolio of overseas orders for conventional products totalled USD 10.8 billion.

The Division expanded its cooperation with foreign energy companies and industry partners in promoting TVS-KVADRAT fuel on target markets.

A number of contracts were signed for the supply of nuclear fuel for Russian-design NPPs that are in operation and under construction (China, Ukraine, Bulgaria, Egypt, Turkey and Belarus).

The Division continued to cooperate with Framatome<sup>19</sup> on the production of nuclear fuel and components from reprocessed uranium for PWR-reactor NPPs in Europe using Framatome's technologies at the production sites of PJSC MSZ.

##### ■ Reduction of the cost of products and the lead time

The Division launched a project to concentrate the operations of JSC VPA Tochmash (the city of Vladimir) and PJSC KMZ (the city of Kovrov in the Vladimir Region). By 2019, relocation of the main production site of PJSC KMZ to the city of Kovrov will help to reduce the production cost of gas centrifuges and the enterprises' total costs by 11.5% and almost 50% respectively. The concentration of operations will involve the transfer of employees and provision of housing in the city of Kovrov, as well as helping redundant employees to find employment in the city of Vladimir.

The Division is working to improve the use and reduce the area of production sites. Since 2009, the area occupied by the Division's nuclear fuel cycle business has already been reduced by a factor of 2.5. By 2022, the area of land plots and buildings should decrease from 19,200 ha to 8,100 ha and from 6.6 million sq. m to 4.6 million sq. m respectively.

##### ■ New products for the Russian and international markets

A contract was concluded with a leading Russian steel and rolled steel producer for the supply of a large batch of calcium injection wire.

A single industry integrator, LLC RME Centrotech, was established within the Division for a new business area: Energy Storage Systems. In-plant electric transport of the Division's organizations JSC UEIP and JSC PA ECP was fitted with Li-ion batteries, which replaced conventional rechargeable batteries. A contract was concluded with CJSC TROLZA (one of the leading Russian producers of autonomous passenger vehicles) for the production and supply of energy storage devices based on Li-ion batteries. A single industry integrator, LLC RusAT, was established within the Division for a new business area: Additive Manufacturing Technologies. The four key areas of its business are as follows:

- Development of integrated software packages for the entire additive manufacturing life cycle;
- Manufacturing of a range of process equipment, including 3D printers and their components;
- Production of materials and metal powder for 3D printing;
- Rendering 3D printing services and integrating additive manufacturing technologies into production.

#### The Division's digital economy projects

■ In 2017, the Division launched a project to develop an information system for managing experimental and engineering data. The project is aimed at building a shared information space for managing engineering data about the Division's products.

■ Simulation modelling was started as part of the Division's programme to concentrate its operations. Simulation modelling of operations is designed to create a digital model that describes in detail the technology of an existing production facility or a facility under construction in order to build an ideal process flow and search for the best composition and arrangement of process equipment meeting various criteria.

■ The Division launched a pilot project to develop a data mining and robotics system and integrate it into procurement processes.

In 2017, a pilot prototype of a second-generation multi-powder metal 3D printer was assembled; the start of batch production is scheduled for 2018. Domestically manufactured printers will be 20% cheaper than foreign analogues.

#### Contribution to sustainable development

The Division contributes to sustainable development in the following areas:

- Social partnership in the regions of operation;
- Projects to create new jobs and foster a business environment;
- Educational and health care projects;
- Charity;
- Ensuring environmental safety and remediation.

A project titled 'My Home. My Courtyard. My Family' forms part of the Division's strategic social initiative aimed at developing the towns and cities in which it operates and improving living conditions. In 2017, the project covered the following key areas:

- Installing workout facilities;
- Establishing the institute of courtyard coaches (instructors) giving free lessons to children and young adults;
- Holding workout competitions in the form of festivals at the level of neighbourhoods and the city as a whole;
- Engaging official organizations (the Workout Federation) and large and popular local communities to organize and hold workout festivals.

### 4.2.2. Plans for 2018

Table. Key performance indicators for 2018

Indicator	Target value
Adjusted free cash flow (JSC TVEL + JSC TENEX + JSC Atomredmetzoloto + Uranium One Group), RUB billion	120.7*
Semi-fixed costs, RUB billion	36.9
Labour productivity (JSC TVEL + JSC TENEX), RUB million per person	10.5
The Division's revenue from new products (outside the scope of the Corporation), RUB billion	8.7
The Division's 10-year portfolio of overseas orders, USD billion	11.9
LTIFR	0.3
Number of events rated at level 2 or higher on the INES scale	0

\* Starting from 2018, the total ACFE is calculated for JSC Atomredmetzoloto, JSC TVEL, JSC TENEX and Uranium One Group.

<sup>18</sup> In 2015 and 2016, revenue from new products and the portfolio of new products were calculated taking into account intra-group turnovers; starting from 2017, only the volumes outside the scope of the Corporation are calculated. Therefore, data for 2015 and 2016 has been recalculated and only indicates revenue from new products and the portfolio of new products outside the scope of ROSATOM.

<sup>19</sup> Formerly AREVA NP.

## 4.3. Mechanical Engineering Division<sup>20</sup>

### Key results in 2017:

- Mechanical engineering products were delivered on time to 11 NPPs in Russia and abroad.
- Contracts were signed for the package supply of nuclear island and auxiliary equipment to Rooppur NPP (Bangladesh).
- A strategic partnership and cooperation agreement was signed with the country's largest LNG producer.
- The Division became a single-source supplier of boiler and turbine island equipment for waste-to-energy plants.
- Contracts were concluded for the production and supply of mini HPPs in Russia and South Africa.

The Mechanical Engineering Division (its holding company is JSC Atomenergomash) is one of Russia's largest groups of mechanical engineering enterprises (29.5% of the market) 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 over 20 power machine engineering enterprises, including manufacturing, research, service and engineering organizations in Russia, the Czech Republic, Hungary and other countries.

Fig. Link between the Division's goals and the strategic goals of ROSATOM



■ Alignment of the Division's objectives with ROSATOM's strategic goals

### 4.3.1. Results in 2017

Table. Achievement of key performance indicator targets

Indicator	2015	2016	2017 target value	2017 actual value
Unit semi-fixed costs, %	41.4	31.5	34.8	34.9
Labour productivity, RUB million per person	2.9	3.7	4.4	4.05
The Division's 10-year portfolio of orders for new products (outside the scope of the Corporation), RUB billion <sup>21</sup>	75.2	65.9	62.8	91.5
LTIFR	0.42	0.25	0.42	0.21
Number of events rated at level 2 or higher on the INES scale	0	0	0	0

### Contribution to the implementation of ROSATOM's strategy

#### ■ Increase of the international market share

In the reporting year, contracts were signed for the package supply of nuclear island and auxiliary equipment to Rooppur NPP (Bangladesh). The Division is also a single-source supplier of equipment for a nuclear steam generator for the second stage of Kudankulam NPP (India), four power units of Akkuyu NPP (Turkey), Hanhikivi 1 NPP (Finland) and the first and second power units of the Belarusian NPP. In partnership with General Electric, the Division is carrying out contracts for package supply of the turbine hall, including turbine unit equipment, for Akkuyu and Hanhikivi 1 NPPs. In addition, the Division continues to produce auxiliary turbine hall equipment for Kudankulam NPP (India) and Bushehr NPP (Iran) right on schedule, in accordance with the contract.

#### ■ Reduction of the cost of products and the lead time

In 2017, the Division continued to improve its performance using the tools forming part of ROSATOM's Production System (RPS). During the year, 486 RPS projects and 2,422 proposals for improvement were implemented, with total savings reaching ~RUB 590 million. At year end, the Division reported a 9.3% increase in labour productivity.

#### ■ New products for the Russian and international markets

The Division's plants in Volgodonsk and Petrozavodsk manufactured three columns for refineries in Moscow and Omsk. This unique equipment had never been produced in Russia before. Equipment supply contracts for two small HPPs were concluded. A salt plant in the Kaliningrad Region and a water treatment complex at the ZapSibNefteKhim petrochemical plant are being built based on the technology and designs developed by JSC SverdNIKhimmash, an organization of the Division. In the Thermal Power segment, equipment was produced for CHPP-1 of JSC Arkhangelsk Pulp & Paper Mill. In 2017, the Division became a single-source supplier of boiler and turbine island equipment for waste-to-energy plants that are being built as part of the Energy from Waste project. A strategic partnership and cooperation agreement was signed with the country's largest LNG producer. It enables the Division to take part in the localization of complex process equipment for LNG production. The first contracts under the agreement are already being carried out.

### Contribution to sustainable development

The Division follows socially responsible business practices and prioritizes job creation both at its own sites and those of its suppliers. In addition, the Division's regional enterprises participate in the beautification and infrastructure development in the regions of operation, and in charity projects.

The following events were conducted in 2017:

- A Day of Good Deeds for abandoned newborn babies in the Nizhny Novgorod Regional Children's Hospital;
- A New Year event for child patients in the surgery department of Children's Hospital No. 27 Aybolit;
- A charity event titled 'New Year for Everyone' for children from orphanages.
- Charitable donations were given to the Korsar Sports Club for the Disabled in Podolsk for the purchase of equipment and sports gear, and to School No. 1 in the town of Vyazniki for targeted payment for treatment and the purchase of drugs for cancer patients.

### 4.3.2. Plans for 2018

In 2018, the Division's strategy will continue to prioritize timely performance of all contractual obligations, improved operational performance (including through the systematic implementation of RPS), increase of export contract volumes and revenue growth across all areas of business.

Table. Key performance indicators for 2018

Indicator	Target value
Adjusted free cash flow (Mechanical Engineering Division and Engineering Division), RUB billion	5.0*
Unit semi-fixed costs, % of revenue	35.1
Labour productivity, RUB million per person	4.9
The Division's revenue from new products (outside the scope of the Corporation), RUB billion	37.1
The Division's 10-year portfolio of overseas orders, USD billion	2.8
LTIFR	0.38
Number of events rated at level 2 or higher on the INES scale	0

\* Starting from 2018, the total ACF is calculated for JSC Atomenergomash and ASE Group of Companies.

<sup>20</sup> For details about the Division's results, see the report of JSC Atomenergomash for 2017.

<sup>21</sup> In 2015 and 2016, revenue from new products and the portfolio of new products were calculated taking into account intra-group turnovers; starting from 2017, only the volumes outside the scope of the Corporation are calculated. Therefore, data for 2015 and 2016 has been recalculated and only indicates the portfolio of new products outside the scope of ROSATOM.

## 4.4. Engineering Division<sup>22</sup>

### Key results in 2017:

- The first criticality programme was launched at power unit No. 4 of Rostov NPP and power unit No. 1 of Leningrad NPP-2.
- As of December 31, 2017, 8 power units of NPPs were under construction in Russia.
- The transformation of the Engineering Division into a digital company was launched.
- A contract for PMC services outside the scope of the industry was signed with Electricite de France.

ROSATOM's Engineering Division is one of the leaders in the global nuclear engineering business. The Division comprises major design institutes in Moscow, Saint Petersburg and Nizhny Novgorod. Its holding company is JSC ASE EC (the Division operates on the international market under the brand name ASE). The Division's main strategic goal until 2030 is to remain the leader on the global market in terms of the number of NPP power units under construction. The Engineering Division is an EPC contractor for most NPP power units under construction and an absolute leader on the Russian market.

### Fig. Link between the Division's goals and the strategic goals of ROSATOM



### Competitive advantages of the Division:

- References on the Russian and foreign markets;
- Safe standard designs with generation 3/3+ VVER reactors that are competitive in terms of LCOE, capital expenses and the duration of construction;
- A well-developed project management system for the construction of NPPs and other complex engineering facilities;
- Multi-D, an integrated industrial and technological platform for managing capital construction projects;
- A highly competent management team and operating personnel with extensive experience in building NPPs and other complex engineering facilities;
- In-house design capabilities;
- Extensive engineering and technical capabilities.

### 4.4.1. Results in 2017

#### Achievement of key performance indicator targets

Indicator	2015	2016	2017 target	2017 actual
Adjusted free cash flow of the Division, RUB billion	0.2	-3.6	23.7	25.0
10-year portfolio of overseas orders, USD billion	70.1	92.3	100.6	90.8
Revenue from overseas orders, USD billion	1.6	1.5	2.3	2.3
The Division's revenue from new products (outside the scope of the Corporation) <sup>23</sup> , RUB billion	10.1	6.2	11.9	8.3 <sup>24</sup>
The Division's 10-year portfolio of orders for new products (outside the scope of the Corporation), RUB billion	59.5	90.8	83.5	91.9
LTIFR (including contractors)	0.16	0.21	0.35	0.06
Number of events rated at level 2 or higher on the INES scale	0	0	0	0

#### NPP construction in Russia<sup>25</sup>

#### ■ Novovoronezh NPP-2, power unit No. 2

Voltage was produced for the NPP's own needs under the design layout, and the flushing of the open reactor was commenced.

#### ■ Rostov NPP, power unit No. 4

On December 6, 2017, the first NFAs were loaded, which marked the start of the first criticality stage at power unit No. 4 of Rostov NPP. Rostov NPP is the only nuclear power plant in modern Russia to launch three power units at one site within seven years (power unit No. 2 in 2010, power unit No. 3 in 2015 and power unit No. 4 in 2017) and the first NPP in modern history to resume so-called 'continuous construction'. Power unit No. 4 is the last power unit under construction at Rostov NPP, essentially concluding the legendary series of power units with VVER-1000 reactors, which incorporate state-of-the-art approaches to safety based on the defence-in-depth principle.

#### ■ Leningrad NPP-2, power unit No. 1

On December 8, 2017, the first criticality stage was launched at power unit No. 1 with a VVER-1200 reactor at Leningrad NPP-2. It is a state-of-the-art generation 3+ reactor meeting all the latest safety requirements. Power unit No. 1 of Leningrad NPP-2 has become the second generation 3+ power unit launched in Russia (the first one was power unit No. 1 of Novovoronezh NPP-2, which successfully started commercial operation in February 2017). The VVER-1200 design has a number of advantages compared to conventional power units of the same type which significantly improve its characteristics. In particular, the capacity of the reactor unit has improved by 20% compared to the previous generation (VVER-1000), while the operational life of main equipment has doubled to 60 years with a potential for extension for another 20 years.

<sup>22</sup> For details, see the section 'International Business' and the report of the Engineering Division for 2017.

<sup>23</sup> In 2015 and 2016, revenue from new products and the portfolio of new products were calculated taking into account intra-group turnovers; starting from 2017, only the volumes outside the scope of the Corporation are calculated. Therefore, data for 2015 and 2016 has been recalculated and only indicates revenue from new products and the portfolio of new products outside the scope of ROSATOM.

<sup>24</sup> Given the adjustment of the target KPI, work in the Research Reactors segment was excluded.

<sup>25</sup> For details on NPP construction abroad, see the section 'International Business'.

#### ■ Kursk NPP-2, power units No. 1 and 2

The NPP is being constructed according to the VVER-TOI design<sup>26</sup>. The VVER-TOI design is being developed based on the designs of VVER.1200E, relying as much as possible on the experience of industry organizations in NPP design based on VVER-1200 technology (Novovoronezh NPP-2). VVER-TOI complies with the main international standards and regulations, including WENRA, the IAEA, the EUR and the NRC.

In 2017, preparatory work was carried out at the NPP site, including the organization of the construction base, earthworks and laying of the foundations of buildings and structures. Reinforcement of the foundation slab of the reactor building was started at power unit No. 1.

#### Contribution to the implementation of ROSATOM's strategy

#### ■ Increase of the international market share, new products for the Russian and international markets

2017 saw the completion of the active stage of construction of the first stage of facilities for the decommissioning of Ignalina NPP (Lithuania).

Construction of a national radioactive waste storage facility was launched in Bulgaria (the project is being implemented by a consortium of Russian and Bulgarian companies).

Contracts for the decommissioning of Biblis NPP (Germany) were concluded with regard to the dismantling of steam generators.

An agreement was signed with EDF on the implementation of an information management system.

#### ■ Reduction of the cost of products and the lead time

In 2017, performance improvement measures (including the use of RPS tools and digital technologies) helped to achieve the following:

- NPP construction projects abroad were implemented on time and on budget;
- The Division's semi-fixed costs were reduced to RUB 27.2 billion (7.7% below the target).

#### ■ TCM NC Programme

In 2017, ROSATOM launched a programme to create and implement a system for integrated management of the time and cost of construction of nuclear facilities (Total Cost Management Nuclear Construction, TCM NC). The Programme is aimed primarily at reducing the duration and cost of NPP construction in order to maintain the Corporation's leadership in the global nuclear industry.

The TCM NC Programme will enable:

- A 20% reduction in the amount of time required to prepare design documents and cost estimates;
- A 50% decrease in the risks of changes in the design;
- A 20% reduction in the construction planning time;
- A 20% reduction in the cost of preparatory and construction works.

Key participants of the programme include the Industry Centre of Capital Construction, the NPP Product Project Office, the Engineering Division, JSC Rusatom Overseas and JSC Greenatom.

The Division implemented a system for incentivizing investment and construction projects in order to enable a reduction in the cost and duration of construction of facilities.

#### Digital transformation of the Engineering Division

In June 2017, ROSATOM represented by JSC ASE EC became one of the digital economy competence centres under the Russian Government. JSC ASE EC also became a representative of the Building Smart Alliance in Russia. The Main Digital Laboratory was established in the Division.

As part of the digital transformation programme, the Division signed important agreements with Russian and foreign organizations:

- on cooperation with IBM Corporation;
- with Autodesk on the use of information modelling (BIM);
- with Assystem SA, SAP CIS, HILTI;
- with the SKOLKOVO Moscow School of Management and the Centre for Strategic Research North-West Foundation on establishing a Digital Transformation Institute;

- with the National Nuclear Research University MEPhI on the establishment of the Higher Engineering School;
- with the Government of the Nizhny Novgorod Region on cooperation in the application of information technologies;
- with the Industry Development Fund of the Russian Ministry of Industry and Trade on cooperation on the development of a national information system for the industry.

#### The Multi-D digital platform for managing the life cycle of complex engineering facilities enables:

- a reduction in the cost and duration of construction of complex engineering facilities;
- optimization of construction and installation works, and detailed planning of the sequence of work activities;
- saving up to 10% of the project budget;
- an integrated web-based space for managing capital construction projects;
- adoption of global best practices in the sphere of digital assets and project management;
- compliance with BIM 4.0 approaches;
- partnership with a leading Russian engineering company.

#### Contribution to sustainable development

The Division's key contributions to sustainable development include the following:

- Ensuring energy security in 23 countries around the world;
- Carrying out nationwide investment projects in a number of countries;
- Positive economic and social impact at the regional, national and international levels (in 2017, the Division created 3,678 jobs, mostly at NPP construction sites in foreign countries);
- Rolling out 'nuclear' know-how in related industries;
- Fulfilling social obligations;
- Meeting the standards of national and international jurisdictions and partnering with Russian and international organizations.

#### 4.4.2. Plans for 2018

In Russia, power start-ups are planned at power unit No. 4 of Rostov NPP and power unit No. 1 of Leningrad NPP-2.

Concreting of the foundation slab ('first concrete') is planned on the construction site of Kursk NPP-2. For details on plans to build NPPs abroad, see the section 'International Business'.

#### Table. Key performance indicators for 2018

Indicator	Target value
Adjusted free cash flow (Mechanical Engineering Division and Engineering Division), RUB billion	5.0*
LTIFR (including contractors)	0.32
Number of events rated at level 2 or higher on the INES scale	0

\* Starting from 2018, the total AFCF is calculated for JSC Atomenergomash and ASE Group of Companies.

<sup>26</sup> Standard optimized and computerized design of an NPP with two power units with a VVER reactor.

## 4.5. Power Engineering Division<sup>27</sup>

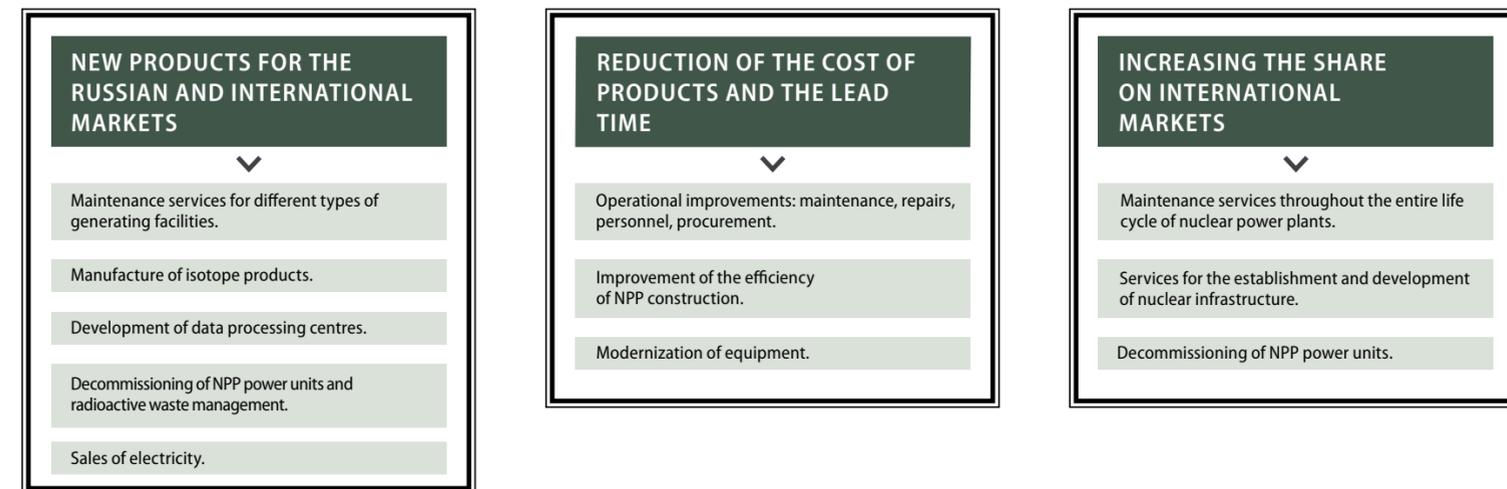
Key results in 2017:

- Power generation by Russian nuclear power plants reached a new all-time high and totalled 202.9 billion kWh (which is comparable to electricity consumption in Moscow and the Moscow Region over two years).
- Installed capacity of 10 Russian NPPs (35 power units) totalled 27.9 GW.
- The NPP capacity factor stood at 83.3%.

The Power Engineering Division generates electricity and heat at nuclear power plants and acts as the operator of all Russian NPPs. JSC Rosenergoatom Concern, the Division's holding company, is Russia's largest power generation company and ranks second in the world in terms of installed capacity among

NPP operators. The Division's mission is to provide consumers with energy produced by Russian NPPs; its top priority is to ensure safety.

Fig. Link between the Division's goals and the strategic goals of ROSATOM



### 4.5.1. Results in 2017

Table. Achievement of key performance indicator targets

Indicator	2015	2016	2017 target value	2017 actual value
Adjusted free cash flow of the Division, RUB billion	107.7	113.7	163.5	177.5
Nuclear power generation, billion kWh	195.2	196.4	201.1	202.9
Unit semi-fixed costs, RUB '000/MW	1,955	1,670	1,776	1,667
Index of implementation of the Division's investment programme, %	99.75	98.6	100	98.7
Labour productivity, RUB million per person <sup>28</sup>	6.35	7.0	8.5	8.65
The Division's revenue from new products (outside the scope of the Corporation), RUB billion	45.3	54.1	53.5	60.5
LTIFR (including contractors)	0.02	0.065	0.15	0.08
Number of events rated at level 2 or higher on the INES scale	0	0	0	0

### Operating results

In 2017, electricity output at 35 power units of 10 operating NPPs totalled 202.9 billion kWh, reaching a new all-time high in the history of Russian nuclear power generation (in 2016, electricity output totalled 196.4 billion kWh).

The NPPs' capacity factor amounted to 83.3% (83.1% in 2016). Nuclear power generation accounted for 18.9% of the total electricity output in Russia (18.3% in 2016).

On February 27, 2017, power unit No. 1 of Novovoronezh NPP-2 with a VVER-1200 reactor started commercial operation. This is the first generation 3+ power unit in Russia and worldwide. *Power*, a prestigious US energy magazine, ranked power unit No. 1 of Novovoronezh NPP-2 among the top three power plants of the world in 2017.

The Division continued to build the floating thermal nuclear power plant (FTNPP) with an installed capacity of 70 MW, as well as hydraulic structures and onshore facilities in the town of Pevek (Chukotka Autonomous District), where the FTNPP will be located. The loading of nuclear fuel into the reactor and the first criticality stage are scheduled for 2018. The commissioning of the FTNPP is scheduled for late 2019.

<sup>27</sup> For details about the Division's results, see the report of JSC Rosenergoatom Concern for 2017.

<sup>28</sup> In 2015 and 2016, revenue from new products and the portfolio of new products were calculated taking into account intra-group turnovers; starting from 2017, only the volumes outside the scope of the Corporation are calculated. Therefore, data for 2015 and 2016 has been recalculated and only indicates revenue from new products outside the scope of ROSATOM.

### Contribution to the implementation of ROSATOM's strategy

#### ■ Increase of the international market share

The Power Engineering Division services Russian-design NPPs abroad. For details, see the section 'International Business'.

#### ■ Reduction of the cost of products and the lead time

In 2017, 39 repairs were conducted at 32 power units of NPPs with a total duration of 1,826.5 days (with the planned duration totalling 1,995 days). The duration of repairs was reduced by a total of 168.5 days due to:

- Thorough search for and elimination of unproductive losses of work time during scheduled maintenance as part of the development of ROSATOM's Production System;
- The use of a conservative approach to the scheduling of power unit maintenance providing additional slack time for the correction of defects;
- The absence of defects affecting the duration of the critical path of repairs.

Overall, the reduction in the duration of equipment repairs at NPPs enabled additional power generation totalling about 2 billion kWh.

The Division continued to implement the RPS tools. In 2017, overall savings from the implementation of RPS projects and proposals for improvement reached RUB 499.4 million.

#### ■ New products for the Russian and international markets

In 2017, the Division's sales unit JSC AtomEnergSbyt continued to operate as the 'energy supplier of last resort' in the Kursk, Tver, Smolensk and Murmansk Regions. The net electricity supply totalled 16.2 billion kWh, up by 0.8% YoY (16.04 billion kWh in 2016). Electricity supply

to households increased (by 7% YoY), while supply to industrial and equivalent consumers decreased (by 4% YoY), with net supply to other consumers remaining unchanged. All branches of JSC AtomEnergSbyt are developing additional products (B2B and B2C).

### Contribution to sustainable development

The Division attaches special importance to developing social capital and the regions of operation and investing in infrastructure. Most investment programmes of JSC Rosenergoatom Concern include the construction of social facilities. Key infrastructure facilities in the towns and cities where NPPs are located were created during the construction of NPPs.

In 2017, the Fund for Fostering Development of Municipal Entities Association of Nuclear Power Plants' Territories (founded by JSC Rosenergoatom Concern and local governments of the municipalities where NPPs are located) launched a new programme to develop small and medium-sized businesses. In addition, in 2017, housing and courtyard improvements were made, and new recreational areas were created in all regions of operation as part of the Urban Environment federal project.

## 4.6. Nuclear-Powered Icebreaker Fleet

Key results in 2017:

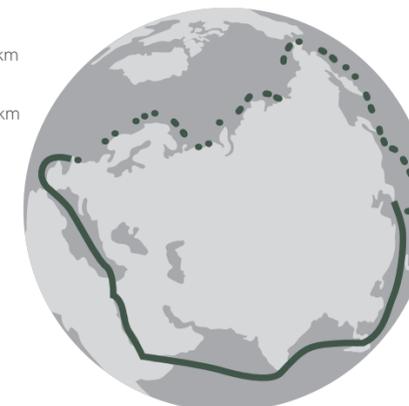
- Nuclear icebreakers escorted 492 vessels with a total gross tonnage of 7.2 million tonnes along the Northern Sea Route (up by 36% compared to 2016).
- The hull of the first follow-on multipurpose nuclear icebreaker, *Sibir*, was launched in Saint Petersburg.
- The work to extend the service life of the nuclear power unit of the *Vaygach* and *Taymyr* nuclear icebreakers was completed.

Russia owns the world's only nuclear-powered icebreaker fleet and has a long track record in the construction and operation of nuclear icebreakers. Icebreakers equipped with nuclear power units help vessels navigate along the Northern Sea Route, making it possible to reduce the distance from Europe to Asia by more than a third.

The nuclear-powered icebreaker fleet owned by ROSATOM participates in mining projects in the Arctic that are strategically important for Russia's economic development.

### Fig. Northern Sea Route

- Northern Sea Route – 14,000 km
- Southern Sea Route – 23,000 km



ROSATOM's research team is developing the digital model of an unmanned vessel (UV), which will help to improve the efficiency of maritime transportation in the Arctic. The UV will enable a significant improvement in the design of the hull and will make it possible to eliminate the need for expensive support systems and increase the capacity of the cargo hold and the amount of time that the vessels can spend at sea. This will considerably reduce the cost of cargo shipping along the Northern Sea Route.

The nuclear-powered icebreaker fleet includes:

- 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 ROSATOM's enterprise FSUE Atomflot, which has the status of a federal nuclear organization.

#### 4.6.1. Key results in 2017

In 2017, nuclear icebreakers escorted 492 vessels with a total gross tonnage of 7.2 million tonnes along the Northern Sea Route (410 vessels with a total gross tonnage of 5.3 million tonnes in 2016).

Given that cargo traffic is set to grow, ROSATOM is upgrading and modernizing its icebreaker fleet on a large scale. The construction of three new project 22220 multipurpose nuclear icebreakers is underway: Arktika was launched in 2016, and Sibir was launched in 2017. The slipway stage of construction of the Ural multipurpose nuclear icebreaker continues.

In addition, in 2017, work was performed to extend the service life of the nuclear power unit of the Vaygach and Taymyr nuclear icebreakers to 200,000 hours. This helped extend the service life of the nuclear ships by five years. Systematic implementation of the programme to extend the service life of reactor units helps to completely prevent the risk of unavailability of icebreakers and to gradually switch to the operation of project 22220 multipurpose nuclear icebreakers, thus strictly complying with all contractual obligations.

#### ■ Reduction of the cost of products and the lead time

The project to create an extensive database of satellite information about the ice conditions in the Arctic from new alternative sources helped to reduce expenditure on obtaining satellite radar images by RUB 9.7 million.

#### ■ New products and services

Key customers placing orders for new products and services in 2017 included large Russian oil and gas and metals companies.

On November 8, 2017, the first icebreaking tugboat, Yuribey, was put into operation as part of the investment project to create a fleet of port vessels for the needs of OJSC Yamal LNG. The construction of the second icebreaking tugboat, Nadym, and the port icebreaker, Ob, continued. In total, the Corporation intends to build two port tugboats, two icebreaking tugboats and one port icebreaker. The vessels will enable the year-round safe mooring of large-capacity vessels at the berths of the port of Sabetta. The service contract with OJSC Yamal LNG is valid until 2040.

#### ■ Contribution to sustainable development and environmental safety

As part of operation of the nuclear-powered icebreaker fleet, special focus is given to environmental safety and the protection of offshore and onshore ecosystems. Measures are being taken to address 'nuclear legacy' issues.

Operations of FSUE Atomflot are organized in such a way as to prevent the accumulation of spent nuclear fuel and radioactive waste. In 2017, the landmark event in North-Western Russia was the removal of the first batch of SNF from the storage facility in Andreev Bay (Murmansk Region) for its subsequent reprocessing at FSUE Mayak Production Association. In addition, as part of the Federal Target Programme on Nuclear and Radiation Safety for the Period from 2016 through 2020 and for the Period until 2030, 152 containers with RAW accumulated during the operation of nuclear icebreakers were removed and transferred to FSUE National Operator for Radioactive Waste Management.

In 2017, which had been declared the Year of the Environment in Russia, FSUE Atomflot carried out a number of environmental initiatives. In particular, the enterprise's employees took part in an ecotour along the shore of the Barents Sea, on Rybachy and Sredny Peninsulas in order to clear up the areas.

#### 4.6.2. Plans for 2018 and for the medium term

- To continue the construction of project 22220 multipurpose nuclear icebreakers;
- To prepare the design of a new super-icebreaker, Lider, which will enable year-round operation in the High Arctic;
- To build port vessels for the Yamal LNG project;
- To improve performance (increase adjusted free cash flow and reduce unit costs as a percentage of revenue of FSUE Atomflot);
- To increase revenue from and expand the portfolio of orders for new products and services.

# 5.0. Innovations to Improve the Quality of People's Life

## 5.1. Research and Innovations

Key results in 2017:

- ROSATOM received the Skolkovo Trend Award for the programme titled 'Management of Technological Innovations: Research Centres'.
- R&D expenses totalled 4.5% of revenue.
- The number of applications filed and international patents obtained by ROSATOM totalled 443 (321 in 2016).

**Yury Olenin**, Deputy Director General for Innovation Management



#### — What do you think are ROSATOM's key objectives in the sphere of research and innovation?

— In 2018, we are faced with a major task of updating the Corporation's business strategy until 2050. We intend to enhance the section of the strategy on the development of our research capabilities. We will prioritize research programmes, which will help us focus on the areas with the highest potential for technological leadership.

One of the key tasks in the field of research will be to draft a plan of R&D topics for 2019. The plan is a list of R&D to be conducted in the industry that is structured along two dimensions: in terms of time, reflecting the readiness

of the results for being launched on the market, and in terms of sources of funding for R&D, including both the Divisions' own funds and the portion of the Corporation's consolidated investment resources allocated for new product lines, as well as other sources of financing. I think we need to establish a special fund in the Corporation to support basic research studies whose potential for commercialization is uncertain. This research is vital, as it can pave the way for subsequent breakthroughs.

#### — What are the main challenges facing scientific and research institutes, and how will they be solved in the future?

— The main challenges of our research institutes are the debt burden, the obligation to support the nuclear legacy, expensive and frequently underutilized or idle experimental capabilities, excess facilities and the fact that in some cases infrastructure services have not yet been fully centralized. This limits our ability to increase remuneration paid to researchers and make the profession itself more prestigious.

To tackle these issues, we have launched initiatives aimed at achieving a financial turnaround of the institutes. We need every R&D institute to have an efficient economic multiplier based on a positive feedback loop: fewer encumbrances – more funds for R&D – better quality – more orders – higher remuneration to researchers – even better performance. A good example is the plan that is already underway in the Research Institute of Atomic Reactors in Dimitrovgrad. The Institute has reached break-even point for the first time in years. This means it has now got funds to invest in R&D, to expand and modernize its production facilities. Based on this success story we will develop financial turnaround plans for other R&D institutes.

Another burning issue is the need to maintain the current level of research

competences and retain key research personnel at ROSATOM's enterprises. The reasons are obvious: old professionals retire, and they cannot always be replaced by the inflow of young specialists. Human resources are not fully replaced for a number of reasons: a career in research is not sufficiently attractive and society does not regard the profession as prestigious; salaries are low; there is a lack of large-scale scientific tasks, and the older generation of researchers are unwilling to pass on their knowledge to the youth. The quality of educational programmes and the qualifications of graduates have deteriorated considerably and do not always meet the needs of large, successful companies. Moreover, we have a persisting issue: R&D is at the very beginning of the life cycle of a product, while profit is generated at later stages, and, like in the past, it is seldom reinvested in research.

There is no universal solution to this problem. We aim to increase the salary of researchers at least to the average level across the industry, implement mentoring programmes for researchers, build a research talent pool and carry out development programmes for the members of this pool, and introduce an expert career in research. Large-scale research programmes will enable researchers of different generations to work together on challenging and exciting projects, which is both an efficient method of learning and passing on knowledge and the best incentive.

ROSTATOM creates breakthrough technologies and innovative 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

A large-scale innovative development and technological modernization programme is underway in the Russian nuclear industry. Its aim is to enable ROSATOM to achieve its strategic goals. In 2017, nuclear organizations, as well as 27 universities, 24 academic institutes and over 35 third-party research organizations were engaged in the implementation of over 70 technological projects.

In the reporting year, innovative activities in the nuclear industry were aimed at developing and introducing new technologies, expanding the range of mechanisms and improving the quality of commercialization of innovative solutions, and providing comprehensive support to innovative projects at all stages.

An agreement was concluded with JSC Russian Venture Company to jointly develop and promote high technologies and innovative solutions created using the R&D capabilities and infrastructure of ROSATOM's organizations.

In 2017, ROSATOM was designated a Competence Centre as part of the programme titled 'Digital Economy of the Russian Federation'; it was assigned responsibility for the Building Research Competences and Technological Know-How area. The Centre will process and consolidate all proposals in the area and submit them for expert review to the working group headed by JSC Russian Venture Company.

Construction of the world's most powerful sodium-cooled Multipurpose Fast Neutron Research Reactor (MBIR) continues at the site of JSC SSC RIAR (Dimitrovgrad, Ulyanovsk Region). The MBIR is designed to replace the BOR-60 research reactor that is currently in operation.

**Table. Key results of the Innovative Development and Technological Modernization Programme in 2017**

Indicator	Target	Actual
Share of innovative products and services in total sales of products and services in the industry, %	11.6	13.46
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.	870	922
Share of projects implemented by universities, small and medium-sized enterprises and other organizations outside the industry, %	10.7	12.8

### Key innovative projects forming part of the Innovative Development and Technological Modernization Programme

Energy projects	Non-energy projects
Adoption of integrated geological and mining simulation techniques; research and technical support for the development of uranium deposits	Development of isotope production technologies in order to expand the use of isotopes in health care
Development of new gas centrifuges for uranium enrichment	Organization of production of the cobalt-60 isotope in an RBMK-type reactor
Validation of the VVER TOI design in order to promote it on international markets	Development of a multipurpose medical device based on thulium fibre laser
Development of technological solutions for the processing of graphite stack elements in order to move RAW to a lower hazard class	Development of additive manufacturing technologies for the manufacture of new products
Development of technologies and equipment for the dismantling of graphite stacks during the decommissioning of graphite-moderated uranium reactors	Development of diamond detectors for radiation detection at nuclear power plants and thermonuclear reactors
Development of experimental fuel elements and fuel assemblies based on high-density mixed uranium-plutonium fuel for fast neutron reactors.	Development of materials for positron emission tomography
Development of technologies and launch of production of mixed oxide (MOX) fuel for fast neutron reactors	Development of a nuclear radioisotope diffusion battery
Development and research of fuel assembly materials for fast neutron reactors	Development of porous carbon materials with a regular structure whose properties can be widely varied
Creation of the International Thermonuclear Experimental Reactor (ITER)	Industrial waste processing
Research and development in the field of controlled nuclear fusion	

### 5.1.2. Proryv (Breakthrough) Project aimed at closing the nuclear fuel cycle

The Proryv (Breakthrough) Project is the key innovative project in the nuclear industry. It is aimed at developing fast neutron reactors and closing the nuclear fuel cycle. The project will result in the development of technologies that will help solve the problem of radioactive waste accumulation and make nuclear power plants more cost-effective.

In 2017, reactor tests of the innovative mixed nitride uranium-plutonium (MNUP) fuel in the BOR-60 research reactor and the BN-600 power reactor continued.

ROSTATOM continued to build the MNUP fuel fabrication and refabrication module forming part of a pilot and demonstration energy facility at JSC SCC. Non-standard equipment for the production of MNUP fuel for the BREST-OD-300 reactor unit was manufactured and delivered.

Medium-term plans for the Proryv project include the completion of manufacture, delivery and installation of equipment for the MNUP fuel fabrication and refabrication module. The module is scheduled to be commissioned in 2020.

In the long term (2025-2030), ROSATOM plans to build a power unit equipped with the BREST-OD-300 reactor and an SNF processing module.

### 5.1.3. Participation in international mega research projects

In 2017, JSC A.A. Bochvar National Research Institute for Inorganic Materials, an organization of ROSATOM, manufactured a trial batch of superconducting elements (so-called strands) for the Large Hadron Collider at the request of the European Organization for Nuclear Research (CERN).

In addition, in the near future, JSC A.A. Bochvar National Research Institute for Inorganic Materials, in cooperation with another of the Corporation's organizations, JSC Chepetsky Mechanical Plant, will master the manufacturing process for advanced superconducting wires for the 'collider of the future', a new Future Circular Collider (FCC), which will be the largest accelerator in history, and other facilities in the area of high energy physics.

### ITER Project

ITER is the world's first experimental fusion reactor that is being built by the international community near the Cadarache nuclear centre in France. The aim of the project is to demonstrate the scientific and technical possibility of using nuclear fusion on an industrial scale and to master the relevant technological processes. The success of the ITER project will contribute to meeting the energy needs of mankind.

In 2017, ROSATOM's organizations produced and supplied a number of key components for the reactor under construction on time and in full compliance with the requirements of the ITER Organization.

As part of Russia's obligations under the ITER reactor construction schedule, in 2018, the winding of the double pancakes for the poloidal field coil PF1 will be completed; two port nozzles for the vacuum vessel and the third gyrotron complex for the additional plasma heating system will be produced.

### Facility for Antiproton and Ion Research in Europe (FAIR)

The FAIR project is aimed at creating a large international laboratory for researchers from all over the world to study fundamental properties and structures of matter and the evolution of the universe after the Big Bang.

In 2017, construction of the northern area of FAIR was started, and equipment for the accelerator and experimental facilities was developed and manufactured.

ROSTATOM arranged the participation of Russian representatives in all meetings of the Assembly of FAIR GmbH, its committees and working groups, which helped to ensure that Russia's interests were respected during the implementation of the project.

### 5.1.4. Intellectual property management and protection

In order to support ROSATOM's global expansion, in 2017, protection of the industry's key products and technologies abroad remained the main priority of the intellectual property management system.

The Industry-Wide Competence Centre for Intellectual Property Management significantly expanded the scope of international patenting: in 2017, the number of applications filed and foreign patents obtained by ROSATOM increased to 443 (321 in 2016).

**Table. Patent activity**

Indicator	2015	2016	2017
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.	1,141	1,090	1,286
Number of applications for state registration of protectable intellectual property (IP), pcs.	853	1,038	1,073
Number of international applications and foreign patents, pcs.	101	321	443

In 2017, a project titled ROSATOM's Patent School was launched, and a comprehensive assessment of professional and technical knowledge and skills of specialists in IP management was carried out.

The system for expert review of R&D deliverables was automated in order to improve legal protection of the Corporation's interests in commercializing intellectual property and implementing foreign projects.

As of December 31, 2017, the IT system for IP rights management contained over 10,500 items of intellectual property owned by organizations in the industry and by the Corporation.

The methodology for building portfolios of intellectual property rights of the Corporation and its organizations was developed and implemented.

In 2018, ROSATOM plans to:

- Build an industry-wide network of patent experts to ensure optimal allocation of resources according to priority tasks, and to improve integral competences of the industry's patent offices;
- Continue to implement the project titled ROSATOM's Patent School;
- Develop an industry-wide system for assessing economic benefits from integrating and using intellectual property in ROSATOM's operations.

### 5.1.5. Knowledge management system

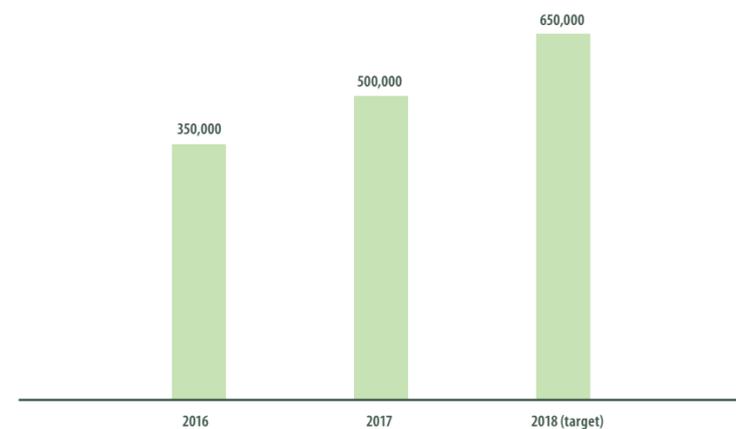
In 2017, pilot projects were carried out as part of the development of integrated infrastructure for managing nuclear knowledge throughout the life cycle of complex process facilities (the projects involved integration of information resources of the knowledge management system and information systems for analysing the operation of nuclear power plants).

A consortium of suppliers responsible for promoting ROSATOM's licensed knowledge management product on the Russian market was formed.

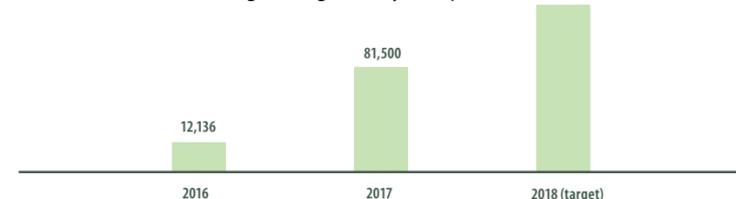
A list of technical standards and regulations was approved as part of the development of the national standardization programme. The list includes a section on knowledge management documents compiled with assistance from ROSATOM.

Information systems for knowledge management were enhanced with AI technologies for analysing research and technical competences.

### Contents of the research and technical information portal, number of documents



### Involvement in the knowledge management system, persons



In 2018, ROSATOM plans to:

- Establish a single centre for subscribing to databases of research, technical and patent information in ROSATOM's organizations;
- Conduct an international conference on knowledge management, RKM 2018;
- In cooperation with Rostekhnadzor, build an information resource for processing experimental data and working with computational software of ROSATOM;
- Provide professional communities forming part of the Corporation's talent pool with access to the electronic library and social media;
- Implement an industry-wide programme to digitize archives containing research and technical information;
- Implement a partner programme to promote the integrated product, ROSATOM's Knowledge Management System, on the Russian market.

### 5.1.6. Research cooperation with universities

In 2017, the total value of R&D orders performed by universities exceeded RUB 1 billion. In 2017, 27 specialized universities were involved in R&D projects. The bulk of the work was performed by NRNU MEPhI, Nizhny Novgorod State Technical University, Bauman Moscow State Technical University, Moscow State University of Civil Engineering, Moscow Aviation Institute, Far Eastern Federal University, Moscow State University and Ural Federal University. In 2017, a project to assess the environmental footprint of nuclear facilities was launched in cooperation with Far Eastern Federal University in order to ensure long-term safety of the facilities during their preparation and decommissioning taking into account the combination of risks (man-made, radiation, chemical, etc.) in the Far Eastern Federal District. As part of the project, the IAEA Cooperation Centre is being established in order to study marine environments using nuclear and isotope technologies in oceanography, including environmental and climate research, pollution monitoring, remote sensing and predictive modelling of the state of the World Ocean.

### 5.1.7. Plans for 2018 and for the medium term

2018 has been declared the Year of Science in the Russian nuclear industry. Priority tasks include developing the industry-wide plan of research topics for each area of research, creating a research ecosystem, securing steady funding for R&D activities and making scientific professions more prestigious.

In 2018, ROSATOM plans to benchmark the level of its technological development and KPIs against those of the leading peer companies. The findings will be used for adjusting the KPIs, areas/projects of ROSATOM's Innovative Development and Technological Modernization Programme and the list of technologies being developed/upgraded by ROSATOM.

**Table. Key indicators of the Innovative Development and Technological Modernization Programme of ROSATOM**

Indicator	2018	2019	2020
Share of innovative products and services in total sales of products and services in the industry, %	12.0	12.4	12.8
Number of items of intellectual property: foreign patents obtained by ROSATOM, submitted and registered applications for foreign patents reflecting the commercialization and expansion of the sphere of application of research results in the nuclear industry (cumulative total), pcs.	1,180	1,700	2,360

## 5.2. Business Diversification

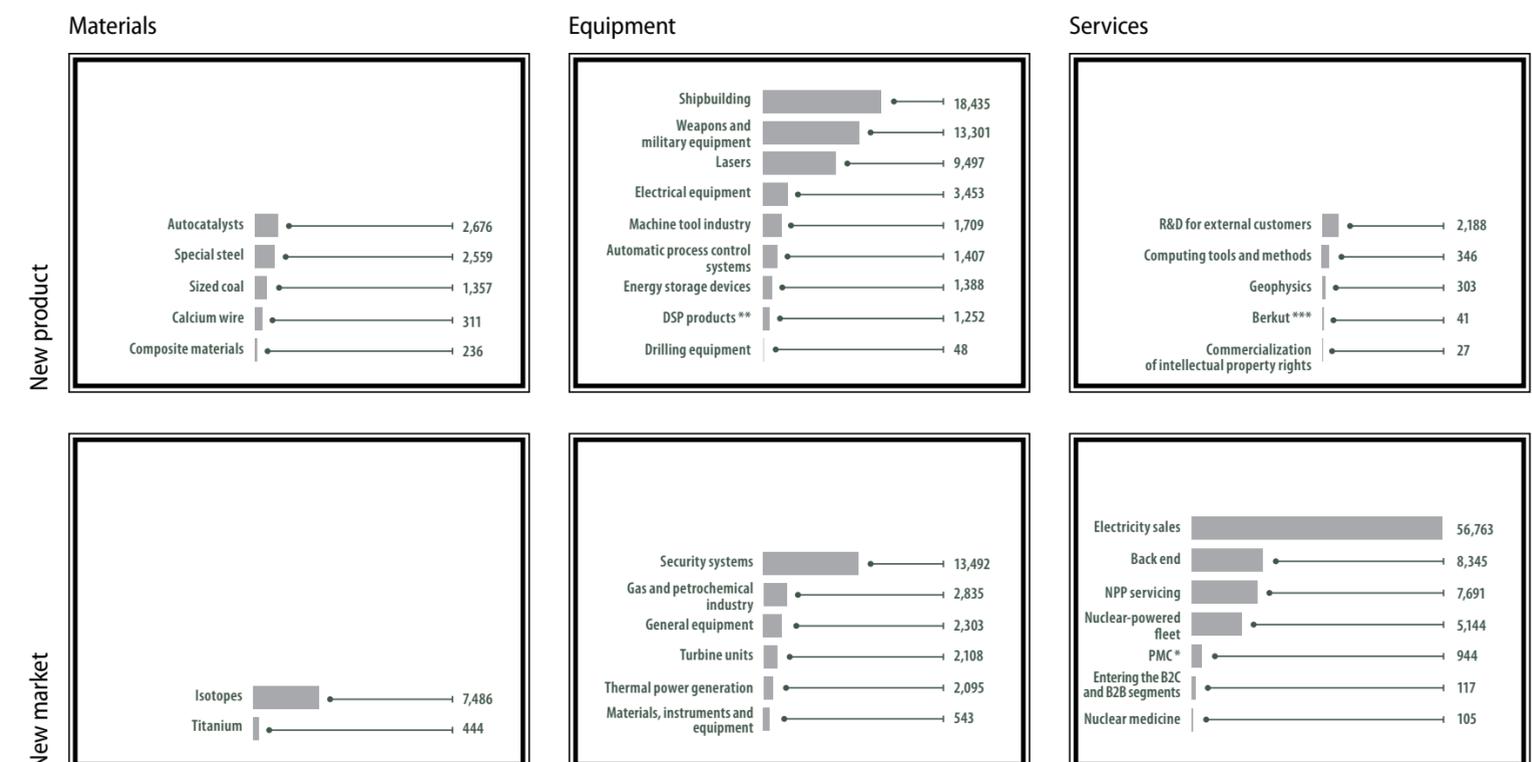
Key results in 2017:

- Revenue from new products outside the scope of the Corporation totalled RUB 170.9 billion (RUB 147.4 billion in 2016), making up 19.8% of the total revenue.
- The 10-year portfolio of orders for new products outside the scope of the Corporation reached RUB 814.1 billion (RUB 692.8 billion in 2016).

New businesses<sup>29</sup> are developed in the segments in which ROSATOM has the relevant competences and/or access to the market. This approach enables it to hedge market and/or technological risks and

take advantage of existing market and/or technological opportunities. ROSATOM has identified six high-priority segments in which new businesses will be developed.

### Map of new businesses



\* PMC — project management consulting

\*\* DSP products mean dedicated and special-purpose products

\*\*\* Berkut stands for LLC Berkut Monitoring Systems (<http://smberkut.ru/>)

■ revenue for 2017, RUB million

<sup>29</sup> A new product (business) is a product outside the scope of the integrated offer covering the delivery of a nuclear power plant and research reactors and the fulfilment of the state defence order.

### 5.2.1. Results in 2017

In the reporting year, revenue outside the scope of ROSATOM totalled RUB 170.9 billion, which is 5.65% above the target (RUB 161.8 billion) and 15.95% higher than in 2016<sup>38</sup>. The 10-year order portfolio outside the scope of the Corporation reached RUB 814.1 billion, which is 14.0% above the target (RUB 714.2 billion) and 17.5% more than in 2016.

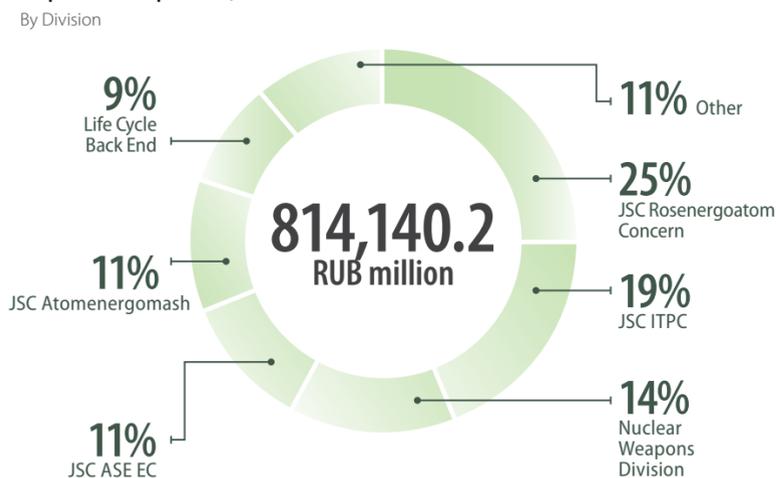
**Table. Revenue from new products and 10-year portfolio of orders for new products (outside the scope of the Corporation), RUB billion**

	2015	2016	2017
Revenue from new products	99.0	147.4	170.9
10-year portfolio of orders for new products	403.3	692.8	814.1

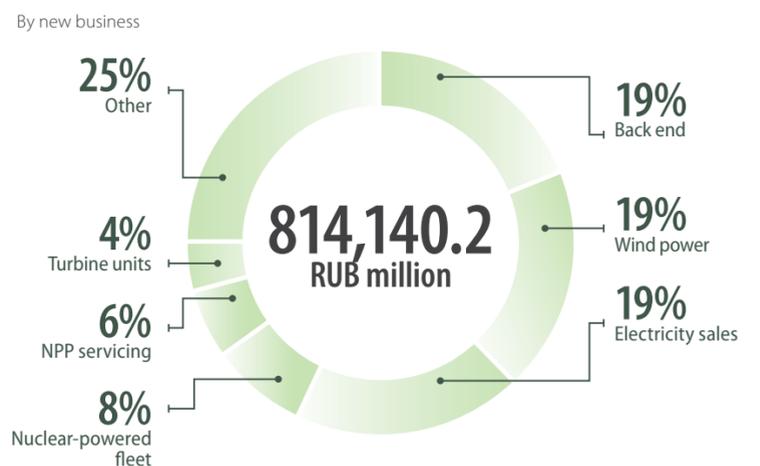
**Fig. Structure of revenue from new products (outside the scope of the Corporation) in 2017**



**Fig. Structure of the 10-year portfolio of orders for new products (outside the scope of the Corporation) in 2017**



LLC Berkut Monitoring Systems, an organization of ROSATOM, provides information on the condition of roads and road infrastructure in Russia. In 2017, a diagnostic assessment of road surfaces was carried out, road data sheets were prepared, and traffic management designs were prepared in the Ryazan and Penza Regions. In 2018, the operating condition of the federal highways will be assessed. The findings of the assessment will be used in the development of an analytics system, which will provide the basis for an integrated digital map of Russian roads.



<sup>38</sup> In 2015 and 2016, revenue from new products and the portfolio of new products were calculated taking into account intra-group turnovers; starting from 2017, only the volumes outside the scope of the Corporation (deliveries to external customers) are calculated. Therefore, data for 2015 and 2016 provided in the report has been recalculated and only indicates revenue from new products and the portfolio of new products outside the scope of ROSATOM.

### Wind power

In 2017, a holding company JSC NovaWind was established in order to implement ROSATOM's wind power projects. JSC NovaWind will consolidate all of the Corporation's wind power assets, as well as competences in the leading wind power segments and technological platforms (in particular, in 2017, product strategies were approved for the development of a product line in the peak generation and commercial dispatching segments).

In 2017, ROSATOM's portfolio of wind farms to be commissioned in Russia by 2022 increased to 970 MW (43% of the Russian wind power market). The Corporation will build wind farms in the Krasnodar Territory, the Republic of Adygea, the Stavropol Territory and the Rostov Region.

In the reporting year, a financing agreement was signed with a major Russian bank for the wind farm construction project. The total funding to be provided for a 10-year period exceeds RUB 60 billion (revenues of JSC VetroOGK under power supply contracts will be the main source of cash flow for debt servicing). See also the section 'Financial Management'.

JSC NovaWind and the Dutch company Lagerwey established a joint venture, Red Wind B.V., which will be responsible for marketing and sales in Russia, turnkey supply of wind turbines and after-sales service. In addition, the joint venture will be responsible for the qualification of suppliers and conclusion of contracts for the delivery of components to the production sites of JSC NovaWind in the city of Volgogradsk. In 2018, the Corporation plans to launch the production of wind turbine components using Lagerwey technologies at the production facilities of the Mechanical Engineering Division in Volgogradsk (to achieve the degree of production localization of 65% in Russia). Commercial capacity of the production facilities will total 100 turbines per year.

In the next 6 to 7 years, the Corporation intends to build wind power capacities totalling 1.4 GW (around 550 turbines) in Russia. In the future, it intends to expand into the international market.

### Nuclear medicine

Nuclear medicine is one of the key areas of ROSATOM's business. The Corporation is developing new high-technology devices and instruments and a range of radiopharmaceuticals based on isotopes produced in-house. It also supplies solutions for nuclear medicine centres comprising diagnostic and radiotherapy modules. JSC Rusatom Healthcare is the industry integrator for this business.

In 2017, 137 open radionuclide sources were synthesized, and 275 open radionuclide sources were supplied to healthcare institutions in Moscow (this amount is sufficient for 2,350 PET (positron emission tomography) scans).

The Corporation started to provide services to local residents at regional healthcare institutions in the Chelyabinsk Region.

ROSATOM started to develop a Russian radiotherapy facility based on a 6 MeV linear electron accelerator. The project is cofinanced by the Ministry of Education and Science of the Russian Federation. The product is expected to be launched on the market in 2022.

Projects to produce xenon-133 and molybdenum-99 isotopes to be used in radionuclide diagnostics in Russia and abroad entered an active investment phase.

ROSATOM launched a project to manufacture new radionuclide products in the CATF of Zarechny (Sverdlovsk Region). It plans to produce a precursor of a drug for targeted cancer therapy based on the lutetium-177 isotope, as well as radiation sources based on iridium-192 and pharmaceuticals based on iodine-125, which will also be used for cancer therapy.

The site for producing sources of ionizing radiation based on the radioactive cobalt-60 isotope started pilot operation in Dimitrovgrad. The sources will be used in Gamma Knives, radiosurgical devices for treating brain tumours.

A drug for liver cancer treatment based on yttrium-90 was developed, and pre-clinical trial studies were started.

The Corporation won an international tender for the supply of a cyclotron complex with radiochemical laboratories to Thailand. The facility will be used for the production of radiopharmaceuticals. The equipment is scheduled for delivery and installation in 2019 and 2020.

In 2018, ROSATOM plans to start the construction of state-of-the-art nuclear medicine centres. It also plans to launch the production of radiopharmaceuticals complying with the GMP standard at JSC Karpov Institute of Physical Chemistry.

### Composite materials

In 2017, the Corporation initiated the development of the Composites Without Borders interregional industry cluster in the Moscow and Saratov Regions and the Republic of Tatarstan. The cluster will support comprehensive development of the polymer composite materials (PCM) industry. Simultaneously, a large-scale programme for introducing PCMs in the nuclear industry was launched.

As part of the PAN production plant construction project, a tender was held for the supply of key equipment, and an agreement was signed with SEZ Alabuga on the construction of the production building.

Carbon fibre is a high-technology material that is widely used in the nuclear industry, aerospace engineering, shipbuilding, wind power, construction, health care and the manufacture of consumer goods (ranging from furniture to golf clubs). PAN (polyacrylonitrile) precursor is used as feedstock for carbon fibre production. This is the most valuable and carefully protected technology in the production chain.

In 2017, the Corporation supplied 470 tonnes of carbon fibre to customers:

- 320 tonnes were exported to China and Europe;
- 150 tonnes were sold in Russia (the Corporation accounts for 50% of the domestic market).

In 2018, ROSATOM plans to:

- Conclude the first contracts for the supply of PCMs to the construction sector of the nuclear industry;
- Launch pilot production of bidirectional fabrics and tapes;
- Proceed with the project to develop composite blades for wind turbines.

### Superconductivity

In 2017, a new strategic technological area, Applied Superconductivity, was launched in the Corporation, and its road map was developed.

JSC D.V. Efremov Institute of Electrophysical Apparatus was designated as the integrator of this area. It will develop comprehensive projects to introduce superconducting materials and equipment in the power industry, transport, science and other sectors of the Russian economy.

In 2017, at the request of the Ministry of Industry and Trade of Russia, ROSATOM built a road bridge from carbon fibre reinforced plastic in the village of Yazykovo (Ulyanovsk Region). This is the first bridge of this kind in Russia. The use of composite materials helped to make the structure more reliable and extend its service life. It also enabled a reduction in the duration of construction and 20% cost savings compared to a standard reinforced concrete bridge. In the future, the Corporation plans to build bridges from carbon fibre reinforced plastic in other regions of Russia.

### 5.2.2. Plans for 2018

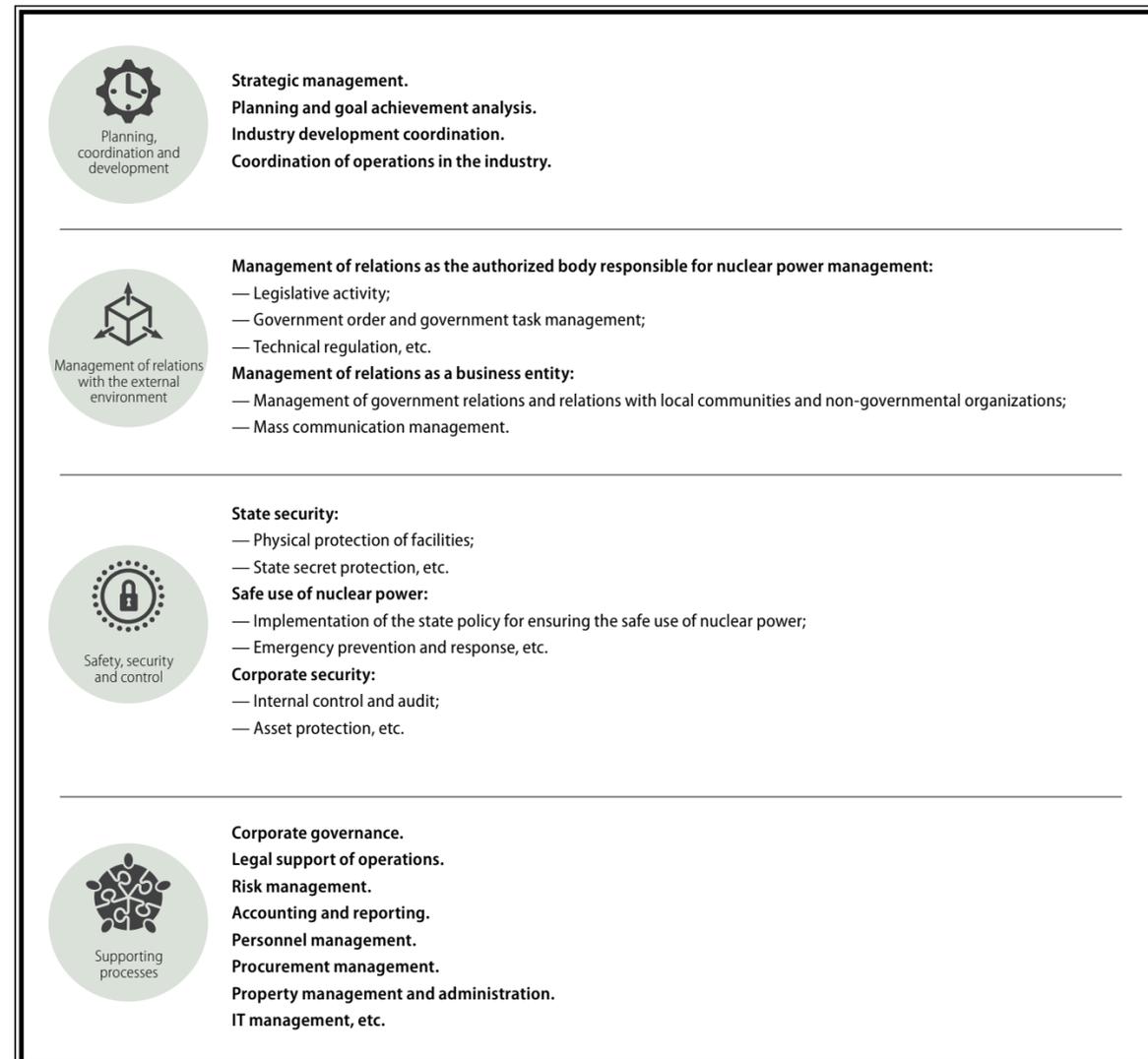
In 2018, the Corporation needs to achieve the following targets for the development of new businesses:

- Revenue from new products outside the scope of the Corporation totalling RUB 197.9 billion;
- The 10-year portfolio of orders for new products outside the scope of the Corporation totalling RUB 880.0 billion.

# 6.0. Effective Management of Resources

## 6.1. Corporate Governance

### Nuclear industry management processes



VALUE CREATION ACTIVITIES  
 (see the section 'Value Creation and Business Model')

ROSATOM's main task in the sphere of corporate governance is to align the management of organizations of the nuclear power industry and the nuclear weapon complex of the Russian Federation, and organizations operating in the area of nuclear and radiation safety, nuclear science and technology and personnel training.

### 6.1.1. Governing bodies

#### Supervisory Board

In accordance with Article 23 of Federal Law No. 317-FZ on State Atomic Energy Corporation Rosatom dated December 1, 2007, the Supervisory Board<sup>31</sup> is ROSATOM's supreme governing body. Powers of the Supervisory Board are stipulated by Federal Law No. 317-FZ dated 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 of December 31, 2017

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 of State Corporation Bank for Development and Foreign Economic Affairs (Vnesheconombank).
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.

Changes in the composition of the Supervisory Board (pursuant to Decree No. 28 of the President of Russia dated January 23, 2017):

- Sergey Korolev was appointed to the Supervisory Board;
- Boris Gryzlov and Yury Yakovlev resigned from the Supervisory Board.

In 2017, the Supervisory Board held 11 meetings, including two face-to-face meetings, and considered 36 issues.

The Supervisory Board approved the following:

- The report on the achievement of key performance targets by ROSATOM in 2016;
- ROSATOM's key performance targets for 2017;
- Key performance targets of federal nuclear organizations for 2017;
- ROSATOM's annual report for 2016.

ROSATOM's Director General is responsible for monitoring the fulfilment of instructions of the Supervisory Board and its Chairman.

#### 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 the Decree No. 527 of the President of Russia dated October 5, 2016). Information on the Director General's background is available on ROSATOM's official website<sup>32</sup>.

#### 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 website<sup>33</sup>. 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 other employees of ROSATOM and their relatives is available on ROSATOM's official website<sup>34</sup>.

#### Composition of the Management Board as of December 31, 2017

Alexey Likhachev	ROSATOM's Director General, Chairman of the Management Board.
Ivan Kamenskikh	First Deputy Director General for Nuclear Weapons.
Alexander Lokshin	First Deputy Director General for Operations Management.
Nikolay Solomon	First Deputy Director General for Corporate Functions, Chief Financial Officer.
Kirill Komarov	First Deputy Director General for Corporate Development and International Business.
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 Innovation Management <sup>35</sup> .
Andrey Petrov	Director General of JSC Rosenergoatom Concern.
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.

<sup>31</sup> <http://rosatom.ru/about/management/supervisoryboard>.

<sup>32</sup> <http://rosatom.ru/about/management/director>.

<sup>33</sup> <http://rosatom.ru/about/management/board>.

<sup>34</sup> <http://www.rosatom.ru/about/protivodeystvie-korrupsii/svedeniya-o-doxodax-rabotnicov>.

<sup>35</sup> Until September 26, 2017, Yury Olenin held the position of President of JSC TVEL.



(CATFs) were established, in cases when the above facilities are built or renovated within these CATFs. In addition, the above Federal Law marked the completion of a stage in the development of the System for the Management of Priority Social and Economic Development Areas (PSEDA) established within the CATFs in the nuclear industry. The Corporation was authorized to exercise the rights of the shareholder of the holding company managing PSEDA within the above CATFs on behalf of the Russian Federation. See also the section 'Developing the Regions of Operation'.

### 6.2.3. Cooperation with the Federal Assembly of the Russian Federation

In 2017, ROSATOM received 71 enquiries from representatives of the chambers of the Federal Assembly of the Russian Federation. All enquiries were considered within the time frame stipulated by law, and enquirers received substantiated replies.

The enquiries were focused mostly on the following topics:

- Sale of items of real property by nuclear enterprises;
- Social security;
- Development of regions where nuclear facilities are situated;
- Provision of financial assistance;
- Implementation of projects to build nuclear facilities, including the construction and location of a disposal facility for hazard class 1 and 2 RAW in the Krasnoyarsk Territory;
- Optimization of production facilities and downsizing at nuclear facilities;
- Useful legislative initiatives related to international cooperation on nuclear energy.

In 2017, ROSATOM's representatives participated in the following events:

- 43 meetings of committees, commissions and advisory boards of the chambers of the Russian Federal Assembly;
- 8 round-table meetings;
- 3 parliamentary hearings.

### 6.2.4. Implementation of the state programme of the Russian Federation 'Development of the Nuclear Power and Industry Complex'

In the reporting year, ROSATOM continued to implement the state programme of the Russian Federation 'Development of the Nuclear Power and Industry Complex' (target metrics and indicators for 2017 have been set by Decree No. 344-11 of the Russian Government dated March 31, 2017)<sup>37</sup>.

Overall performance against the targets set in the state programme for 2017, which also takes into account the amount of budgetary and extrabudgetary financing used for implementing measures stipulated in the state programme, was assessed at 100%.

### 6.2.5. Implementation of federal target programmes

In 2017, ROSATOM's enterprises and organizations implemented measures forming part of five 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 34,335.2 million, including RUB 16,348.6 million from the federal budget and RUB 17,986.6 million from extrabudgetary sources.

### 6.2.6. Contribution to the implementation of the 'May decrees' of the President of Russia

As part of the implementation of the decrees of the President of Russia dated May 7, 2012, in the reporting year, ROSATOM and its organizations achieved the following results:

- Under Decree No. 597 on Measures for Implementing the State Social Policy: in 2017, the actual nominal salary increased by 5.6% compared to 2016 (see the section 'Personnel Management');
- Under Decree No. 596 on the Long-Term National Economic Policy:
- In terms of increasing investments to at least 27% of GDP: by the end of 2017, the amount totalled 22.3% of the Corporation's revenue (see the section 'Investment Management');
- In terms of increasing the share of products of high-technology and knowledge-intensive sectors

of the economy in GDP by a factor of 1.3 against 2011 by 2018: the share of innovative products in the Corporation's total sales at year-end 2017 totalled 13.46% (1.46 times higher than in 2011) (see the section 'Research and Innovations').

### 6.2.7. Provision of public services

In 2017, ROSATOM's divisions providing public services and exercising government oversight functions on behalf of the Corporation were authorized to process complaints regarding the provision of public services and performance of government oversight functions. Responsible employees of the divisions providing public services were connected to the federal state information system of pre-trial appeals.

### 6.2.8. State property management and restructuring of non-core assets

In 2017, 15 non-core items of real property owned by joint-stock companies in which ROSATOM held more than 25% of shares were excluded from the scope of the Corporation. Proceeds from the sales totalled RUB 182 million.

As regards the property of joint-stock companies in which ROSATOM owned less than 25% of shares and companies whose shares were held by the Russian Federation represented by ROSATOM, 538 non-core items of real property were excluded from the scope of the industry in 2017 (310 items were sold, 151 items were transferred free of charge to the federal government and municipal governments, and 77 items were liquidated). Proceeds from the sales totalled RUB 802 million.

In addition, in the reporting year, 182 items of federal real property were excluded from the scope of the Corporation. More specifically:

- 162 items of federal real property were transferred free of charge to local governments, to federal subjects of Russia or to the Russian Treasury in order to address regional issues and provide the population with utility infrastructure;
- 20 items of federal real property were liquidated due to the total or partial loss of usefulness to consumers.

In 2017, ROSATOM registered its title to 293 items of real property (buildings and structures).

## 6.3. Risk Management

Nikolay Nikolaenko, Head of the Risk Management Division



— In 2017, project risk was added to the list of key risks inherent in ROSATOM's business. What was the reason for this?

— In accordance with our strategic goals, NPP construction and the expansion of our portfolio of overseas orders are one of key areas of ROSATOM's development. A large number of NPP construction projects are currently entering the active stage of design and construction, while the number of overseas orders is increasing year by year. The growing demand for nuclear power generation and the global shift towards 'green' energy have prompted international and regional regulators to pay closer attention to the NPP construction process and develop new safety regulations. New control standards developed in one region are then rolled out in other regions, which makes it necessary to centralize control and management, to share accumulated experience and continuously improve in-house project management standards.

In addition, according to ROSATOM's strategy, by 2030, revenue from new businesses should make up at least 30% of the total revenue. To accomplish this objective, we assess and develop promising areas for investment and take steps to enable organizations in the industry to fully unlock their potential and capabilities.

In 2017, ROSATOM launched a programme to create and implement a system for integrated management of the time and cost of construction of nuclear facilities (Total Cost Management Nuclear Construction, TCM NC). The TCM NC Programme is aimed primarily at reducing the duration and cost of NPP construction in order to maintain the Corporation's leadership in the global nuclear industry. The risk management process is an integral part of the programme; it involves developing a wide range of tools.

All this suggests that project activities have become central to ROSATOM's business, and we give special focus to project risks.

— According to a report of the World Economic Forum, major global risks to doing business include the risk of natural and man-made disasters and climate change. How does ROSATOM manage this group of risks?

— Safety is one of ROSATOM's key values. In the course of its operations, ROSATOM gives priority to ensuring the full safety of people and the environment. In the field of safety, everything is important; we know safety rules and comply with them to prevent violations.

ROSATOM complies with all international safety requirements and is a technological leader in the field of NPP safety systems. For instance, the greatest potential danger in the nuclear industry is a nuclear meltdown in the event of an accident at an NPP. The Corporation has designed the most advanced protection against such incidents. For the first time in the history of the global nuclear industry, Tianwan NPP in China has been equipped with a unique device, the so-called core catcher designed to catch the molten fuel and structural materials even if the reactor core is completely destroyed. This technical solution has been approved by international experts and has gained worldwide recognition. It has been subsequently upgraded and incorporated in the design of new-generation NPPs that are currently under construction. Moreover, during the construction of Russian-design nuclear power plants, we always take into account possible contingencies such as an earthquake, a tsunami or the reactor vessel being directly hit by an aircraft. Indeed, strict safety requirements apply not only to the NPP design and operation stages, but also to all stages of production of radioactive materials, from uranium enrichment to spent nuclear fuel and radioactive waste management.

All of ROSATOM's enterprises have drafted the necessary regulations stipulating the measures to be taken by the management, emergency services, emergency response teams and employees in order to prevent natural and man-made disasters, and the necessary funds and equipment have been allocated for emergency response.

I would like to add that special divisions of the Corporation continuously gather and analyse information on the state of the natural and man-made environment in the areas where facilities posing nuclear and radiation hazards are located. These are only some of the measures that ROSATOM takes to minimize the risk of natural and man-made disasters.

<sup>37</sup> Publicly available information on the state programme of the Russian Federation 'Development of the Nuclear Power and Industry Complex' is posted on the Corporation's website: <http://www.rosatom.ru/upload/iblock/ebf/ebfd0cc7d42b82644ac56914c619d7e4.pdf>

### 6.3.1. Risk management system

ROSATOM has in place a risk management system (RMS), which is integrated into 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.

In 2017:

- A single risk management approach to pilot NPP construction projects was rolled out at Kursk NPP-2 and Bushehr-2 NPP (Iran);

- Following a diagnostic assessment of the risk management process, proposals were formulated for the improvement of RMS elements in two of the Corporation's divisions;
- The Uniform Industry-Wide Guidelines for Compliance with Risk Management Procedures for Investment Projects of ROSATOM and Its Organizations were approved;
- A list of key risk indicators was developed in order to monitor risks related to the state programme 'Development of the Nuclear Power and Industry Complex'.

Fig. Risk management process at ROSATOM

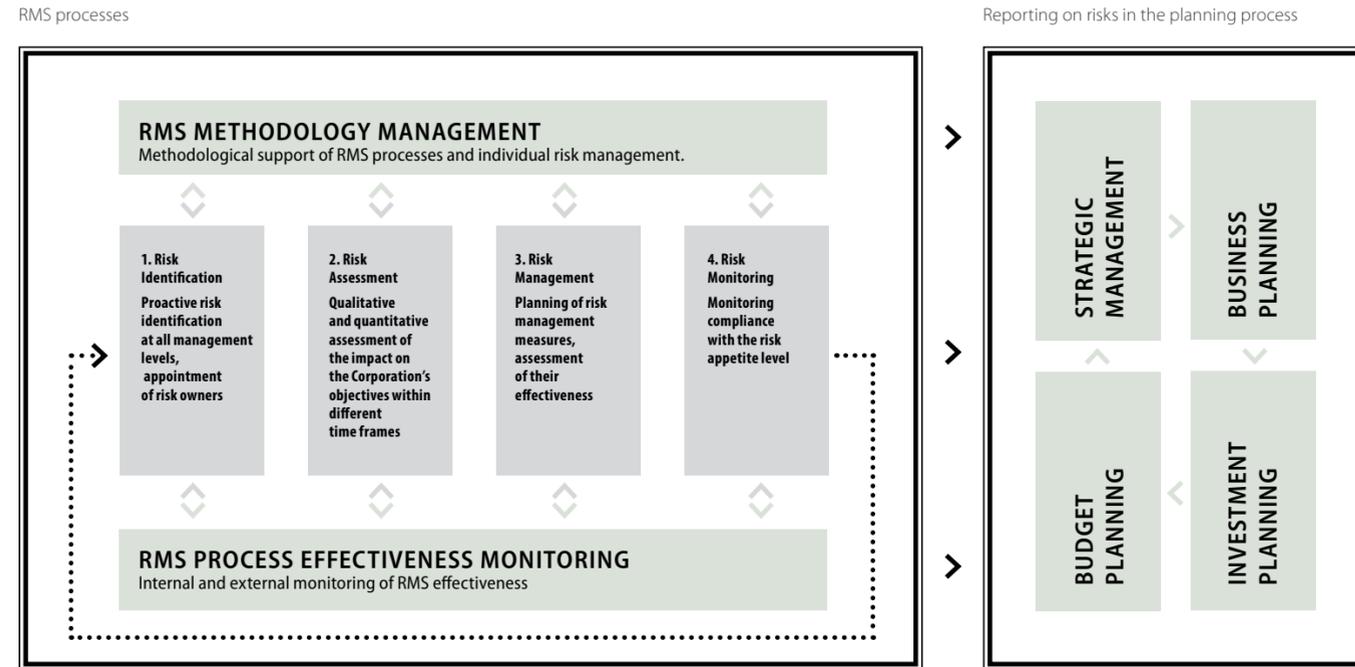
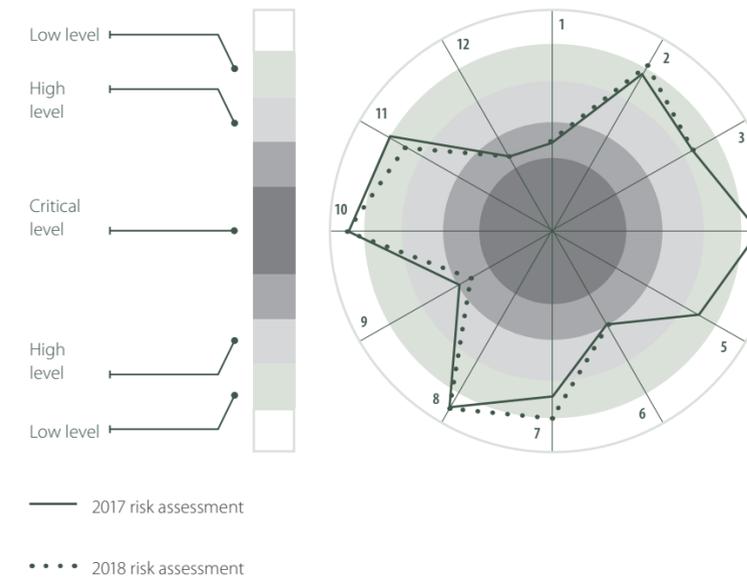


Fig. Organizational model of the risk management system at ROSATOM



Fig. Risk radar



### 6.3.2. Key business risks of ROSATOM<sup>38</sup>

As part of the functioning of the RMS, a list of critical risks and risk owners was compiled; risks were assessed, and risk management measures were developed and implemented.

1. Currency risk
2. Interest rate risk
3. Credit risk
4. Liquidity risk
5. Nuclear fuel cycle product and service market risk
6. Electricity and capacity market risk
7. Risk of a decrease in power generation
8. Industrial and environmental safety risk
9. Political risk
10. Risk of loss of and damage to assets
11. Reputational risk
12. Project risk

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 the table below.

<sup>38</sup> 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.

### 6.3.3. Risk management outcomes in 2017

Change in estimated risk levels for 2018:

▲ increase

▼ decrease

■ no significant changes

ROSATOM's strategic goals:

1 To increase its international market share

2 To reduce production costs and the lead time

3 To develop new products for the Russian and international markets

Risks and changes in risk levels (risk owners)	Risk description	Risk management practices	Connection with strategic goals
<b>Financial risks</b>			
1. Currency risk ■ (Heads of ROSATOM's Divisions)	Adverse changes in exchange rates	<b>Management approaches:</b> <ul style="list-style-type: none"> <li>Maintaining a balance of claims and liabilities denominated in foreign currencies (natural hedging);</li> <li>Use of financial hedging instruments.</li> </ul> <b>Results:</b> An optimal ratio of assets and liabilities denominated in the same currency was maintained.	1 2 3
2. Interest rate risk ▼ (ROSATOM's Treasury Department)	Adverse changes in interest rates, different timing of interest income and interest expenses	<b>Management approaches:</b> <ul style="list-style-type: none"> <li>Maintaining a balance of interest income and interest expenses in terms of timing and amounts;</li> <li>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;</li> <li>Floating-rate loans on which interest rates may be increased are refinanced using the intragroup liquidity pool.</li> </ul> <b>Results:</b> The Corporation 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 6.2%, partly because the rouble-denominated portion of the credit portfolio was refinanced in 2017.	1 2 3
3. Credit risk ■ (ROSATOM's Treasury Department for banks; heads of the Corporation's organizations for other counterparties)	Failure by counterparties to fulfil their obligations in full and on time	<b>Management approaches:</b> <ul style="list-style-type: none"> <li>Setting limits for counterparty banks;</li> <li>Use of suretyship, guarantees, restrictions on advance payments in favour of external counterparties;</li> <li>Improvement of the legal framework for the wholesale electricity and capacity market (including an increase in fines, improvement of the system of financial guarantees);</li> <li>Monitoring of accounts receivable and the financial position of counterparties;</li> <li>Internal counterparty solvency rating system.</li> </ul> <b>Results:</b> There were no significant losses through the fault of counterparties.	1 2
4. Liquidity risk ■ (ROSATOM's Treasury Department for the Corporation and JSC Atomenergoprom/Heads of Divisions)	Lack of funds for the fulfilment of obligations by the Corporation and its organizations	<b>Management approaches:</b> <ul style="list-style-type: none"> <li>Centralized cash management (cash pooling);</li> <li>Rolling liquidity forecasts and cash flow budget;</li> <li>Maintaining required amounts of open lines of credit with banks;</li> <li>Reducing the period of keeping free cash on bank deposits when this is advisable from an economic perspective;</li> <li>Discussion of matters related to state support with Russian federal executive authorities.</li> </ul> <b>Results:</b> ROSATOM maintained sufficient liquidity to repay liabilities on time, preventing unacceptable losses and managing reputational risk. For details, see the section 'Financial Management'.	1 3

Risks and changes in risk levels (risk owners)	Risk description	Risk management practices	Connection with strategic goals
<b>Commodity risks</b>			
5. Nuclear fuel cycle (NFC) product and service market risk ■ (Heads of the relevant Divisions of ROSATOM)	Adverse change in the pricing environment and demand on markets for natural uranium and uranium conversion and enrichment services	<b>Management approaches:</b> <ul style="list-style-type: none"> <li>Maintaining an optimal balance between market-focused and escalation pricing mechanisms (benchmark price inflation) in contracts;</li> <li>Aligning pricing mechanisms used for procurement and those used in contracts with a high level of commodity risk;</li> <li>Discussing the volume of future orders with customers in advance;</li> <li>Embedding options in contracts with suppliers to align purchase and sales volumes;</li> <li>Providing supply guarantee mechanisms;</li> <li>Improving the technical and economic characteristics of nuclear fuel; developing new types of fuel;</li> <li>Promoting products in new market segments.</li> </ul> <b>Results:</b> Despite persisting stagnation of demand and prices on the NFC product and service markets, in 2017, the 10-year portfolio of overseas orders on these markets exceeded USD 36 billion. The risk level remains unchanged, as the fact that natural uranium prices and separative work unit (SWU) prices are currently low limits their further reduction and at the same time creates growth opportunities if the market environment is favourable (e.g. if reactors are restarted in Japan). For details, see the section 'International Business' and annual reports of JSC TENEX and JSC TVEL for 2017.	1 2
6. Electricity and capacity market risks ■ (Director General of JSC Rosenergoatom Concern)	Adverse changes in electricity and capacity prices	<b>Management approaches:</b> 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 Concern are negotiating with PJSC FGC UES and JSC SO UEC in order to align the schedule of power grid equipment maintenance.	1
<b>Operational risks</b>			
7. Risk of a decrease in power generation ▼ (Director General of JSC Rosenergoatom Concern)	Decrease in power generation due to equipment shutdowns and unavailability	<b>Management approaches:</b> <ul style="list-style-type: none"> <li>Scheduled preventive maintenance and repairs at NPPs;</li> <li>Implementation of the NPP life extension programme and the programme to increase power generation (including the possibility of power units operating at above nameplate capacity).</li> </ul> <b>Results:</b> 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.	1
8. Industrial and environmental safety risk ■ (Heads of ROSATOM's Divisions)	Major accidents/incidents at nuclear enterprises	<b>Management approaches:</b> <ul style="list-style-type: none"> <li>Provision of an up-to-date legal framework;</li> <li>Engineering measures to ensure the safety of nuclear facilities;</li> <li>Maintaining a high level of professionalism and safety culture among employees.</li> </ul> <b>Results:</b> Safe operation of nuclear facilities and hazardous industrial facilities. For details, see the section 'Nuclear and Radiation Safety'.	1 3
9. Political risk ▲ (International Cooperation Department of ROSATOM)	Changes in the regulatory and political climate in foreign countries imposing restrictions on the operations of the Corporation and its organizations	<b>Management approaches:</b> <ul style="list-style-type: none"> <li>Cooperation with the Russian Ministry of Foreign Affairs and other authorities;</li> <li>Political support for global operations of nuclear organizations;</li> <li>Using the platform of specialized international organizations;</li> <li>Awareness-raising activities conducted worldwide.</li> </ul> <b>Results:</b> As of December 31, 2017, the 10-year portfolio of overseas orders totalled USD 133.5 billion. The growth was driven primarily by the overseas NPP construction project portfolio. The Corporation concluded 11 intergovernmental agreements and 16 major interdepartmental agreements, which is a positive trend.	1 2 3
<b>Changes:</b> The risk tends to increase, as further imposition of sanctions against a number of Russian individuals and legal entities generally increases political uncertainty for Russian residents. For details, see the sections 'International Cooperation' and 'International Business'.			

Risks and changes in risk levels (risk owners)	Risk description	Risk management practices	Connection with strategic goals
<p><b>10. Risk of loss of and damage to assets</b></p> <p>■</p> <p>(Asset Protection Department of ROSATOM)</p>	<p>Corruption and other offences leading to the damage to/loss of assets.</p>	<p><b>Management approaches:</b> ROSATOM has implemented an integrated industry-wide system for the prevention of corruption and other offences.</p> <p><b>Results:</b> Benefits from preventive measures and inspections carried out in 2017 in order to protect the Corporation's assets totalled RUB 8 billion. <i>For details, see the section 'Prevention of Corruption and Other Offences'.</i></p>	<p>1</p> <p>2</p>
<p><b>11. Reputational risk</b></p> <p>▲</p> <p>(Communications Department of ROSATOM and Heads of Divisions)</p>	<p>Changes in stakeholder perception of the trustworthiness and appeal of the Corporation and its organizations.</p>	<p><b>Management approaches:</b></p> <ul style="list-style-type: none"> <li>Measures are taken to shape a positive public opinion on the development of nuclear technologies through improved informational transparency and open stakeholder engagement;</li> <li>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 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;</li> <li>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).</li> </ul> <p><b>Results:</b> According to an opinion poll by Levada-Centre, in early 2018, 73.9% of the Russian population supported the use of nuclear power (71% in 2016). Over the past few years, this figure remains persistently high. Projects implemented abroad are supported by government bodies. The main Russian nuclear industry exhibition, ATOMEXPO 2017, titled 'Nuclear Technologies: Safety, Environment, Stability' was attended by over 6,500 specialists and experts from 65 countries worldwide.</p> <p><b>Changes:</b> An increase in the risk level was due to its strong correlation with political risk. <i>For details, see the section 'Stakeholder Engagement'.</i></p>	<p>1</p> <p>3</p>
<p><b>12. Project risk</b></p> <p>■</p> <p>(Heads of ROSATOM's Divisions)</p>	<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>	<p><b>Management approaches:</b></p> <ul style="list-style-type: none"> <li>Development of action plans for the interaction with foreign customers;</li> <li>Implementation of a programme to reduce the cost and duration of NPP construction;</li> <li>Reallocation of available credit resources between projects, when possible.</li> </ul> <p><b>Results:</b> The Corporation continuously improves the system for managing all stages of NPP construction, from front-end engineering design to the commissioning of power units. Requirements for the monitoring of construction and installation have been drafted and implemented at NPP construction sites; they help to standardize the collection and analysis of data and information on the quality of construction and installation work across all construction sites. <i>For details, see the section 'International Business' and the annual reports of JSC ASE EC and JSC Rosenergoatom Concern for 2017.</i></p>	<p>1</p> <p>3</p>

### 6.3.4. Risk insurance

Risk insurance is one of the main risk management approaches used by ROSATOM. To improve the reliability of insurance coverage, in 2017, the Corporation continued to cooperate with the insurance community on the reinsurance of Russian operators against property risks in the international pooling system. 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 of the industry will continue to be audited for insurance purposes in 2018.

### 6.3.5. Objectives for 2018 and for the medium term

To further develop the RMS, ROSATOM plans to:

- Improve escalation mechanisms for the provision of information on risks for various decision-making levels and improve mechanisms for allocating risk management responsibilities;
- Implement the Risk Management component of the Programme to Implement the Total Cost Management Nuclear Construction (TCM NC) Framework for 2018 and 2019;
- Improve RMS processes taking into account the findings of diagnostic assessment of the risk management culture in the Corporation;
- Improve the system for early response to risks affecting the implementation of the state programme 'Development of the Nuclear Power and Industry Complex'.

## 6.4. Financial and Investment Management

Key results in 2017:

- The investment programme was 89% completed.
- Return on the investment portfolio stood at 17.4%.
- A total of about RUB 31.7 billion was saved through intra-group financing within the industry between 2010 and 2017.

### 6.4.1. Financial management

#### Implementation of ROSATOM's financial strategy

Given the scale of ROSATOM's business in Russia and abroad, the Corporation's management attaches great 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. The main goal of the financial strategy is to ensure the financial sustainability of ROSATOM and its organizations in a changing environment and to maximize the efficiency of financing and financial risk management.

Key financial transactions of ROSATOM have been centralized. Cash flow management is centralized through:

- An established 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 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 scope of consolidation of ROSATOM on a daily basis.

Targets for 2017 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 2017, the Corporation continued to work towards:

- Accumulating spare cash in the accounts of pool leaders<sup>39</sup>;
- Improving the accuracy of payment scheduling (a rolling liquidity forecast);
- Ensuring competitiveness of the cost of servicing of the consolidated debt portfolio;
- Centralizing treasury transactions (complying with the Uniform Industry-Wide Financial Policy).

A total of about RUB 31.7 billion was saved through intra-group financing within the industry between 2010 and 2017.

#### Raising financing for ongoing projects

In 2017, a financial partner was engaged to participate in the wind power plant construction project in the south of Russia and provided financing exceeding RUB 60 billion in the form of both senior debt and mezzanine financing (by acquiring a 49.5% equity stake in a project company JSC VetroOGK and issuing shareholder loans). This deal enabled ROSATOM to engage a major co-investor to cooperate on the project. In addition, the use of project financing will make it possible to develop the promising business without an increase in financial leverage and to roll out the relevant experience across other projects of the Corporation. *See also the section 'Business Diversification'.*

In addition, in 2017, a credit facility agreement with a project company Fennovoima Oy was signed with assistance from ROSATOM as part of the project to build Hanhikivi 1 NPP in Finland. The principal amount of the credit facility totals up to EUR 500 million; it matures on December 31, 2027 with the option of extension until December 31, 2029.

#### Receiving and maintaining credit ratings

Given ongoing reforms in the credit rating industry in Russia, in 2017, JSC Atomenergoprom worked towards receiving a national credit rating from the national rating agency JSC Expert RA. As a result, JSC Atomenergoprom was assigned a rating at the level of Russia's sovereign credit rating: 'ruAAA', with a stable outlook.

In addition, in the reporting year, JSC Atomenergoprom continued to make efforts to maintain its credit ratings assigned by international rating agencies. Each Big Three international rating agency (S&P, Moody's Investors Service, Fitch Ratings) rated JSC Atomenergoprom at the level of Russia's sovereign credit ratings: BB+, Ba1 and BBB- respectively (as of December 31, 2017).

#### Debt portfolio management

Throughout 2017, the Corporation maintained sufficient liquidity or sources of liquidity (credit facilities, etc.) to repay liabilities on time, preventing unacceptable losses and managing reputational risk.

To reduce the cost of documentary transactions and borrowings, the Corporation continued to use suretyship as security for repayment of advance payments and fulfilment of contractual obligations and as a means for reducing the cost of financing.

JSC AtomCapital (a wholly-owned subsidiary of ROSATOM 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.

#### Plans for 2018 and for the medium term

- To maintain 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 current lenders and rating agencies;
- To discuss financing arrangements for ROSATOM's projects in order 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 range of financing instruments used by the Corporation (provided it is economically feasible to do so) in order to reduce the cost of debt service and ensure timely and full financing of the investment programme of organizations in the industry on acceptable terms.

<sup>39</sup> 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. A pool leader is appointed under the resolution of ROSATOM's executive bodies.

## 6.4.2. Investment management

### Investment management tools

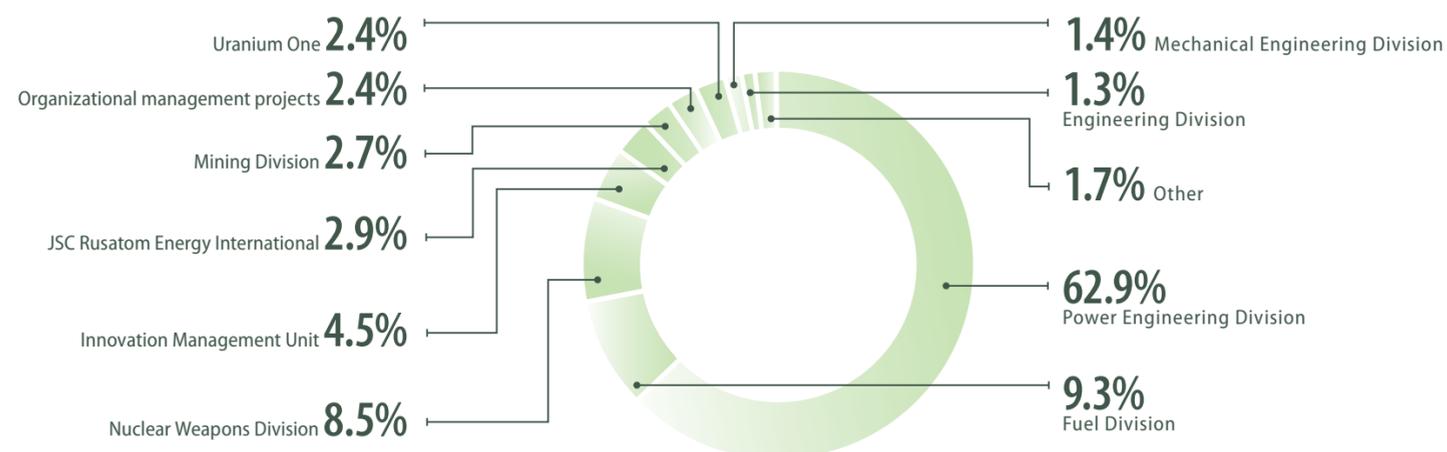
- A distributed system for investment decision-making by the governing bodies of ROSATOM and its organizations aligned with the distribution of competence centres across various areas of business in the industry;
- Decisions on key milestones of projects vital for ROSATOM are made and the projects are monitored at the level of the Corporation;
- Investment decisions related to ongoing maintenance of assets are delegated to organizations;
- To improve the efficiency of investment decision-making, opinions of experts independent from the project initiator are taken into account;
- 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 on investment;

- Deviations from project implementation plans in the organizations in the industry are monitored at the level of the Corporation;
- Organizations in the industry use a phase-gate approach to project implementation;
- Experts are engaged to perform an in-depth probabilistic risk analysis; the findings of analysis are incorporated in the decision-making system;
- A comprehensive audit is conducted, which helps formulate recommendations on how to improve planning and implementation of investment projects;
- ROSATOM is developing approaches to raising financing as an alternative to using its own funds.

### Results in 2017

In 2017, ROSATOM's investment programme was 89% completed, while the return on the investment portfolio stood at 17.4%. The investment programme was not implemented in full (including in ROSATOM's divisions) due to the deferral of expenditure on certain projects to subsequent reporting periods. In turn, the deferrals were necessitated by the need to revise project implementation plans in some cases given a change in the external environment in order to use the funds more efficiently.

Fig. Breakdown of investments in 2017



### Key investment projects of ROSATOM<sup>40</sup>

Division/complex	Project	Key results in 2017 <sup>41</sup>
Mining Division	Construction of Mine No. 6 at PJSC PIMCU.	Construction of high-priority infrastructure facilities was started.
Fuel Division	Modernization of separation facilities at JSC UEIP. Construction of a new gas centrifuge plant at PJSC Kovrov Mechanical Plant.	Five sections of a process unit with ninth-generation gas centrifuges were put into operation following an upgrade. The powder spraying section, the electroplating section and four machining sections started full-scale operation following an overhaul.
Mechanical Engineering Division	Development of research and technological capabilities of JSC Afrikantov OKBM. Modernization of production facilities of JSC Central Design Bureau of Machine Building.	The metal coating and electrochemical plating sections were renovated and put into operation; equipment for 3D research was commissioned; R&D was completed as part of the project to develop fast neutron reactors. The coating and drying facility was put into operation; jib cranes started full-scale operation; high-performance numerical control machining centres were purchased; vertical turning machines were upgraded.
JSC Rusatom Energy International	Construction of Akkuyu NPP (Turkey).	A limited licence for NPP construction was obtained from the Turkish Atomic Energy Authority (TAEK). Under the licence, construction and installation operations are underway at all facilities of the nuclear power plant, except for facilities that make an impact on nuclear safety and the environment.
Nuclear-powered icebreaker fleet	Construction of port vessels to be operated in the port of Sabetta for OJSC Yamal LNG.	Construction of the Yuribey icebreaking tugboat was completed. The boat started regular operation as a port vessel in the port of Sabetta.
Life Cycle Back-End Division	Construction of a pilot and demonstration centre for spent nuclear fuel reprocessing at FSUE Mining and Chemical Plant.	A number of construction and installation operations were performed.
New businesses	Establishment of a state-of-the-art plant for the production of PAN precursor. Construction of wind power plants.	A contract was concluded for the delivery of process facilities in order to build a PAN precursor plant with a capacity of no less than 5,000 tonnes. An agreement on the construction of a PAN production plant was concluded with the Alabuga special economic zone. Red Wind, a joint venture with the Dutch company Lagerwey, was established. A contract for the delivery of wind turbine components was signed with Lagerwey.

<sup>40</sup> Apart from NPP construction in Russia (information on the implementation of the investment programme of the Power Engineering Division is provided in the 2017 report of JSC Rosenergoatom Concern).

<sup>41</sup> For details, see the relevant sections of the Report and the annual reports of JSC Atomredmetzoloto, JSC TVEL and JSC Atomenergomash for 2017.

### Measures to improve investment efficiency

In 2017, ROSATOM completed the first stage of the project to establish a Project Management School, a single industry-wide platform for project talent management. It launched employee training and assessment at a basic level in accordance with ROSATOM's methodology, best practices in the sphere of project management and the ISO 21500 standard. The Corporation completed the formalization of the risk management process for investment projects and introduced a qualitative risk assessment methodology and the relevant tools for project managers in order to improve the quality of risk management. The functionality of ROSATOM's project portfolio management system (the SIRIUS information system) was expanded.

A decision was made to establish an industry venture fund worth RUB 3 billion or more. In 2017, the legal form of the fund was discussed, and the team was selected.

Jointly with the Skolkovo Foundation, the Corporation launched a project to hold a Start-Up Contest in the new sectors of the industry. The Corporation plans to select start-ups to meet its objectives taking into account their maturity and the findings of a technological assessment carried out by industry specialists and invited independent experts.

In 2017, ROSATOM represented by the Investment Management Department remained a partner of the Project Olympus contest held by the Analytical Centre for the Government of the Russian Federation. JSC TVEL and JSC Science and Innovations participated in the contest in the 'Project Management Systems in State-Owned Companies and Commercial Organizations' and 'Organization and Functioning of Project Management Offices in State-Owned Companies and Commercial Organizations' categories.

### Challenges of the reporting period and mitigation measures

Challenge	Mitigation measures
Inadequate rationale for investments.	<ul style="list-style-type: none"> <li>– Further standardization of requirements for project management, supporting materials, material quality control procedures;</li> <li>– Improvement of the project review institution;</li> <li>– Improvement of the industry-wide knowledge base on investment activities and projects;</li> <li>– Development of competences of project team members.</li> </ul>
Major changes in the external environment (macro parameters).	<ul style="list-style-type: none"> <li>– Search for new projects, technological and design solutions for ongoing projects to optimize investment expenditures;</li> <li>– Improved accuracy of investment and project planning;</li> <li>– Stricter control in order to prevent misuse of funds;</li> <li>– Improvement of the risk management system.</li> </ul>
Lack of manoeuvrability of the project portfolio.	<ul style="list-style-type: none"> <li>– Linking projects through shared deliverables to track their mutual influence; use of a programme-based approach.</li> <li>– Development of centralized tools for assessment, training and formulation of individual development plans for senior and middle-level project managers and project team members;</li> </ul>
Lack of professional project managers.	<ul style="list-style-type: none"> <li>– Development of a system of financial and non-financial incentives for the project manager and the project team;</li> <li>– Developing career path options for project team members and project managers.</li> </ul>

### Plans for 2018 and for the medium term

- To develop the competences of participants of projects and investment activities;
- To improve the system of incentives for participants of projects and investment activities; to introduce option-based incentives;
- To develop the entrepreneurship culture in the industry by holding the relevant industry events and using programme management approaches to develop new businesses in the industry;
- To develop certain elements of the investment environment using the 'open innovations' model (the Start-Up Contest, the industry venture fund, supporting acceleration programmes);
- To ensure that the level of maturity of project management in nuclear organizations is consistent with best practices;
- To increase the level of project and investment automation.

## 6.5. Procurement Management

### Key results in 2017:

- Overall savings from competitive procurement procedures (using ROSATOM's own funds and federal budget funds) totalled RUB 38.37 billion.
- The share of electronic procurement totalled 99%.
- 19,358 contracts worth a total of RUB 91 billion were concluded with small and medium-sized enterprises, including contracts concluded following special auctions worth a total of RUB 47.4 billion.
- Pursuant to the order of the Prime Minister of Russia to disclose information on counterparties, ROSATOM disclosed information on ~16,000 counterparties (100%).



— In May 2018, the President of Russia Vladimir Putin signed the Decree on National Goals and Strategic Objectives of the Russian Federation until 2024, which sets out the programme for the digitization of the national economy, among other things. What digital technologies does ROSATOM intend to use in the near future to develop its procurement practices?

— Digitization is one of the key areas of ROSATOM’s corporate development. We have been working on this aspect for a long time. Over the last 8 years, we have created a shared information space for procurement management, which currently covers 8,000 users from almost 400 nuclear organizations and 80,000 suppliers. A number of processes have been automated, such as demand planning taking into account available inventories, procurement planning, calculation of initial prices and procurement, review of tender bids, and conclusion of contracts.

Today, we aim to provide full automation of contract performance, which involves recording the milestones. The system will enable timely monitoring of quality and project deadlines and will help to manage any irregularities that may be identified. The Corporation intends to build a database of nonconforming products to be used when carrying out the relevant procedures. The process itself will take place in a shared information

space used by customers and suppliers. We also plan to introduce digital technologies for the assessment of suppliers’ experience and resources, which will make it possible to assess the workload of those participating in the procurement process under other agreements.

— How important are the non-financial characteristics of suppliers and contractors (such as business reputation, respect for human rights, non-discrimination, social responsibility) for ROSATOM? How does ROSATOM monitor these characteristics and compliance with the relevant criteria?

— Non-financial characteristics are a measure of competency of our contractors. Given the importance of these characteristics and in order to guarantee the high quality of work, goods and services purchased under the contracts, in 2017, ROSATOM launched a data reliability audit for our potential business partners. Based on its findings, we can assess manufacturing capabilities of a contractor’s enterprise and its commitment to meeting both quality requirements and contract deadlines.

As for our suppliers’ respect for human rights and social responsibility, in our case, in the course of procurement, customers impose mandatory requirements (legal capacity, no arrears on taxes and duties, disclosure of information on beneficial owners) and additional requirements (experience, material and technical resources, personnel, system for the assessment of working conditions, no listings in registers of dishonest suppliers) for bidders in this area.

We also intend to introduce additional requirements for suppliers stipulating that all root causes of non-compliance with quality requirements must be addressed. Suppliers that fail to remedy the causes of non-compliance within the established time frame will not be entitled to participate in our tenders. A similar principle will apply to contractors lacking resources. I would like to add that we are currently considering creating a shared database that will provide reliable information on suppliers. This tool will completely transform our procurement practices. The lengthy procedure of identifying the winner will no longer be needed, and corruption and subjective decisions will be fully eliminated. The use of these tools will enable ROSATOM to build and develop a community of bona fide business partners.

The Uniform Industrial Procurement Standard (UIPS) (the Regulations on Procurement) of ROSATOM is the main document that regulates the procurement activities of ROSATOM and industry organizations.

Governing and supervisory bodies:

- 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 (Federal Law No. 44-FZ));
- Central Arbitration Committee of ROSATOM and arbitration committees of the Divisions;
- Chief Controller.

Official procurement website: [www.zakupki.rosatom.ru](http://www.zakupki.rosatom.ru).

In 2017, ROSATOM was awarded for the performance of its procurement system in the 2017 National Procurement Transparency Ranking. The Corporation was awarded the top status, Guaranteed Transparency, according to the annual survey of the National Association of E-Commerce Participants. In addition, in 2017, Roman Zimonas, Director for Procurement, Logistics and Quality Management at ROSATOM, topped the ranking of chief procurement officers compiled by AK&M Agency.

#### 6.5.1. Implementation of the annual procurement programme<sup>42</sup>

In accordance with the Annual Procurement Programme, in 2017, ROSATOM and its organizations made 33,329 competitive purchases totalling RUB 523.50 billion. Savings totalled RUB 36.69 billion (8.7% of the amount of actual purchases).

486 competitive purchases totalling RUB 21.01 billion were made using federal budget funds in accordance with Federal Law No. 44-FZ. Savings totalled RUB 1.68 billion (9.0% of the actual purchases)<sup>43</sup>. As a result of the implementation of the annual procurement programme, contracts were concluded with 16,166 counterparties. The share of electronic procurement totalled 99%<sup>44</sup>.

Table. Amount of competitive purchases and achieved savings<sup>45</sup>, RUB billion

	2015	2016	2017
<b>Total amount of procurement orders placed under an open competitive procedure including:</b>			
Using ROSATOM’s own funds	643.59	450.96	544.51
Using federal budget funds	21.19	35.86	21.01
<b>Total savings including:</b>	<b>27.33</b> (4.82%)	<b>29.82</b> (9.0%)	<b>38.37</b> (8.71%)
<b>Savings from competitive procurement procedures using ROSATOM’s own funds</b>	<b>26.4</b> (4.8%)	<b>28.2</b> (9.4%)	<b>36.69</b> (8.7%)
<b>Savings from competitive procurement procedures using federal budget funds</b>	<b>0.93</b> (5.30%)	<b>1.62</b> (5%)	<b>1.68</b> (9.0%)

#### 6.5.2. Expansion of access to procurement procedures for small and medium-sized enterprises (SMEs)

Pursuant to Decree No. 1352 of the Government of the Russian Federation on the Special Features of Participation of Small and Medium-Sized Enterprises in the Procurement of Goods, Work and Services by Certain Types of Legal Entities dated December 11, 2014 and as part of the efforts to expand access to procurement procedures for SMEs:

- ROSATOM’s organizations concluded 19,358 contracts with SMEs worth a total of RUB 91 billion, including contracts concluded following special auctions (with only SMEs participating) worth a total of RUB 47.4 billion;
- The list of products purchased exclusively from SMEs was updated and posted on the Corporation’s website; the list comprises 590 OKPD<sup>246</sup> codes of various levels across a range of administrative and maintenance activities and other products for which a competitive market has been formed and the practice of purchasing from SMEs has been adopted.

An agreement was concluded at the 9<sup>th</sup> International Forum ATOMEXPO 2017 in order to expand access of SMEs to factoring during contract execution stipulated by Federal Law No. 223-FZ on the Procurement of Goods, Work and Services by Certain Types of Legal Entities. In the reporting year, nuclear organizations covered by Decree No. 1352 on the Special Features of Participation of Small and Medium-Sized Enterprises in the Procurement of Goods, Work and Services by Certain Types of Legal Entities dated December 11, 2014 published their annual reports on the procurement of goods, work and services by certain types of legal entities from SMEs in the Integrated Information System in a timely manner.

#### 6.5.3. Improvement of the industry-wide procurement and logistics system

As part of measures to improve the procurement and logistics system, in 2017, a number of changes were introduced into ROSATOM’s Uniform Industrial Procurement Standard (Regulations on Procurement): a number of mechanisms were introduced to reduce the procurement lead time; certain powers were delegated to the heads of nuclear organizations, and the business reputation ranking system was integrated into the procurement system.

A new tool, namely a data reliability audit, was introduced for the first time in the nuclear industry. It helps to confirm the supplier’s ability to duly execute the relevant contract. The audit involves an on-site visit of producers by the customer’s commission possessing the necessary competences and special knowledge of the items to be procured. In 2017, the mechanism was used by 23 industry organizations, which conducted 209 audits.

A new procurement method, an e-store, was introduced with the initial maximal purchase value of up to RUB 1 million to improve and speed up procurement and logistics processes. The list of products for which this procurement method may be used and document templates (notification, standard protocol, draft contract) were defined and approved. Pilot purchases were made during the year by organizations in the industry via the Roseltorg electronic trading platform. In the future, the EOS-Zakupki automated system and the Roseltorg electronic trading platform are to be improved, and the project is to be rolled out on other electronic platforms. Category strategies<sup>47</sup> for goods, work and services were designed as part of the development of the procurement system. The category management of logistics was introduced in 96 of ROSATOM’s organizations which purchase 89% of materials, equipment and work/services. Standardization of technical specifications for products was started; this process involves open professional discussion of technical specifications with product manufacturers.

Comprehensive measures were taken to improve procurement and logistics processes in order to improve supply quality and timeliness:

- requirements for the acceptance of NPP equipment were optimized;
- standard quality requirements for suppliers were formulated;
- ROSATOM switched to risk-based quality management and focused on preventing potential issues using the 8D problem solving method (searching for and eliminating the causes of irregularities in order to prevent their recurrence).

<sup>42</sup> The annual procurement programme is publicly available at <http://zakupki.rosatom.ru/Web.aspx?node=gpzz>.

<sup>43</sup> 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.

<sup>44</sup> Except for the cases stipulated by the Uniform Industrial Procurement Standard.

<sup>45</sup> Savings from competitive purchases are the difference between the set initial maximum purchase price and the purchase price obtained as a result of competitive procurement procedures. Only actual procurement procedures were taken into account.

<sup>46</sup> National Classification of Products by Economic Activity.

<sup>47</sup> A category strategy is a plan of action to enable efficient procurement, supply and inventory management.

## Procurement for international business

The following measures were taken to develop the procurement system for international business:

- guidelines on procurement management were developed as part of implementation of the NPP construction project in Finland in accordance with the laws of Finland and Russia, ROSATOM's regulations on procurement, individual requirements of the foreign customer and the Radiation and Nuclear Safety Authority of Finland;
- ROSATOM in cooperation with Russian government bodies made amendments to Federal Law No. 223-FZ on the Procurement of Goods, Work and Services by Certain Types of Legal Entities dated July 18, 2011. The amendments helped eliminate the risk of a conflict between the Russian legislative statutory provisions and the statutory provisions of the countries in which the Corporation's foreign projects are being implemented, requirements of national executive bodies and requirements of foreign customers. In addition, the amendments make it possible to apply more flexible tendering mechanisms taking into account the requirements of foreign customers.

Pilot operation of an integrated industry-wide procurement system for international business was started. The automated system enables the Corporation and nuclear organizations to efficiently manage their planning and procurement activities abroad, monitor the quality of procurement activities and obtain up-to-date analytics.

### 6.5.4. Communication with suppliers and other stakeholders

As part of the development of a training and awareness system for customers and suppliers, in 2017, ROSATOM's Corporate Academy held 105 training events, including 61 professional development courses on various procurement-related topics. A total of 1,753 people underwent the training, including 111 representatives of organizations interested in supplies to nuclear enterprises.

In November 2017, the 9<sup>th</sup> International Forum of Nuclear Industry Suppliers ATOMEX 2017 was held in Moscow. The Forum was attended by 2,807 people. The number of participating supplier companies increased from 433 to 1,164, with the number of foreign participants increasing from 43 to 116.

As part of cooperation with the Federal Corporation for Small and Medium-Sized Business Development (RSMB Corporation) and All-Russian Non-Governmental Organization of Small and Medium Business OPORA RUSSIA, regular meetings were conducted in various Russian regions; they were attended by representatives of ROSATOM, RSMB Corporation, OPORA RUSSIA and regional SMEs.

Representatives of ROSATOM and its organizations took part in conferences and other events focusing on the development of the procurement system, such as the 12<sup>th</sup> National Forum and Exhibition 'GOSZAKAZ – For Transparent Public Procurement', the 3<sup>rd</sup> National Conference 'Innovative Procurement', the 5<sup>th</sup> National Practical Conference and Workshop 'Corporate Procurement: the Practice of Application of Federal Law No. 223-FZ', the 4<sup>th</sup> Annual Conference 'Electronic Trading Platforms', the Saint Petersburg International Economic Forum, etc.

### 6.5.5. Plans for 2018 and for the medium term

Due to significant amendments to Federal Law No. 223-FZ, ROSATOM plans to take measures to ensure compliance of its procurement system methodology with Russian legislative requirements and to participate in law-making activities in order to introduce amendments for ROSATOM's benefit to Federal Law No. 223-FZ, adopted by-laws and draft laws governing procurement activities, including procurement from SMEs, the voluntary certification procedure, etc.

In 2018, ROSATOM will continue to develop the Qualified Buyer, a division possessing proper qualification, experience and resources for performing the full range of work under the procurement and logistics process, performing this work and bearing full responsibility for the entire range of the work performed.

Quality assurance processes during the procurement of materials and equipment will be improved in order to improve the quality and timeliness of deliveries.

One of the priorities in 2018 will be to build an integrated incentive system encouraging technical, procurement, logistics and quality management functions of organizations in the industry to perform the full range of work on the logistics process on time and to a high standard, and to establish a single KPI measuring the impact on outcomes.

In the sphere of automation and optimization of the logistics, procurement and quality management process, ROSATOM will continue to build a shared information space for customers, participants, planners and manufacturers and to implement control and monitoring projects at the stage of contract performance and operation:

– building a single industry-wide quality management system which includes functions for managing irregularities occurring at any stage of the product life cycle and provides IT support for eliminating irregularities using the 8D methodology;

– implementing the contract performance management system;

– developing smart search tools for market analysis and assessment of suppliers (their financial position, business reputation, manufacturing capabilities, etc.);

– adjusting information resources on procurement according to the amendments to Federal Law No. 223-FZ.

## 6.6. Internal Control System

Key results in 2017:

■ During rapid monitoring of financial management quality by the Russian Ministry of Finance, ROSATOM's internal control system scored 100 points on all dimensions of the control and audit assessment (which is the highest possible score).

■ During the federal budget performance audit for 2016, the Accounts Chamber of the Russian Federation gave a high score to internal financial audit at ROSATOM.

■ The Treasury of the Russian Federation rated the organization of internal financial control and internal financial audit at ROSATOM at 95% (to compare, the average score of 93 key budget holders stood at 64%).

■ ROSATOM's Internal Audit Department won the 2<sup>nd</sup> degree award in the Internal Audit Function of the Year category in the 5<sup>th</sup> National Contest 'Internal Auditor of the Year'.

The internal control system of 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).

### 6.6.1. Improvement of the internal control system

As part of the efforts of ROSATOM's Internal Control and Audit Function (ICAF) to provide reasonable assurance of achieving the Corporation's strategic goals, in 2017:

– The risk-based approach to conducting inspections was improved through a significant expansion of the analytical part of the consolidated planning process;

– The limited-scope audit technique was adopted;

– A limited-scope audit was conducted to validate the KPIs of TOP-30 senior managers. Based on the audit findings, actual values of the indicators were adjusted, and changes were introduced to the KPI sheets, including those improving the transparency of KPI calculation;

– The technique for communication with regulatory and supervisory government bodies was mastered;

– An IT system for supporting ICAF activities was put into operation; it will help to automate individual internal control and internal audit processes, including planning, preparation and conducting of inspections, follow-up checks, reporting, etc.

In 2017, comprehensive assessment of the performance of the governance system was launched within ROSATOM's divisions (an internal performance audit was conducted in the Corporate Centre).

### 6.6.2. Results in 2017

#### Conducting inspections

Specialized internal control bodies (SICBs) conducted 724 inspections at ROSATOM and its organizations.

12 inspections were conducted by external regulators supervising compliance with the budget legislation, including 7 inspections by the Accounts Chamber of the Russian Federation. No instances of misuse or illegal use of budgetary funds or assets were detected within ROSATOM or its organizations.

Findings of inspections conducted in 2017 show an improvement of financial and business discipline in a number of areas. There was a reduction in the number of breaches of business contracts, violations in the sphere of procurement, accounting and remuneration, as well as in the number of instances of non-compliance with local regulations.

Following the inspections, 589 corrective measures were developed and scheduled for implementation. Implementation of corrective measures remains effective, which helps to reduce the number of repeated violations.

Based on the findings of inspections conducted in the reporting year, disciplinary sanctions were imposed on 538 employees of ROSATOM and its organizations, including the dismissal of 8 senior managers.

#### Stakeholder control

In 2017, ROSATOM continued to take measures in the sphere of stakeholder control during public procurement and asset sales:

– An arbitration committee was established at JSC ASE EC;

– A business reputation rating system (BRRS) for assessing suppliers in the nuclear industry was implemented in all organizations in the industry;

– The Uniform Industry-Wide Guidelines for Assessing Business Reputation were approved; the Guidelines establish the procedure for entering information on negative business reputation into the BRRS;

– An RPS project was implemented in order to notify stakeholders of procurement appeals more promptly by automating the sending of notices of receipt of complaints and the outcome of their review.

In 2017, the Central Arbitration Committee and arbitration committees of the Divisions, which are responsible for the legality and out-of-court settlement of disputes related to procurement at ROSATOM and its organizations, received 1,093 complaints, 202 of which were found to be substantiated (18%).

*See also the section 'Procurement Management'.*

#### 6.6.3. Plans for 2018

– To monitor the transformation of the Engineering Division and implement a system for integrated management of the time and cost of construction of nuclear facilities (TCM NC);

– To develop criteria for assessing the efficiency of inspections and audits;

– To improve horizontal communication between SICBs and the Corporation's management, between SICBs of the Divisions, and improve vertical communication between SICBs of the Divisions and organizations in the industry;

– To roll out the IT system for supporting the ICAF activities across the industry and to continue to improve it;

– To expand the scope of analysis for the planning and preparation of inspections, including through the use of big data.

Arbitration committees are expected to:

– Reduce the duration of processing of complaints by 20% (from 20 to 16 business days);

– Automate the relevant processes (submission of complaints, publication of resolutions by arbitration committees, contextual search through complaints and resolutions);

– Update the legal framework for the monitoring of non-competitive procurement;

– Participate in developing a programme to assess controllers' competence in order to maintain the required level of their qualification.

## 6.7. Prevention of Corruption and Other Offences

Key results in 2017:

- All instructions of the President of Russia and the Prime Minister of Russia concerning the National Anti-Corruption Plan for 2016 and 2017 were carried out.
- 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>).
- Savings from measures to prevent and compensate for the loss of assets totalled RUB 8 billion.

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 Ethics<sup>48</sup> and the Uniform Industry-Wide Anti-Corruption Policy of ROSATOM and Its Organizations<sup>49</sup>).

Measures to prevent corruption and other offences are implemented in accordance with ROSATOM's Anti-Corruption Plan for 2016 and 2017<sup>50</sup> (issued pursuant to Federal Law No. 273-FZ on Combating Corruption dated December 25, 2008, Decree No. 147 of the Russian President on the National Anti-Corruption Plan for 2016 and 2017 dated April 1, 2016 and other anti-corruption laws and regulations).

### 6.7.1. Key results in 2017

#### Prevention and recovery of damage

In 2017, savings from measures to prevent the loss of assets and recover the damage incurred by the Corporation totalled RUB 8 billion (according to aggregate data provided by organizations in the industry).

Over a thousand employees in the industry (half of them heads and deputy heads of organizations and divisions and other officers) were held liable in accordance with the law. Where required by law, criminal proceedings were started based on the materials filed to law enforcement agencies and providing evidence of damage inflicted on the Corporation and its organizations.

#### Preventive measures

Current and prospective employees of ROSATOM are instructed to comply with restrictions and prohibitions stipulated by anti-corruption legislation. In addition, the form of the employment contract was amended to include a special Anti-Corruption Clause and recommendations on notifying the employer in the event of any changes in the records of their relatives.

In 2017, the industry media published over 140 articles, stories, messages and press releases on preventing corruption and other violations, and on improving procurement terms, procedures and mechanisms.

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 (<http://www.rosatom.ru/about/protivodeystvie-korrupsii/obratnaya-svyaz-dlya-soobshcheniy-o-faktakh-korrupsii>).

#### Personnel training in anti-corruption practices

A system of anti-corruption training for employees of ROSATOM and its organizations, including those responsible for preventing corruption and other offences, is being developed on the basis of training centres in the industry. In 2017, 286 employees in the industry, including 129 employees of ROSATOM (including heads of divisions and other officers), completed anti-corruption training programmes. In addition, a new topic, Anti-Corruption Issues, was included in the employee onboarding course titled Introduction to the Company.

### 6.7.2. Objectives for 2018

- To encourage employees in the industry to participate more actively in initiatives aimed at preventing corruption and other offences;
- To respond more efficiently to identified violations in accordance with the rule of law and the principle that wrongdoings are inevitably punished in accordance with the law;
- To expand the scope of preventive and awareness-raising efforts aimed at forming a zero tolerance attitude to any corrupt practices among employees in the industry;
- To develop a professional development system and to improve the professional qualifications and expertise of employees in the industry responsible for preventing corruption and other offences.

<sup>48</sup> <http://www.rosatom.ru/social-respons/code-of-ethics>.

<sup>49</sup> <http://www.rosatom.ru/about/protivodeystvie-korrupsii/normativnye-pravovye-i-inye-akty>.

<sup>50</sup> <http://www.rosatom.ru/about/protivodeystvie-korrupsii/normativnye-pravovye-i-inye-akty>.

## 7.0. Development of Human Potential and Infrastructure

### 7.1. Implementation of the HR Policy

Key results in 2017:

- The average monthly salary totalled RUB 73,600 per month (+5.6% against 2016).
- 31.3% of employees were aged under 35.
- The employee engagement rate stood at 83% (on a par with the best employers of Russia).
- 45% of members of the executive succession pool were appointed to a managerial position.
- 392 employees of ROSATOM and its organizations received government awards, certificates of appreciation and acknowledgements from the Russian President. 10,600 people received industry awards.
- Over 1,200 university graduates were hired by nuclear organizations.

#### Tatyana Terentyeva, Director for Human Resources



— The digital transformation launched in the nuclear industry will gradually change ROSATOM's business model and its approaches to workflow organization. What changes in the sphere of personnel management do you think this will bring about?

— I would rather focus not on the changes, but on the objectives that these changes will enable us to accomplish. Firstly, this is support to senior management by creating a shared digital space and mobile services allowing us to promptly respond to requests, make decisions and provide feedback to employees. Secondly, automation and robotization of routine HR processes will help to reduce the duration and cost of transactions and will free up additional resources across HR functions to address more complex and strategically important business tasks. Thirdly, augmented reality and the introduction of a distance learning platform will significantly improve the speed and coverage of training in specialisms that are most relevant to the business.

— What new competences will employees need to develop?

— On the one hand, digital technologies are becoming simpler, and interfaces are becoming easier to use. On the other hand, an increasing number of new technologies which need to be mastered are emerging in a shorter period of time. Therefore, employees must learn to use the emerging technologies. Not only do they have to learn to manage big data sets or IT systems, but they also need to do so as quickly, efficiently and safely as possible. Another new skill to acquire will be to work in distributed teams. Today, people no longer need to meet in person to discuss many issues which, with modern technology, can be addressed remotely. New digital products will require

testing, promotion and ‘turnkey’ logistic support until they are delivered to the customer, i.e. new ‘digital’ professions will emerge in the nuclear industry, and the key competence will be the employees’ readiness to master them. Lifelong learning is how I would describe the new competences that employees will have to master in the era of digitization. They will have to be able to learn anywhere and at any time, from experts, colleagues, partners and clients, that is to say, from everyone who employees interact with on a daily basis.

#### — Do you expect a large-scale robotization and automation of work processes?

— Since robotization and automation of routine transactions significantly improve their speed, efficiency and quality, thus freeing up employees for more complex tasks within their core areas of work, I think we can well expect wide application of technologies in all economic sectors. The Russian Ministry of Labour is working in this area in cooperation with employers and has initiated the Paperless HR Document Management project to convert employment record books, contracts and orders into electronic form. One of our companies, Greenatom, is actively involved in this project.

#### — Will the Corporation provide certain categories of employees with the opportunity to work remotely?

— Special conditions will be provided for special types of activities and categories of employees, such as young specialists and researchers, graduate students on work placements or doing internships, and women with young children. Interns will be able to combine work with studies due to the 12-hour working week permitted in the divisions. Many students on work placements in PR offices of nuclear organizations work remotely as they prepare materials for the industry media and representative offices of ROSATOM on social media. In addition, the entire range of IT support services and basic HR processes have been separated into service centres and have already been performed remotely for 8 and 5 years correspondingly. However, it should be remembered that due to the special nature of the nuclear industry, the key personnel involved in production, construction and classified projects are not supposed to work remotely.

#### — How would you describe the gender equality situation in the Corporation and nuclear organizations? Do you conduct any comparative studies and analysis of employment, salaries and career advancement of men and women?

— Speaking of ROSATOM’s business structure as a whole, it mainly comprises production, construction, operation and maintenance of industrial nuclear facilities. Historically, the nuclear industry usually employs graduates of technical universities, the majority of whom are men. According to the statistics, in 2017, men and women made up 67% and 33% of the workforce in the industry respectively. A similar proportion holds true for the top 30 executives, with the share of men and women at 76% and 24% respectively. According to an international study by Grant Thornton, the statistics are comparable to the global average ratio of male and female executives (75% and 25% respectively). The shares of men and women in the industry’s talent pool stand at 80% and 20% respectively. Women get promoted to senior executive positions slightly less often than men (18% vs 82%). Speaking of the ratio between men and women in ROSATOM’s Central Office, we can be justly named the absolute top performer: with a 50/50 ratio of men to women, following a promotion, the ratio remains almost unchanged: 53% of men and 47% of women. Men and women have equal opportunities in terms of employment and remuneration: what matters to us is that the employee be a professional in their field.

#### — Does the Corporation employ any tools to prevent discrimination?

— Although we are proud to say that to date we have received no complaints of discrimination, ROSATOM has a wide range of tools for fighting it, including ROSATOM’s Code of Ethics and Professional Conduct for Employees, the Ethics Committee and a 24/7 hotline for reporting violations, which guarantees full confidentiality of personal data provided by the whistleblowers.

In 2017, ROSATOM and its organizations employed 247,300 people, including 1,850 people in foreign organizations.

Number of employees by employee category:

- Executives: 31,100 people;
- Specialists: 98,800 people;
- White-collar workers; 10,300 people;
- Blue-collar workers: 107,100 people.

139,500 employees<sup>51</sup> (56.4% of the total headcount) have a university degree. Over 3,300 employees (1.35% of the total headcount) are Candidates and Doctors of Sciences.

The age of employees averaged 43.5 years (46.6 years for executives). 31.3% of employees were aged under 35.

In 2017, the personnel turnover rate stood at 10.01%. Over the past three years, this rate has been decreasing due to the competitiveness of remuneration and the benefit package offered by the Corporation (in 2016 and 2015, the turnover rate stood at 10.45% and 11.15% respectively).

**Table. Average headcount by business area, '000 people**

Division/complex/organization	2015	2016	2017
<b>Nuclear Weapons Division</b>	<b>92.38</b>	<b>95.23</b>	<b>93.79</b>
Emergency preparedness units	–	–	2.04 <sup>52</sup>
Mining Division	8.19	7.28	6.66
Uranium One Holding	2.9 (2.8) <sup>53</sup>	1.58 (1.48)	1.51 (1.4)
Fuel Division	22.53	22.13	21.79
Sales and Trading Division	0.54	0.57	0.61
Power Engineering Division	51.0	48.57	48.43
Mechanical Engineering Division	19.1 (0.2)	17.28 (0.32)	17.1 (0.32)
Promising materials and technologies	0.69	0.64	0.63
Overseas Division	0.7	0.79	0.75
New businesses	–	0.39	0.54
Engineering Division	18.0 (0.15)	14.99 (0.11)	14.54 (0.11)
Life Cycle Back-End Division	9.96	9.62	8.64
Innovation Management Unit	12.27	11.89	10.37
Administrative units	6.03	6.60	6.18
JSC ITPC	3.50	3.44	3.34
Security units	8.51	8.65	8.72
Non-core assets	0.36	0.29	0.08
JSC Rusatom Healthcare	–	–	1.56
<b>ROSATOM, total</b>	<b>256.66</b>	<b>249.94</b>	<b>247.30</b>

The downsizing at ROSATOM forms part of measures to improve the performance of organizations in the industry: work processes are automated; new production and management technologies are introduced, and a number of functions are outsourced. The reduction in the headcount was also due to the change of the scope of consolidation in a number of the Corporation’s Divisions.

#### 7.1.1. Staff costs and remuneration system

In 2017, staff costs totalled RUB 291.3 billion, up by 4.2% year on year. The costs per employee per year increased from RUB 1,114,200 in 2016 to RUB 1,174,100 in 2017 (up by 5.4% year on year).

**Table. Structure of staff costs, %**

	2015	2016	2017
<b>Payroll fund</b>	<b>74.9</b>	<b>75.2</b>	<b>75.4</b>
<b>Insurance contributions</b>	<b>20.9</b>	<b>20.6</b>	<b>20.7</b>
<b>Social and other expenses (including personnel training)</b>	<b>4.2</b>	<b>4.2</b>	<b>3.9</b>

#### Remuneration system

The current remuneration system at ROSATOM:

- Provides adequate remuneration matching the compensation in the best Russian companies;
- Is result-based: strengthening the link between employees’ compensation and their efficiency and achievement of key performance indicators (KPIs).

Employees’ remuneration is linked to their performance through a number of mechanisms, including regular salary reviews based on personal performance evaluation, as well as annual and ad hoc bonuses for the achievement of targets which are set following a decomposition of industry-wide strategic goals. Managerial KPIs of ROSATOM are linked to the strategic goals and KPIs established for the Corporation by the Supervisory Board. 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 2017, the monthly average salary per employee at ROSATOM increased by 5.6% compared to 2016 and totalled RUB 73,600 per month.

#### 7.1.2. Executive succession pool

A centralized programme to build and develop an executive succession pool (ESP) is implemented to ensure succession and train executives to be appointed to managerial positions at ROSATOM.

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 level that they occupy in the ESP is determined by the target position of a candidate within the ESP:

- ROSATOM’s Assets (top executives);
- ROSATOM’s Assets. Basic level (introduced in 2017);
- ROSATOM’s Capital (middle-level executives);
- ROSATOM’s Talents (promising specialists and junior executives).

In 2017, the executive succession pool comprised 2,384 people (79.9% of them men and 20.1% women). Candidates for the ESP must meet strict selection criteria, which include the requirement that the next career move should already be approved. This helps to determine what position an ESP member is preparing to occupy and to track his or her subsequent progress towards the target position.

In 2017, ESP members completed a module-based training programme aimed at developing managerial knowledge and skills.

<sup>51</sup> Hereinafter, in accordance with the GRI Sustainability Reporting Standards (GRI SRS), the term ‘employee’ is equivalent to the GRI term ‘employee’.

<sup>52</sup> Until 2017, emergency preparedness units were part of the Nuclear Weapons Division.

<sup>53</sup> The figures in brackets indicate the average headcount in foreign organizations of the Divisions.

Table. Training as part of ESP development programmes

ESP level	Development programme	Key training areas	Number of participants		
			2015	2016	2017
Senior executives	ROSATOM's Assets	Strategy, market-oriented thinking, strategic leadership, innovation management, marketing for high-technology companies	155	84	248
	ROSATOM's Assets. Basic level		–	–	147
Middle-level executives	ROSATOM's Capital	Leadership and project management, advanced managerial skills, data management	870	582	994
Junior executives	ROSATOM's Talents		1,102	1,085	995
<b>Total</b>			<b>2,127</b>	<b>1,751</b>	<b>2,384</b>

In 2017, 45% of the ESP members were appointed to a new managerial position.

Table. Appointment of ESP members to new positions, %

	2015	2016	2017
Share of ESP members among senior, middle-level and junior executives that were appointed to a new (managerial) position	34	54	45 <sup>54</sup>
Share of ESP members appointed to vacant top and senior executive positions (TOP 30 and TOP 1000 executives of the industry)	41.72	48.95	57.67

### 7.1.3. Personnel training

ROSATOM's HR policy prioritizes the development of competences and employee training. In 2017, over 116,000 employees underwent training and retraining and completed professional development programmes.

The number of training hours per employee averaged 29.5 hours. The share of employees who underwent training in the reporting period totalled 47% of the average headcount.

Table. Annual average training hours per employee by employee category

Employee category	Average number of hours per employee		
	2015	2016	2017
Executives	37	41	41
White-collar workers	18	17	23
Blue-collar workers	35	27	33

Table. Number of employees who underwent training

Employee category	Number of employees who completed at least one training programme		
	2015	2016	2017
Top executives	77	22	43
Senior executives	1,131	1,196	1,356
Middle-level executives	6,562	6,667	7,317
Junior executives	14,826	12,413	12,893
White-collar workers	44,311	36,742	38,342
Blue-collar workers	50,794	50,630	56,105
<b>Total</b>	<b>117,701</b>	<b>107,670</b>	<b>116,056</b>

ROSATOM's Corporate Academy is the central training platform for specialists and executives in the industry<sup>55</sup>. 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.

To improve the efficiency of training, in 2017, several initiatives were implemented in order to cut training costs while maintaining the scope of training: flexible (distance) learning formats, localization and measures to increase the attendance of training events.

### Industry-wide programme for developing leaders and globalization participants

To achieve its goal of increasing its share on international markets, ROSATOM is carrying out an industry-wide programme for developing leaders and globalization participants. The programme is aimed at developing skills that are necessary for the Corporation to successfully do business abroad. The programme is targeted at employees of nuclear organizations engaged in international projects. The training course consists of six specialized modules aimed at developing key international competences: customer focus, working in a cross-cultural environment, openness to changes and innovations, working in accordance with international and national standards of customer countries, commitment to business development, and working in cross-divisional teams.

### New Products industry-wide development programme

To develop market competences and launch new products, ROSATOM is carrying out an industry-wide employee development programme titled ROSATOM's New Products. The programme comprises two disciplines, Economics of Engineering Design and Business Workshop, which are based on the agreed competency model.

As part of the Economics of Engineering Design course, projects to reduce production costs and improve product quality are developed and presented to a panel of experts. The target audience includes chief designers/process engineers and designers/process engineers.

The Business Workshop is aimed at preparing participants for developing new businesses, and initiating and implementing projects to launch civilian products on the market. The target audience includes managers of business development projects and 'in-house entrepreneurs'.

### Industry-wide targeted employee training programme for international organizations

To promote the interests of the Russian Federation and sustainable development of the global nuclear power sector, and to increase ROSATOM's representation in the IAEA and the OECD NEA, the Corporation is carrying out an industry-wide targeted employee training programme for international organizations. A mechanism for selecting and training employees of ROSATOM and its organizations for the IAEA and the OECD NEA was developed as part of the programme. An expert pool comprising candidates for vacant positions was formed in accordance with the Corporation's priorities. Experts undergo training in procedures for competing for vacant positions in international organizations, including submission of documents and job interviews.

In 2017, a three-stage selection of applicants was carried out; individual development programmes were implemented for the members of the expert pool, and the second workshop was held for Russian experts in cooperation with the Division of Human Resources of the IAEA.

### 7.1.4. Participation in the WorldSkills movement

WorldSkills International is a not for profit association operating in 76 member countries worldwide. The aim of WorldSkills is to provide skills training to meet market needs and to develop talent by organizing professional skill competitions. Participants of the movement include college and university students, young specialists, teachers, the government and industries.

Areas of cooperation between ROSATOM and WorldSkills International/the WorldSkills Russia Union<sup>56</sup>:

- Organization of sectoral and national skills competitions in accordance with WorldSkills standards (AtomSkills, DigitalSkills, WorldSkills Hi-Tech<sup>57</sup>;
- Analysis and benchmarking of qualifications of the Corporation's employees against the national, European and international level;
- Establishment and development of expert communities in the industry;
- Provision of infrastructure for large-scale training of highly qualified workers and engineers.

<sup>54</sup> The indicator calculation methodology changed in 2017 in order to obtain exact information on the share of ESP members appointed to managerial positions. Only appointments to managerial positions in 2017 were taken into account (previously, calculations had taken into account appointments to a new position involving a wider scope of authority, a change in the scope and/or area of work, a fundamentally new level of responsibility, assignment of a higher category).

<sup>55</sup> <http://rosatom-academy.ru>.

<sup>56</sup> <https://worldskills.ru/>.

<sup>57</sup> AtomSkills is a professional skills contest organized by ROSATOM; DigitalSkills is a national contest for digital economy specialists; WorldSkills Hi-Tech is Russia's largest professional skills contest for the winners of corporate contests.

### WorldSkills Championship at ROSATOM

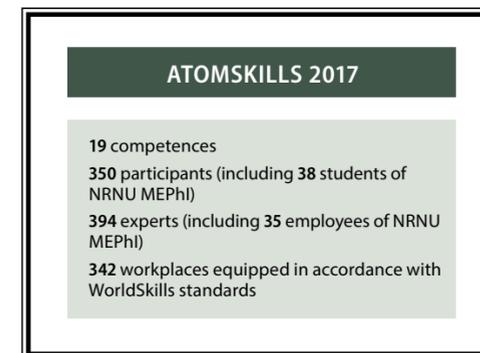
2015



2016



2017



### OUR AWARDS



### 7.1.5. ROSATOM's Person of the Year

ROSATOM's Person of the Year is an industry contest aimed at recognizing the achievements of the best employees in the industry. The primary selection criteria include significant work achievements, ability to think out of the box, adherence to corporate values, and professional competences of the candidates. An employee can be nominated for the contest either independently by filling in the application, or on the recommendation of their line manager. The contest includes individual and team nominations. The contest is truly the 'Nuclear Oscars'. In an official ceremony, the Director General and top executives of the industry hand out awards to all prize winners of the contest. Despite tight competition and a multilevel selection system, the number of nominees increases every year by 25% on average. In 2017, 1,813 applications were submitted, and 369 people won prizes.

### 7.1.6. Employee engagement surveys<sup>58</sup>

In 2017, the survey covered 44,672 employees in 68 of ROSATOM's organizations. According to the findings of the annual survey, the employee engagement rate in the industry stood at 83%, which is on a par with the best employers of Russia (85%). In 2017, to increase the employee engagement rate, a new format of Information Days was introduced: a live Q&A session, which provided over 16,000 employees with an opportunity to listen to the live address by the Corporation's Director General Alexey Likhachev and ask him questions. As part of this project, over 6,700 responses to employees' questions on key topics were collected and prepared.

Table. Employee engagement rate at ROSATOM and its organizations, %

	2013	2014	2015	2016	2017
Employee engagement rate	74	75	78	77	83

The target for the next three to five years is to maintain the employee engagement rate at the level of global leaders in the technology industry (at least 72%) and to achieve this rate in 90% of industry organizations that participate in the survey.

### 7.1.7. 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 expenses.

Employment benefits provided to employees and retirees comply with the Uniform Industry-Wide Social Policy (UISP), which is based on standardized corporate social programmes.

### Code of Ethics

ROSATOM has in place the Code of Ethics and Professional Conduct for Employees. The Code of Ethics promotes the 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, industrial and environmental safety, preventing conflicts, resolving conflicts of interest and keeping up the corporate image.

The Code of Ethics is available on the official website of the Corporation (<http://www.rosatom.ru/social-respons/code-of-ethcs/>).

The structure of corporate social programmes and the relevant expenses are determined based on the Corporation'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 of employees);
- Traditions established in ROSATOM (companies in the Russian nuclear industry always pay great attention to retired employees who have 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 aimed at promoting the development of mass sports, providing additional pensions and supporting families with children, young professionals, people in need, etc.

Table. Expenditure on corporate social programmes at ROSATOM, RUB billion<sup>59</sup>

Corporate social programmes	2015	2016	2017
Voluntary health insurance and personal insurance against accidents and diseases	1.4	1.7	1.9
Health resort treatment and recreation for employees and their children, including:	0.9	1.1	1.1
health resort and rehabilitation treatment for employees	0.6	0.8	0.8
health resort treatment and recreation for children	0.3	0.3	0.3
Improving the living conditions of employees	0.8	0.8	0.8
Private pension plans	1.0	1.2	0.9
Support for retirees	1.3	1.3	1.2
Sporting and cultural events	1.3	1.2	1.3
Assistance to employees	1.0	1.2	1.1
Other	1.9	1.3	0.7
<b>Total</b>	<b>9.6</b>	<b>9.8</b>	<b>9.0</b> <sup>60</sup>

### Sporting events

In 2017, over 3,100 sporting events were held in the industry; they were attended by over 85,500 worker athletes. 15,000 employees took part in the 9<sup>th</sup> Winter Spartakiad for Employees in Nuclear Power, Industry and Science 'Atomiada 2017'. 282 top athletes competed in the final stages of the event for 47 sets of medals in five disciplines. On August 12, 2017, the first Single Ready for Labour and Defence (RLD) Day was held in the nuclear industry; it was timed to coincide with the Sportsman's Day. Over 5,000 employees of ROSATOM passed the tests of the Ready for Labour and Defence (RLD) National Sport and Fitness Programme. ROSATOM's team of 43 athletes won 54 medals (29 gold, 18 silver and 7 bronze) and the second place trophy at the 13<sup>th</sup> International Workers' Sports Festival in Varna (Bulgaria). ROSATOM's team of 22 athletes won 76 medals (60 gold, 12 silver and 4 bronze) at the 5<sup>th</sup> CSIT World Sports Games in Riga (Latvia). At the 17<sup>th</sup> International Issyk Kul Games in Cholpon-Ata (Kyrgyzstan), ROSATOM's team of 26 athletes won 51 medals (45 gold and 6 silver).

<sup>58</sup> Engagement is an emotional and intellectual state encouraging employees to do their job to the best of their abilities. Employee engagement surveys in the Russian nuclear industry have been conducted since 2011 under the international methodology with assistance from an independent expert organization. The engagement rate means the share of engaged employees as a percentage of the total number of respondents.

<sup>59</sup> Compensations and benefits forming part of corporate social programmes are provided to full-time employees.

<sup>60</sup> The reduction in spending on corporate social programmes is due to a partial transfer of expenses to other expense items (including occupational safety expenses).

### Support to industry veterans

The Interregional Social Movement of Veterans of Nuclear Power and Industry (ISMV NPI)<sup>61</sup> comprises 128 veteran organizations in Russia with over 322,300 members.

2017 saw the start of development of a special industry-wide programme for veterans' wellness to be implemented at the health resorts of the Russian Federal Biomedical Agency (FMBA) and the industrial trade union. Under an agreement with the Arkhipo-Osipovka resort of the FMBA (Krasnodar Territory), veterans of the nuclear industry will be offered 20% discounts in the off season and 15% discounts throughout the rest of the year.

In 2017, at the request of ISMV NPI:

- 66 veterans were awarded ROSATOM's badge,
- 120 veterans were awarded certificates of appreciation and letters of acknowledgment from ROSATOM;
- 108 veterans were presented with the Veteran of Nuclear Power and Industry badge.

ISMV NPI is actively engaged in establishing nuclear veteran organizations in former Soviet Union countries. In 2017, ROSATOM concluded cooperation agreements with veteran organizations in Kazakhstan and Belarus. The Union of Veteran Organizations of the Uranium Mining Industry of Russia, Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan was established.

### 7.1.8. Social partnership in the nuclear industry

ROSATOM adheres to the Industry-Wide Agreement on Nuclear Power, Industry and Science for 2015–2017. 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<sup>62</sup>. The Agreement has been developed and is implemented jointly with the Russian Trade Union of Nuclear Power and Industry Workers<sup>63</sup>. The Agreement gives priority to the protection of employees' lives and health (*see the sections 'Occupational Safety' and 'Social Policy'*). 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 the section 'Occupational Safety'*.

### 7.1.9. Cooperation with universities and recruitment of young professionals

Specialized educational institutions that train specialists for the nuclear industry form part of the Consortium of Core Universities of ROSATOM. The Consortium comprises 16 universities specializing in disciplines relevant to the nuclear industry. The National Research Nuclear University MEPhI (NRNU MEPhI) is the central university for the industry. In 2017, over 2,432 students attended universities under arrangements with nuclear enterprises. Over 5,800 university students did internships in nuclear organizations. Over 1,200 university graduates were hired, with almost half of them graduating from core universities. ROSATOM has prepared a forecast until 2027 for the industry's demand for specialists who have received university education or secondary vocational education. The industry organizations are expected to hire around 1,300 graduates of core universities per year on average, including around 650 graduates of NRNU MEPhI and its branches.

Collective agreements in all of the Corporation'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 mass dismissal.

Collective agreements cover 85% of employees working at ROSATOM's enterprises.

### Structure of demand of ROSATOM's organizations for professionals by speciality (average values for 2018-2027)

Speciality	Share in the total enrolment
Power Engineering and Electrical Engineering	7.7%
Nuclear Power Plants: Design, Operation and Engineering	6.8%
Design and Technology of Machinery Production	6.5%
Nuclear Physics and Technologies	6.4%
Thermal Power Energy and Thermal Engineering	5.2%
Nuclear Reactors and Materials	4.7%
Nuclear Power Engineering and Thermal Physics	4.3%
Construction	4.2%
Electronics and Automation of Physical Facilities	3.5%
Chemical Engineering of Materials in Modern Power Engineering	3.5%
Automation of Technological Processes and Production	3.1%
Computer Science and Computer Engineering	3.1%
Applied Mathematics and Computer Science	2.9%
Instrumentation Engineering	2.5%
Informational Systems and Technologies	2.0%
Mechanical Engineering	1.9%
Applied Mechanics	1.8%
Applied Mathematics and Physics	1.7%
Chemical Technology	1.5%
Design of Technological Machines and Complexes	1.4%
Design and Technology of Electronic Instrumentation	1.4%
Use and Operation of Special-Purpose Automated Systems	1.4%
Materials Science and Technology of Materials	1.3%
Management in Engineering Systems	1.3%
Electronics and Nanoelectronics	1.2%
Technological Machines and Equipment	1.2%
Other	17.6%

<sup>61</sup> <http://www.veteranrosatom.ru>.

<sup>62</sup> In late 2017, a new Industry-Wide Agreement was signed for 2018-2020.

<sup>63</sup> <http://www.profatom.ru>.

**NRNU MEPhI has been included in leading global and national university rankings:**

- Top 20 of the Times Higher Education BRICS & Emerging Economies University Ranking;
- Top 40 of the QS University Rankings BRICS;
- Top 100 of the QS Physics & Astronomy subject ranking;
- Top 100 of the U.S. News & World Report ranking in Physics;
- 1<sup>st</sup> place among engineering universities in the ranking of demand for Russian universities compiled by Russia Today International News Agency;
- 2<sup>nd</sup> place in the Interfax National Ranking;
- 2<sup>nd</sup> place in the Russian Universities Through the Eyes of Students ranking compiled by Russia Today International News Agency;
- 3<sup>rd</sup> place in the National Ranking compiled by Expert RA.

In 2017, ~30,000 students took part in school competitions organized by NRNU MEPhI.

The average score achieved in the Unified State Examination by students who were enrolled based on the examination results totalled 90.5 (top 10 best Russian universities).

■ **TeMP Tournament**

The TeMP Tournament for Young Professionals is a landmark project for recruiting, selecting and hiring promising graduates. In 2017, the focus of the Tournament shifted towards the development of start-ups by the participants for ROSATOM's key business development areas. Over 3,000 students and graduates from specialized and core universities participated in the Tournament. For the first time in its history, young specialists of the Corporation's enterprises took part in this event. At the end of the Tournament, 20 projects were selected to be considered for implementation in nuclear organizations.

■ **The 7<sup>th</sup> International Forum of Young Power Engineers and Industrialists Forsazh 2017**

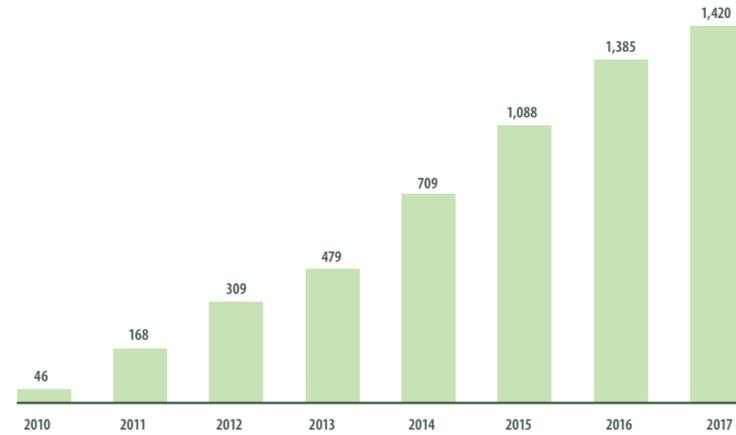
In 2017, over 600 people participated in the annual Forsazh Forum, which is traditionally held in the Kaluga Region. Young people from all over Russia gathered together in a field camp to begin a long conversation with futurologists, scientists, science fiction writers and entrepreneurs about the challenges and prospects of the world until 2040. The outcomes of all streams of the Forsazh 2017 Forum provided a foundation for the Global Youth Declaration of the World Festival of Youth and Students, which took place on October 14-22, 2017 in Sochi. The majority of delegates of the Forsazh 2017 Forum participated in the thematic stream of the Industries of the Future academic programme for the corporate sector forming part of the Global Festival.

In 2017, over 6,500 people participated in Career Days held by ROSATOM in Ekaterinburg, Nizhny Novgorod, Tomsk, Saint Petersburg and Moscow. ROSATOM created an Industry-Wide Career Portal for students and graduates ([www.rosatom-career.ru](http://www.rosatom-career.ru)), which became a 'one-stop shop' for graduate employment. By the end of 2017, over 40,000 CVs were posted on the website.

**7.1.10. 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. As of December 31, 2017, over 1,400 people were studying in Russia, including students from Vietnam, Bangladesh, Jordan, Egypt, Algeria, Nigeria, South Africa, Cuba and other countries (a total of ~40 countries). In February 2017, the first 27 Vietnamese students graduated from NRNU MEPhI. Another ~300 students are due to enrol in 2018.

**Fig. Number of foreign students at the Corporation's core universities and partner universities**



**7.1.11. Strengthening the employer brand; prizes and awards in HR management**

At year-end 2017, ROSATOM ranked second in the Ranking of the Best Russian Employers compiled by HeadHunter, having strengthened its position in the top three and having climbed 30 places compared to 2012, when it was first included in the ranking.

ROSATOM's Corporate Academy won the contest of employers' best practices in developing human capital titled 'Shaping the Future', which was organized by the International Association for Corporate Education (MAKO) at the request of the Russian Ministry of Education and Science. The project titled 'ROSATOM's Academy: Strategic Partnership with Business' won the top prize in the Synergy of Cooperation category for the most sustainable model of a corporate university and generation of exceptional value for business.

**7.1.12. Plans for 2018 and for the medium term**

- To increase the share of executive succession pool members appointed to top 30 and top 1,000 positions;
- To maintain a high level of employee engagement;
- To establish an HR Shared Services Centre;
- To develop professional competence centres in the industry;
- To recruit university graduates to nuclear organizations;
- To improve the level of satisfaction of the Corporation's businesses with the performance of the HR function.

## 7.2. Developing the Regions of Operation

**Key results in 2017:**

- Taxes paid to Russian budgets of all levels totalled RUB 148.5 billion.
- NPPs accounted for 18.9% of the total electricity output in Russia.
- RUB 1,097 million were allocated for charity programmes by nuclear organizations.

**Andrey Polosin, Head of the Local Communities Relations Unit**



**— One of ROSATOM's priorities in developing nuclear towns and cities is to improve the quality of life of their residents. How do you achieve this?**

— First of all, the quality of life is determined by a large number of factors. These include jobs, urban infrastructure, the modern look of cities and certainly support for culture and maintaining the highest possible standards of general and special education.

We indeed do quite a lot for 'our' towns and cities. However, I would like to emphasize that for us, it is more than just social responsibility. It is primarily about having a very clear understanding of the objectives of the industry and the role of the towns and cities at present and in the future, both the short term and the long term. Human capital is the key. A lot depends on how people and their families live outside the workplace. Given the long-term nature of the task, in 2017, the Corporation made a decision to include comprehensive development plans of the regions of our core business into ROSATOM's development strategy.

**— By the end of 2017, three priority social and economic development areas (PSEDAs) were established in the nuclear towns and cities. What results did you manage to achieve?**

— What matters to us is not the establishment of PSEDAs as such. We are faced with a larger task right now, which is to turn the PSEDAs into an efficient tool for implementing investment projects. To date, PSEDAs have been established in Krasnokamensk (Zabaykalsky Territory), Dimitrovgrad (Ulyanovsk Region) and the CATF of Sarov (Nizhny Novgorod Region). By the end of 2017, six residents were registered in these PSEDAs; projects will be launched and the first jobs will be created in 2018.

As far as the future is concerned, draft regulations on establishing PSEDAs in Snezhinsk and Ozersk (Chelyabinsk Region) and in the CATF of Zheleznogorsk (Krasnoyarsk Territory) are about to be finalized. Regarding single-industry towns, an application will soon be filed for establishing a new PSEDA in Glazov (Republic of Udmurtia).

**— The Urban Technology project was launched two years ago. Could you tell us more about it?**

— We examined technologies applied in the industry to see which of them could be used in the sphere of municipal services. We reviewed a number of areas, such as lighting, security and water supply. In 2017, we designed a framework for developing municipal services through the use of digital and smart technologies; afterwards, we appointed JSC ITPC as the business integrator in this sector of the industry. I am sure that the project will improve the performance of municipalities and quality of life of urban dwellers by providing new technological solutions.

In 2017, ROSATOM, jointly with the Russian Ministry of Construction, took an active part in urban improvement projects, which is one of our key initiatives. For example, the development of a concept for the improvement of the Lesnaya recreational area in the town of Zarechny (Penza Region) was put out to tender. Over 40 applications were received, and a winner was selected out of seven finalists. Footpaths were built; benches were installed; sports and children's grounds were equipped. By September 2018, piers, pavilions and new children's playgrounds will be built, and amenities will be provided on the Peschany beach. The look of Zelenogorsk is also changing rapidly. In cooperation with the Russian Ministry of Construction, ROSATOM has designed a model programme for urban improvement and development of the urban environment.

## — What progress has been made in the development of education and culture in the nuclear towns and cities?

— We have been successfully implementing the project titled ROSATOM's School since 2011. Last year, as part of the project, we organized a children's theatre festival, a metadisciplinary school competition and an engineering festival. Russia hosted the first ever football competition for preschoolers from 20 nuclear towns and cities. Importantly, in 2018, ROSATOM's School will become an open project, and any school and any teacher will be able to take part in our competitions. Moreover, we will launch additional and special educational programmes.

In the sphere of culture, last year we monitored the performance of museums, libraries, theatres and cultural institutions in nuclear towns and cities. The results of public opinion polls showed that the residents wanted cultural institutions to respond to their needs more promptly and efficiently. In addition, ROSATOM assisted in developing an educational webinar programme in order to improve the quality of public services. In 2018, the institutions will be drafting a new strategy and adjusting their formats to better meet the residents' needs.

ROSATOM's organizations and enterprises are located in more than 70 municipalities in 38 federal subjects of Russia. Important regions of operation include 10 towns and cities with nuclear power plants (with a population of 750,000 people) and 10 closed administrative and territorial formations (CATFs) of the nuclear industry (with a population of 650,000 people). ROSATOM seeks to raise the standard of living in the towns and cities in which it does business by implementing projects aimed at improving social and economic conditions, developing infrastructure and creating a favourable urban environment.

### 7.2.1. Ensuring the energy security of Russian regions

NPPs accounted for 18.9% of the total electricity output in Russia (18.3% in 2016). Nuclear power generation contributes significantly to Russia's regional power systems.

**Table. Share of nuclear power generation in the total power generation in Russia in 2017 by region**

Indicator	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	IPS of the East**
Nuclear power generation at JSC Rosenergoatom Concern, billion kWh	202.869	202.64	100.36	32.00	36.90	23.18	10.20	0.23
Share of nuclear power generation at JSC Rosenergoatom Concern, %	18.9	24.9	42.3	29.7	34.1	23.2	3.9	0.46
Power generation in Russia***	1,073.6	814.4	237.5	107.8	108.4	100.0	260.7	48.9

\* European Russia: IPS of the Centre + IPS of the Middle Volga + IPS of the North-West + IPS of the South + IPS of the Urals.

\*\* Including isolated systems.

\*\*\* Data on power generation in Russia in 2017 according to the press release of the System Operator of the Unified Power System dated January 10, 2018 ([www.so-ups.ru](http://www.so-ups.ru)).

### 7.2.2. 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 ranks among the ten largest taxpayers in Russia. In 2017, payments to budgets of all levels totalled RUB 148.5 billion.

**Table. Taxes paid by ROSATOM and its organizations, RUB billion**

Taxes	2015	2016	2017
Total, including:	164.5	125.3	148.5
to the federal budget	100.5	82.4	95.1
to the budgets of federal subjects of Russia	63.2	42.3	52.7
to local budgets	0.8	0.6	0.7

### 7.2.3. Generating employment through NPP construction

The construction and commissioning of nuclear facilities, including NPP power units, creates new jobs: a number of employees are recruited from local communities within a 100 km radius of the construction site. In addition, every job in the construction of an NPP creates another 10 to 12 jobs in related sectors of the economy (the metals industry, mechanical engineering, etc.).

**Table. Number of employees engaged in NPP construction in 2017**

NPP	Employees of contractor organizations engaged in NPP construction
Novovoronezh NPP-2 (Russia)	3,984
Leningrad NPP-2 (Russia)	2,659
Rostov NPP (Russia)	3,100
Kursk NPP-2 (Russia)	1,098
Rooppur NPP (Bangladesh)	1,672
Akkuyu NPP (Turkey)	270
Bushehr NPP (Iran)	260
Ostrovets NPP (Belarus)	7,819
<b>Total:</b>	<b>20,862</b>

## 7.2.4. Establishment of priority social and economic development areas in the CATFs in the nuclear industry

ROSATOM actively supports the establishment of priority social and economic development areas (PSEDAs) as the points of growth of nuclear towns and cities with the most efficient and comfortable ecosystem for the development of its dwellers and new residents of PSEDAs. The establishment of PSEDAs within CATFs will foster the development of new businesses, create new jobs, increase investments and enable the commercialization of new civilian products of the Nuclear Weapons Division. It will also significantly boost budget revenues of CATFs, thus fostering the development of the social and cultural environment and infrastructure.

The establishment of PSEDAs within CATFs is expected to create 14,600 high-tech jobs and generate RUB 86 billion in investments and RUB 251.8 billion in tax payments (between 2018 and 2026).

In 2017, PSEDAs were established in Sarov and Dimitrovgrad. In 2018, CATFs are to be established in the CATFs of Ozersk, Zheleznogorsk and Snezhinsk, as well as other CATFs in the nuclear industry.

The Smart City project was launched in 2017 as part of the digital transformation of the Russian nuclear industry. ROSATOM offers platform-based solutions for the smart city digital infrastructure, including the Digital Municipality management system, as well as individual module solutions, such as the street light management system and modernization of the water supply system. Sarov became a pilot town in 2017; in 2018, the project will cover other CATFs and towns where NPPs are situated.

## 7.2.5. Development of innovative clusters

In 2017, ROSATOM continued to actively develop innovative clusters in Sarov, Zheleznogorsk and Dimitrovgrad. In the reporting year, projects were implemented in the clusters both by ROSATOM's organizations and as part of consortia (including the project to organize production of the nickel-63 isotope and new materials and devices based on it, and the project to produce sorbents based on patterned mesostructured silicates with a specific surface).

## 7.2.6. Improving the quality of services provided to the population in the towns and cities of operation

ROSATOM shares its management technologies and workflow organization methods with the towns and cities in which it operates. In particular, the introduction of the principles and tools of ROSATOM's Production System enables a significant improvement of the quality of services provided to local residents by state and municipal institutions.

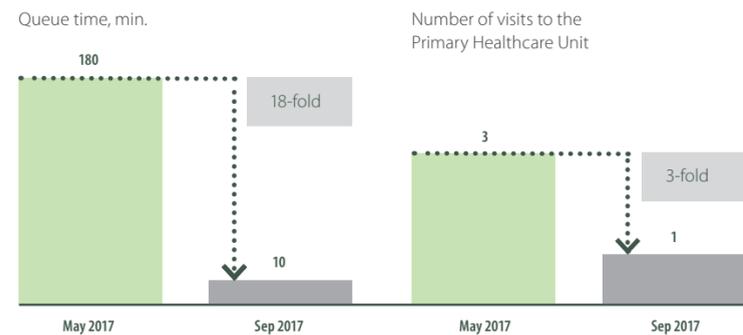
The Lean Polyclinic project is aimed at improving the performance of healthcare institutions and the overall availability and accessibility of healthcare services. The project drastically reduces queues, speeds up the performance of medical tests and processing of their results, makes it easier to make appointments with GPs and makes it possible to attend to many more patients with the same resource pool. This saves time for both healthcare personnel and patients. In 2017, 43 projects to establish 'lean polyclinics' were implemented in the nuclear towns and cities. Another 60 projects are scheduled for 2018. In the future, ROSATOM's experience will be replicated in other spheres of municipal services (housing and utilities, multifunctional service centres) in various regions of Russia.

In 2017, ROSATOM continued its cooperation with the Association of CATFs in the Nuclear Industry (<http://zato.tv/association>) in the following areas:

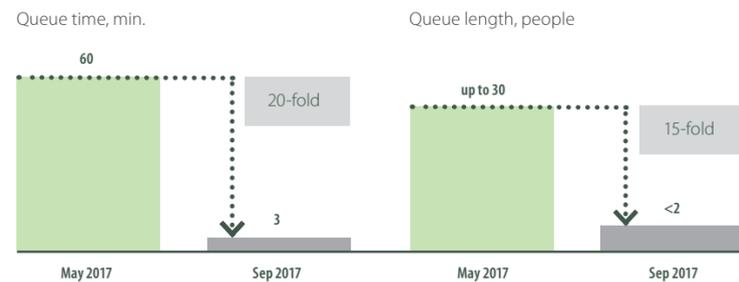
- Improving the legal and regulatory framework in order to manage social and economic development processes in CATFs more efficiently;
- Establishing PSEDAs within CATFs;
- Improving the quality of healthcare services as part of the Lean Polyclinic project;
- Developing and implementing projects aimed at modernizing urban infrastructure, improving the urban environment and promoting culture and education in CATFs;
- Ensuring that the development of the nuclear power industry is acceptable to society (including through the preparation of ROSATOM's public reports).

Fig. Examples of improved performance of healthcare institutions as part of the Lean Polyclinic project

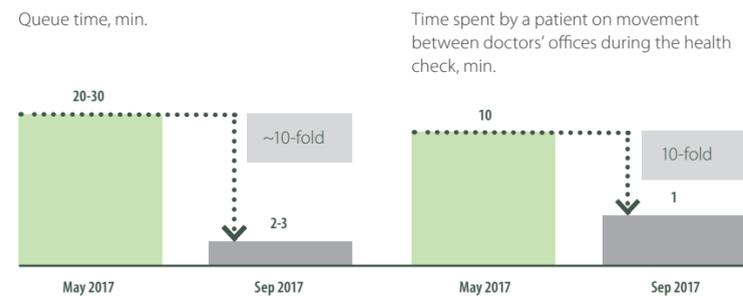
### VOLGODONSK, PRIMARY HEALTHCARE UNIT NO. 5 OCCUPATIONAL HEALTH CHECKS FOR EMPLOYEES OF ROSTOV NPP



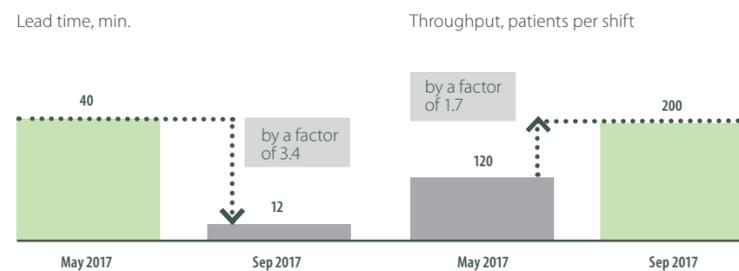
### VOLGODONSK, CHILDREN'S POLYCLINIC NO. 2 OPTIMIZATION OF THE LABORATORY TESTING WORKFLOW



### NOVOURALSK, PRIMARY HEALTHCARE UNIT NO. 31, POLYCLINIC NO. 3 HEALTH SCREENING OF THE ADULT POPULATION



### OZERSK, MUNICIPAL POLYCLINIC NO. 1 BLOOD SAMPLING PROCESS



### 7.2.7. Implementation of social and charity programmes in ROSATOM's regions of operation

#### Charity programmes

Continuing the traditions of the nuclear industry, ROSATOM and its organizations adhere to the principles of responsible business. The Corporation is guided by the priorities of the 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 (details on ROSATOM's approaches to charity work are available at [http://ar2012.rosatom.ru/upload/ru/Rosatom\\_AR\\_2012.pdf](http://ar2012.rosatom.ru/upload/ru/Rosatom_AR_2012.pdf)).

Table. Areas and scope of charity work in 2017

Areas of charity work	Amount, RUB million
Assistance provided at the request of local governments and individuals, including improving the quality of healthcare services and non-financial assistance	405
Contests of social and charity projects	216
Initiatives to preserve and build up the historical and cultural heritage of Russia	215
Educational initiatives and support for projects of educational institutions	98
Initiatives to develop children's sports and popular amateur sports and the promotion of a healthy lifestyle	72.5
Initiatives in the field of culture and spiritual and moral education of young people	53
Assistance to veterans, disabled persons, orphans and people in need	31
Patriotic education and donations for commemorative events	6.5
<b>Total</b>	<b>1,097</b>

#### Territory of Culture

The objective of the programme titled ROSATOM's Territory of Culture is to introduce the best works of art and to support local initiatives in the towns and cities where nuclear facilities are located. The motto of the programme is: 'Culture should be open in a closed town'.

The long-term project titled ROSATOM's School (<http://rosatomschool.ru>) 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 2017, the following events were organized:

- A children's theatre festival titled 'What a Wonder These Fairy Tales Are!' in the town of Sarov;
- The first industry-wide game festival 'CATF: Clearly A Ton of Fun' in the town of Snezhinsk;
- The 25<sup>th</sup> Russian Dance Sport Tournament 'ROSATOM's Cup named after Efim Slavsky FIREWORKS 2017' in the town of Zarechny.

In addition, in 2017, leading Russian performers and ensembles performed concert tours in the nuclear towns and cities. Highlights included a concert tour of the Moscow Philharmonic Orchestra under Yury Simonov in Snezhinsk; a concert of the Moscow Soloists Chamber Orchestra and Yury Bashmet in Novouralsk; a performance by Dmitry Pevtsov and the Pevtsov-Orchestra band in Zarechny, and an evening with the People's Artist of Russia Elena Yakovleva in Novouralsk and Ozersk.

In 2017, musicians from 17 nuclear towns and cities participated in a project titled '10 Nuclear Songs'. Two videos titled 'This World' and 'The Last Hour of December' were posted online and enjoyed great popularity among Internet users (over a million views during the first month after they were posted on YouTube).

Nuclear towns and cities hosted regional stages of the Theatre Festival titled 'The First'. The Festival is a follow-up to the contest 'Glory to the Creators!' As part of the event, documentary plays were written and staged based on veterans' stories about the development of the nuclear industry. Educational programmes were launched for students and teachers of children's art schools and specialists from the cultural sector:

- Workshops for children as part of the 2<sup>nd</sup> International Musical Academy and the Winter International Arts Festival organized by Yury Bashmet (Sochi);
- The Rifey National Summer Arts Academy (Novouralsk);
- The 10<sup>th</sup> National Competition of Folk Instrument Performance for children from art schools in the towns and cities of ROSATOM's operation (Sarov).

### 7.2.8. Work of the Public Council

ROSATOM's Public Council<sup>64</sup> was established in 2006 in order to engage Russian citizens, non-governmental organizations and professional associations, research institutions and local governments in the formulation of recommendations for ROSATOM on the development of the nuclear power industry.

The main areas of its work include the following:

- Organization of research, conducting research and expert activities;
- Work in the regions, conducting public dialogue forums;
- Public awareness campaigns, educational, social and cultural activities.

#### Public dialogue forums

In 2017, the Public Council traditionally organized dialogue forums dedicated to the safe use of nuclear power:

- The Regional Public Dialogue Forum 'Nuclear Energy. Technologies of the Future: Reducing the Environmental Footprint' (May 22-24, Ekaterinburg);
- The International Public Dialogue Forum held simultaneously with the AtomEco Exhibition (November 21-22, Moscow); the events were conducted under the motto 'Clean Energy for Future Generations' and were attended by over 1,000 people.

ROSATOM's Public Council implements projects and programmes to engage residents of the regions in which nuclear facilities are located in a meaningful dialogue in order to create a favourable social environment in its regions of operation.

The dialogue with the civil society includes communication with various target groups reflecting the full range of interests and opinions of the local population.

Members of the Public Council also participate in various international events where they present the outcomes of the efforts to hold a meaningful dialogue with the general public. In 2017, members of the Public Council participated in the meeting of permanent representatives to the IAEA as part of the visit to Leningrad NPP, in the IAEA seminar on the new RAW management project and a study of the experience of member countries in the sphere of stakeholder engagement, etc.

#### Building a network of public experts

In 2017, the Corporation launched a long-term project to build a network of public experts in the regions of its operation in order to identify and unlock the educational potential of members of the public interested in a meaningful dialogue on nuclear matters. Over 150 public experts (university students and professors, high school students and teachers) participated in the preparation of up-to-date materials and research projects on the prospects for the use of nuclear technologies and development of the nuclear power sector, including an analysis of alternative sources of energy and public acceptance of nuclear power across various population groups. To promote the projects and communicate the results of the experts' work, the Public Council partnered with 23 educational institutions (universities, schools, further education institutions) in eight key regions of operation and held 35 regional public events, as well as a panel discussion titled 'Public Dialogue. Expert Roles and Views' as part of the Regional Dialogue Forum in Ekaterinburg, and a youth session titled 'Energy of the Youth: Energy of the Future' as part of the International Dialogue Forum and the AtomEco Exhibition.

The project also involves other forms of communication with public experts, including for a young audience: environmental games for high school and university students, a contest of essays titled 'Alternative Atom', support for research projects on the topic 'Water and the Atom', lectures of nuclear specialists for graduate and postgraduate students, etc.

A unique project titled 'Children's Sails of ROSATOM' is a boat race for children aged 8 to 15 from nuclear towns and cities. In 2017, the young athletes made a 7-day yacht trip across three lakes in the Chelyabinsk Region, moored on the shore of Lake Bolshie Kasli and jointly with local school students took part in the Atom Quest which had been organized for them by specialists from FSUE Mayak Production Association.

<sup>64</sup> <http://www.osatom.ru>.

### Contest of socially important projects

As part of ROSATOM's ongoing cooperation with non-governmental and non-profit organizations in its regions of operation, the Corporation held an annual contest of socially useful 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. 460 projects from 29 regions of Russia were entered in the contest in 2017. Following the contest, 83 projects worth a total of RUB 48 million were implemented.

Contest of socially important projects

	Number of presented projects	Number of approved projects	Cost of implemented projects, RUB million
2015	501	73	47.8
2016	445	79	55.8
2017	460	83	48.0

## 7.3. Stakeholder Engagement

Key results in 2017:

- 74% of the population in Russia supports the use of nuclear energy.
- Over 470,000 people visited Nuclear Energy Information Centres.
- Viewership of channels broadcasting the *Strana ROSATOM* TV programme in various regions of Russia totals 7.2 million people.

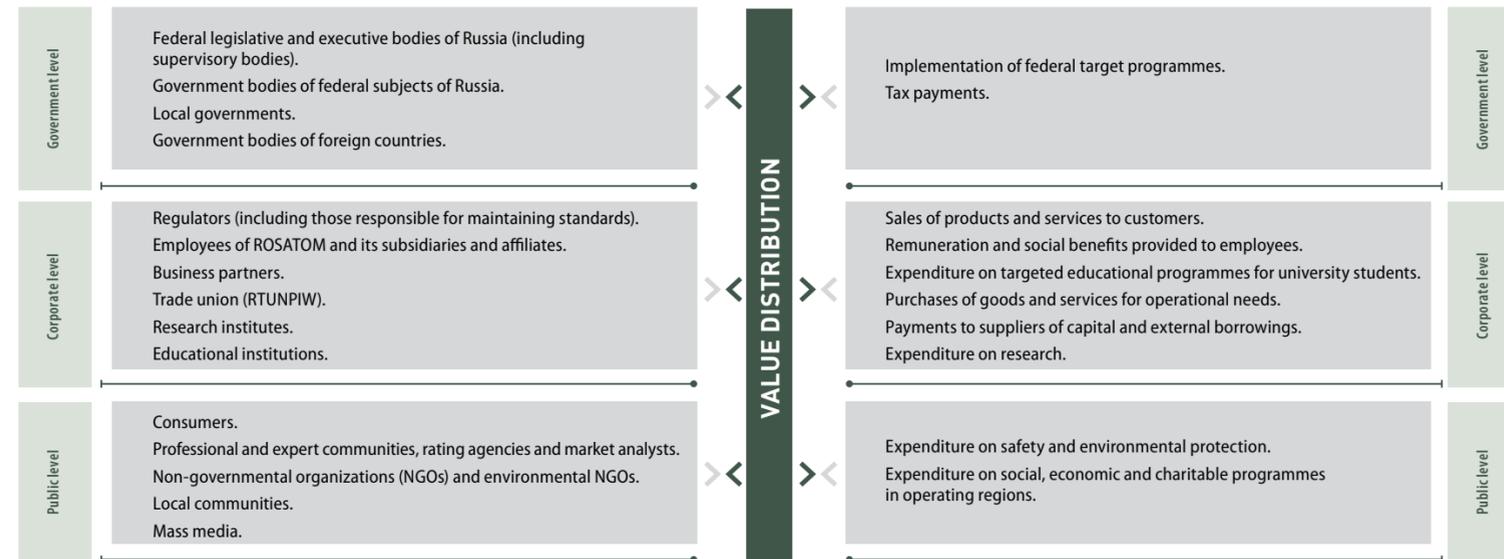
### 7.3.1. Approaches to stakeholder engagement

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 work with stakeholders is aimed at achieving strategic objectives 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 the Corporation's activities;
- Striving to provide specific benefits to all participants;
- Fulfilment of obligations.

### Stakeholder map



### 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 operating regions	2, 11, 15, C, E, F, G, K, P, Q
International organizations, including those in the nuclear sector	1, 2, 6, 7, 10, A, 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, L, 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 operating regions	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

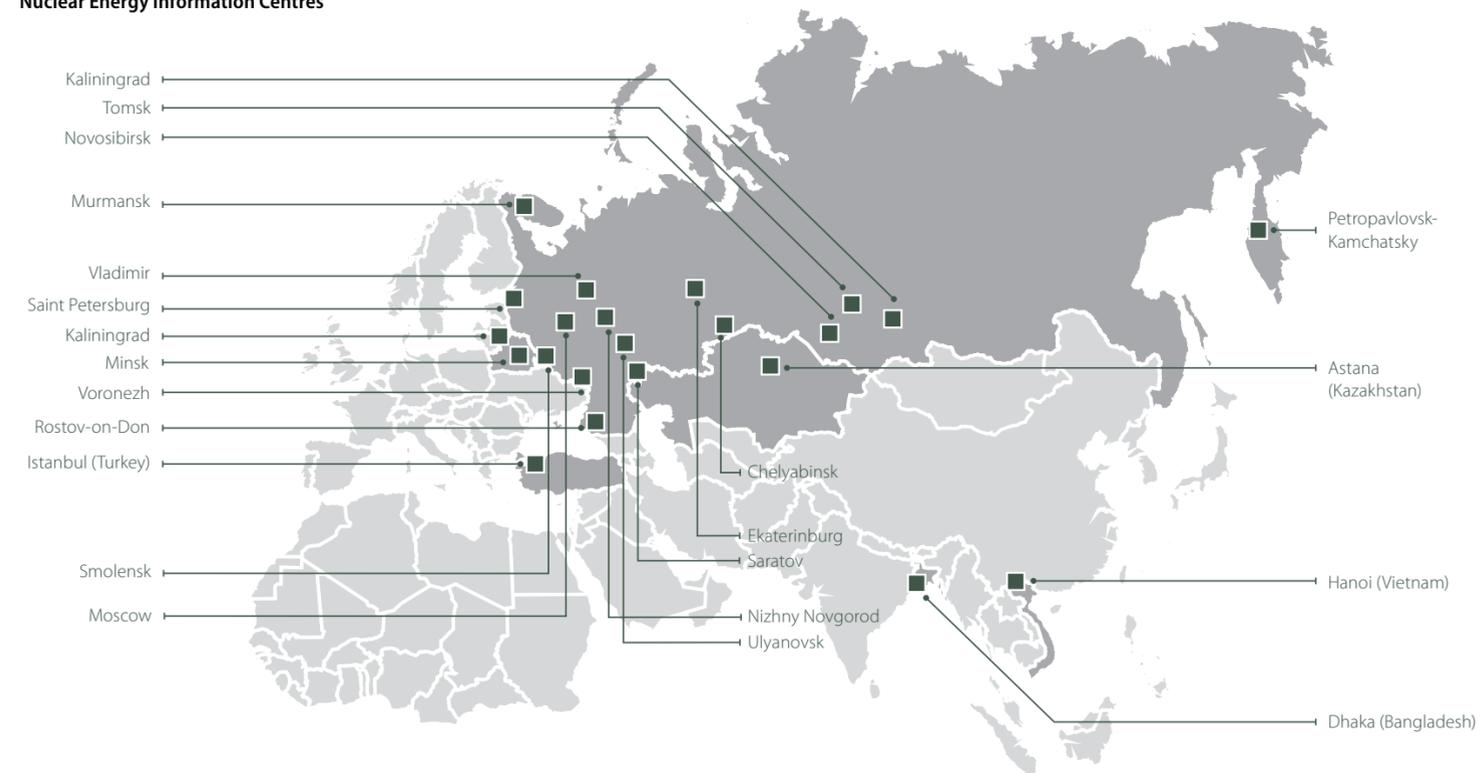
### Stakeholder interests

- Ensuring non-proliferation of nuclear materials and technologies
- Nuclear, radiation and environmental safety
- Technological modernization in the nuclear industry
- Efficient use of budget funds
- Economic efficiency of ROSATOM's organizations
- Compliance with international and Russian legislation
- Fair competition and responsible behaviour in the market
- Competitiveness in global markets
- Improvement of product and service quality
- Transparency of ROSATOM's operations, including transparency of procurement activities
- Dealing with the legacy of past business operations and defence efforts in the industry
- Reliable electricity supply
- Adoption of international management norms and standards
- Adequate remuneration to employees; support for professional development of employees; safe working conditions
- Improvement of the quality of life in operating regions
- Development of human resources in ROSATOM and its organizations

### Types of stakeholder engagement

- Cooperation with specialized international organizations, participation in international programmes and projects
- Participation in law-drafting activities
- Public consultations and public environmental impact assessments of NPP power unit construction projects
- Employee training and development programmes
- Social programmes and projects
- Participation in the development of operating regions
- Charity work
- Opinion polls, customer satisfaction surveys
- Hotlines
- Programmes of cooperation with specialized universities
- Dialogues, presentations, forums, conferences
- Open and competitive procurement procedures
- Programmes of cooperation with other companies
- Programmes of cooperation with government regulators (supervisory bodies) and law enforcement agencies
- Public governing and supervisory bodies
- Information and communication
- Public reports

### Nuclear Energy Information Centres



### 7.3.2. Nuclear energy information centres<sup>65</sup>

Since 2008, a project has been underway to build a network of nuclear energy information centres (NEICs) in ROSATOM's regions of operation. The first centre was opened in 2008. As of December 31, 2017, the NEIC network comprised 17 centres in Russia and 5 centres abroad. In 2017, over 470,000 people visited the centres.

#### Key projects of the NEICs

In 2017, the Kstati (By the Way) Festival of Science took place in Chelyabinsk, Kaliningrad, Ekaterinburg and Novosibirsk. The Festival was conducted in the form of a marathon of interactive lectures, popular science shows, intellectual games, workshops, film screenings and talk shows. Over 50 scientific experts from Russia's leading research institutions participated in the Festival. The project had an audience of more than 20,000 people.

An event titled 'Scientific Battles / U-Round' was held in Saint Petersburg, Chelyabinsk and Sarov. The aim of the project is to support talented young researchers from nuclear enterprises and organizations in acquiring presentation skills, to introduce the audience to the extensive sphere of application of nuclear technologies, and to engage the public in a dialogue about the value of nuclear discoveries and their impact on society. Before participating in the competition, researchers take a special course in communication skills. As part of the project, 30 researchers underwent training, and 11 of them presented their best projects to the audience. In addition, the first children's Scientific Battles were held as part of the popular Krasnoyarsk Book Culture Fair (KRYAKK). In December, the Moscow office of the NEIC network organized the Scientific Battles / U-Round Super Cup at NRNU MEPhI for the winners of previous competitions working for nuclear enterprises.

In 2017, 393 teams comprising over 2,000 people from 14 Russian regions participated in the Formula of Intelligence National Simultaneous Championship for school students in the What? Where? When? Intellectual Games.

Nuclear Kids (NucKids) (<http://www.nuckids.ru/>) is an annual non-profit international art project for the children of employees of Russian nuclear organizations and ROSATOM's foreign partners. The main aim of the project is to promote friendship between children of employees in the nuclear industry, offer talented children an opportunity to unlock their creative potential, and develop new traditions of cultural communication. In 2017, 70 children of employees in the nuclear industry from seven countries participated in the production of a musical titled 'Just a Summer Rain'. The musical was performed in Russia (Saint Petersburg, Sarov, and Nizhny Novgorod) and Hungary (Paks and Kalocsa). The Nuclear Kids — 2017 creative team gave their final performance at the Helikon Opera Theatre in Moscow. A total of over 3,000 people saw the musical.

<sup>65</sup> <http://www.myatom.ru>.

### 7.3.3. Exhibitions

In 2017, Russian nuclear organizations participated in 12 major exhibitions abroad. Apart from traditional exhibitions on nuclear power as part of events such as the 42<sup>nd</sup> annual World Nuclear Association (WNA) Symposium, the 61<sup>st</sup> IAEA General Conference, etc., they also participated in exhibitions on new areas of business:

- Composites Europe 2017 — the 12<sup>th</sup> European Trade Fair & Forum for Composites, Technology and Applications (Stuttgart, Germany)
- The Wind Europe Conference & Exhibition 2017 (Amsterdam, the Netherlands).

In 2017, ROSATOM organized and held a number of workshops on Russian nuclear technologies in a range of countries, including Brazil, Paraguay, Sudan, Zambia, Ghana, Egypt and China. The Atomex

The 9<sup>th</sup> International Forum ATOMEXPO 2017 (Moscow) was a major event for the international nuclear business community. The main topic of the forum was 'Nuclear Technologies: Safety, Environment, Stability'. The event was attended by over 6,500 people from 65 countries around the world, including 33 official delegations and 10 ministers. For the first time in its history, the forum was attended by representatives of Sudan, Ethiopia, Colombia and Sri Lanka. Five official interdepartmental documents were signed during the event.

Europe 2017 International Forum of Nuclear Industry Suppliers organized and held in Hungary was a landmark event. It was attended by about 400 participants willing to cooperate with ROSATOM on overseas NPP construction projects. A forum for Finnish suppliers involved in the Hanhikivi 1 NPP construction project was held in Finland.

In 2017, ROSATOM with assistance from Private Institution Rusatom International Network became a partner of the Astana EXPO-2017 International Specialized Exhibition and participated in the pavilion of the Russian Federation.

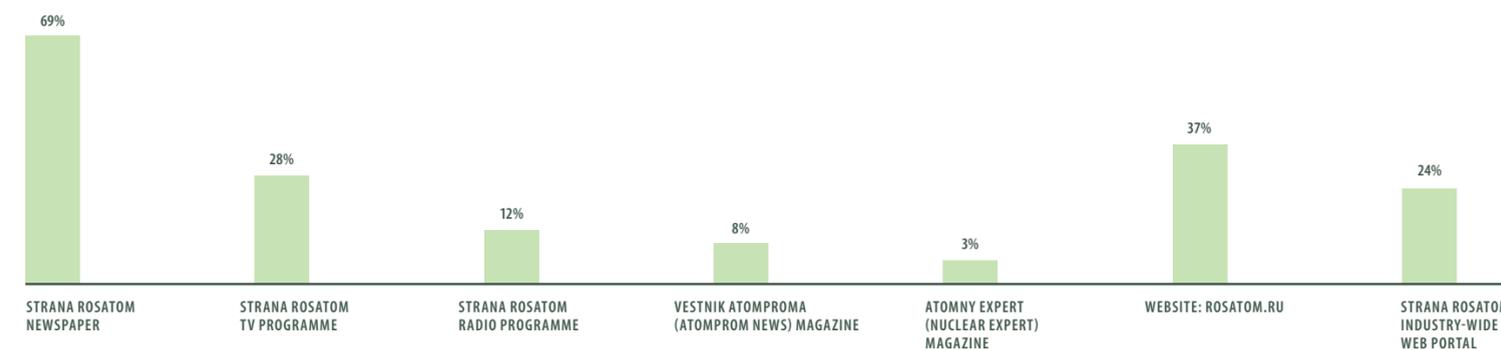
In June 2017, ROSATOM and the World Energy Council (WEC) signed an agreement on participation in the Patronage Programme, which was another important milestone for ROSATOM.

### 7.3.4. Industry media

To inform employees and other stakeholders of the news and key events at ROSATOM and in 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 61 organizations, as well as in the Central Office of the Corporation, members of the Consortium of Core Universities of ROSATOM and the branches of NRNU MEPhI, with a circulation of 59,000 copies and a readership of 250,000 people);
- A radio programme (it is broadcast two or three times a week in 30 of the Corporation's organizations and has an audience of 50,000 people);
- A television programme (it is aired weekly in 20 cities where ROSATOM operates; the viewership of the channels that broadcast the programme totals 7.2 million people).

Fig. What sources of information do you usually use to obtain information about your organization and the nuclear industry as a whole?<sup>66</sup>



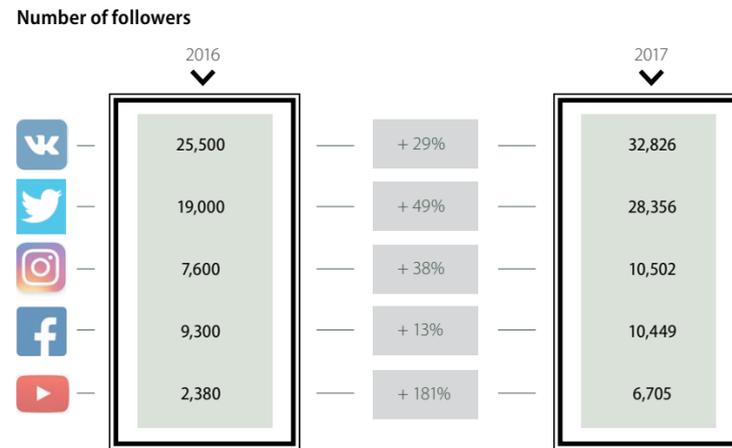
<sup>66</sup> Findings of an opinion poll among employees of ROSATOM and its organizations as part of the annual employee engagement survey.

### 7.3.5. Online communications

ROSATOM is actively developing online communication with stakeholders. In 2017, the Corporation's official website at [www.rosatom.ru](http://www.rosatom.ru) was visited by about 522,000 people, or approximately 4,500 people per day. 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 2017, ROSATOM recorded a substantial increase in the number of its followers across all main social media.

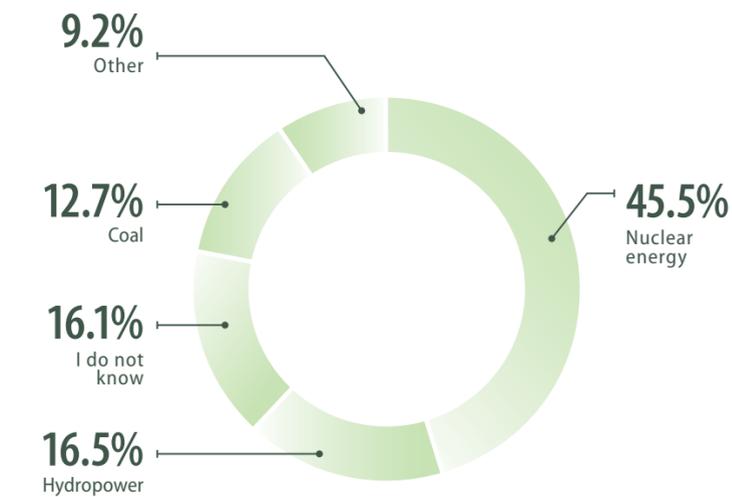
### 7.3.6. Opinion polls

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-Centre<sup>67</sup>, 73.9% of the Russian population supported the use of nuclear power (71% in 2016). 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?

— They say Russia will run out of oil and gas in 20 years. What do you think could replace them as a source of energy?



<sup>67</sup> The survey was conducted from February 8 through February 21, 2018 across a representative sample of Russian citizens consisting of 4,003 people aged 18 and above.

## 8.0. Safety and Environmental Protection

### 8.1. Nuclear and Radiation Safety; Occupational Safety and Health

Key results in 2017:

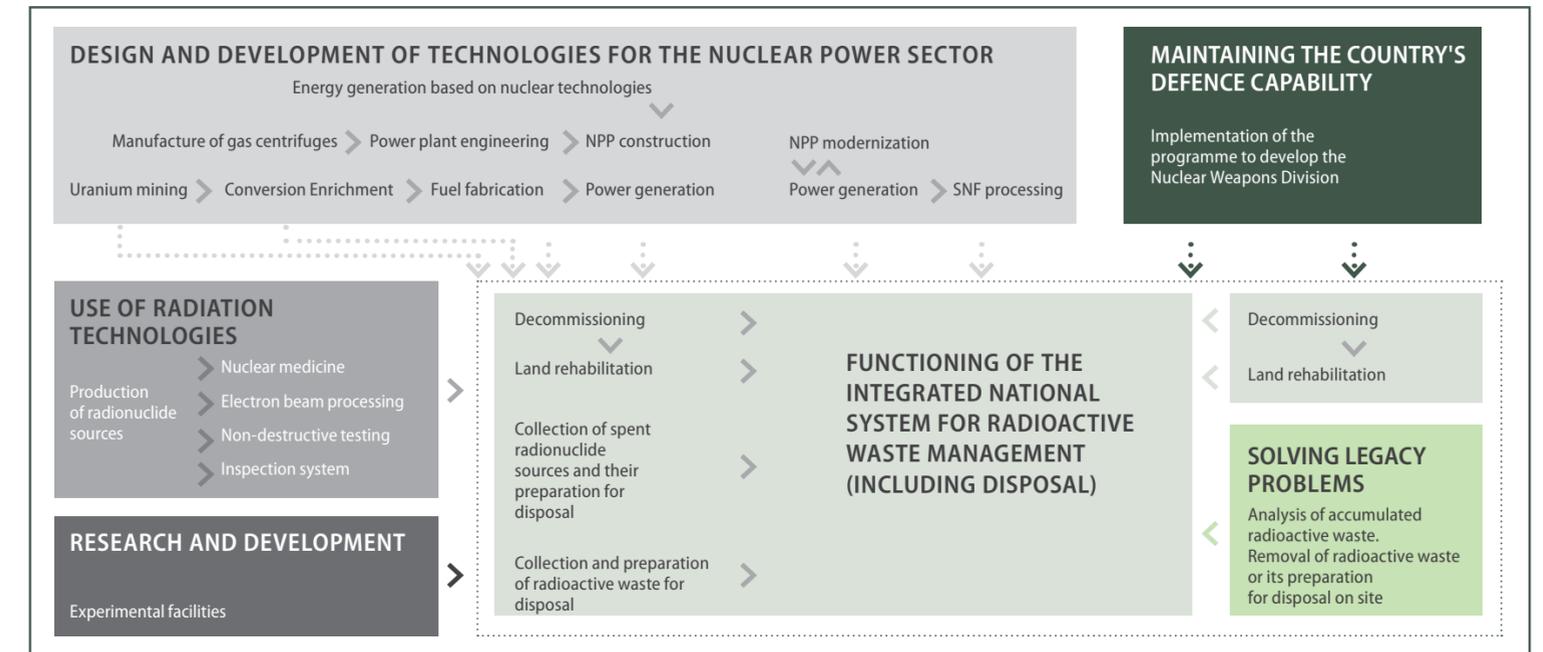
- No events rated at level 1 or higher on the INES scale were detected.
- The injury frequency rate and the lost time injury frequency rate (LTIFR) stood at 0.26 and 0.13 respectively.
- Individual radiation risk was calculated for 65,614 people using the IRAW system.

#### 8.1.1. Nuclear and radiation safety management

ROSATOM focuses on the effective exercise of powers and performance of functions in the area of nuclear power management stipulated by the legislation, the foremost of which is to ensure safety and

protect the environment during the use of nuclear power. This task is addressed by various business units and organizations of ROSATOM using all principal governmental and non-governmental management mechanisms.

Fig. 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.

The following business units of ROSATOM perform the nuclear and radiation safety management functions:

- The General Inspectorate participates in the preparation of proposals for the formulation of 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 responsible for ensuring that the personnel and equipment are ready to deal with emergency situations at nuclear facilities and for monitoring the implementation of preventive measures;
- The Directorate for Public Policy on Radioactive Waste and Spent Nuclear Fuel Management and Nuclear Decommissioning plays a crucial role in the system for the management of state programmes related to dealing with 'nuclear legacy' issues;
- The Technical Regulation Department updates the system of technical safety requirements in the area of the use of nuclear power.

### 8.1.2. Nuclear and radiation safety at nuclear facilities

In 2017, ROSATOM ensured safe and steady operation of enterprises in the nuclear industry. There were no incidents involving radiation leaks in 2017. Limits on employee radiation exposure were not exceeded.

#### Nuclear power plants

As in recent years, in 2017, no events rated at level 2 or higher on the international INES scale were detected at Russian nuclear power plants (level 1 and 0 deviations do not pose a risk to employees operating the facilities, local residents or the environment). Moreover, in 2017, no events rated level 1 on the INES scale were detected at Russian NPPs.

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 7 levels; the upper levels (4-7) are termed 'accidents', while the lower levels are 'incidents' (2-3) and 'anomalies' (1). Events which have no safety significance are classified as 'below scale' at level 0. Events which have no safety relevance are characterized as 'out of scale'.

Table. Changes in the number of deviations in the operation of NPPs on the INES scale<sup>68</sup>

	2015	2016	2017
Total, including:	34	46	33
Level 0 and out of scale	31	44	33
Level 1	3	2	0

In 2017, the number of deviations in the NPP operation decreased due to the following:

- Implementation of programmes to modernize and replace NPP equipment;
- Introduction of a special mode of NPP operation;
- Introduction of a special procedure for the investigation of recurring events in NPP operation;
- Development and implementation of a programme to prevent employee errors;
- Strengthening the quality control of reports on the investigation of NPP events;
- Development and implementation of modern information systems on operational experience;
- In-depth analysis of the factors and events that may have a significant impact on the NPP operation in the future.

### Research reactor units

#### ■ JSC SSC RIAR

On February 1, 2017, the VK-50 research reactor operating at 45 MW was shut down by the emergency protection system. This was caused by a failure of channel No. 3 of the reactor power measurement equipment and simultaneous false alarm in channel No. 2. Safe operating limits were not exceeded. On December 16, 2017, the BOR-60 research reactor operating at 50 MW was shut down by the emergency protection system. This was caused by the shutdown of the main circulation pump of the 2<sup>nd</sup> circuit by the overcurrent protection system of the electric motor. Safe operating limits were not exceeded.

#### ■ JSC Karpov Institute of Physical Chemistry

On May 4, 2017, during the unloading of a spent fuel assembly from the spent fuel pool in the storage facility, the end fitting of one fuel assembly suffered mechanical damage (fuel elements were not damaged). There were no radiation consequences.

Safe operating limits were not exceeded.

### 8.1.3. Physical protection of nuclear facilities

The security and physical protection of ROSATOM's facilities posing nuclear and radiation hazards and nuclear and radioactive materials used and stored by ROSATOM (including during their transportation) complies with the Russian legislation. Furthermore, Russian regulatory requirements are fully consistent with the IAEA recommendations on physical protection and in some respects even exceed them.

In 2017:

- 12 scheduled checks of physical protection in ROSATOM's organizations were carried out, including an assessment of their compliance with anti-terrorist security requirements;
- ROSATOM continued to improve the information system for monitoring the condition of the physical protection system of ROSATOM's facilities posing nuclear and radiation hazards; the system was deployed at eight nuclear facilities;
- ROSATOM upgraded and replaced security equipment along more than 20 kilometres of the perimeters of protected areas of facilities posing nuclear and radiation hazards, including 40 checkpoints for people and vehicles;
- Over 5,000 items of equipment were installed in protected areas as part of equipment systems for physical protection;
- Equipment for physical protection was upgraded in more than 75 buildings;
- More than 60 kilometres of cable routes of physical protection systems were laid.

In 2017, 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.

### 8.1.4. Emergency preparedness<sup>69</sup>

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 of December 31, 2017, 15 professional emergency response teams (ERTs) and 59 volunteer ERTs had been formed and were in a state of readiness in the nuclear industry. They comprise a total of 2,453 emergency response workers.

In 2017, the emergency response teams participated in ~350 emergency, tactical and command post exercises and drills, including jointly with the governing bodies and the teams of functional ISSEPR subsystems of various ministries and departments (Rubezh ('Border') and Atom series of exercises, etc.). As part of the development of international cooperation in the area of emergency preparedness and response, ROSATOM participated in a number of international events related to emergency preparedness and response (the initiatives of the IAEA, events forming part of cooperation between Russia and Scandinavia and cooperation with the Republic of Belarus).

<sup>68</sup> Excluding deviations at power units that were in pilot operation or at the commissioning stage.

<sup>69</sup> Detailed information on the operation of the emergency prevention and response system is available at <http://www.skcr.ru>, <http://www.nwatom.ru>, and on the official websites of ROSATOM and industry organizations.

### 8.1.5. Industry-wide automated radiation monitoring system (IARMS)

The IARMS is a functional subsystem of the Integrated State Automated Radiation Monitoring System (ISARMS). Its main function is to monitor the radiation level in the areas where facilities posing nuclear and radiation hazards are located. The IARMS is one of the tools for alarm notification and providing information for decisions on accident response.

As of December 31, 2017, on-site ARMSs integrated into the IARMS operated in the locations of 31 facilities of ROSATOM posing nuclear and radiation hazards, including all NPPs. In 2017, the total number of fixed monitoring stations increased to 443 compared to 440 in 2016 (with 308 stations located outside industrial sites and 135 ARMS stations located at industrial sites of ROSATOM's organizations). These include<sup>70</sup>:

- 425 stations monitoring the gamma radiation dose rate;
- 3 stations monitoring hydrogen fluoride concentration in the atmosphere;
- 5 stations monitoring the volumetric activity of radioactive gases and aerosols;
- 19 stations monitoring meteorological parameters.

Real-time data from the radiation monitoring stations is available on the website at [www.russianatom.ru](http://www.russianatom.ru).

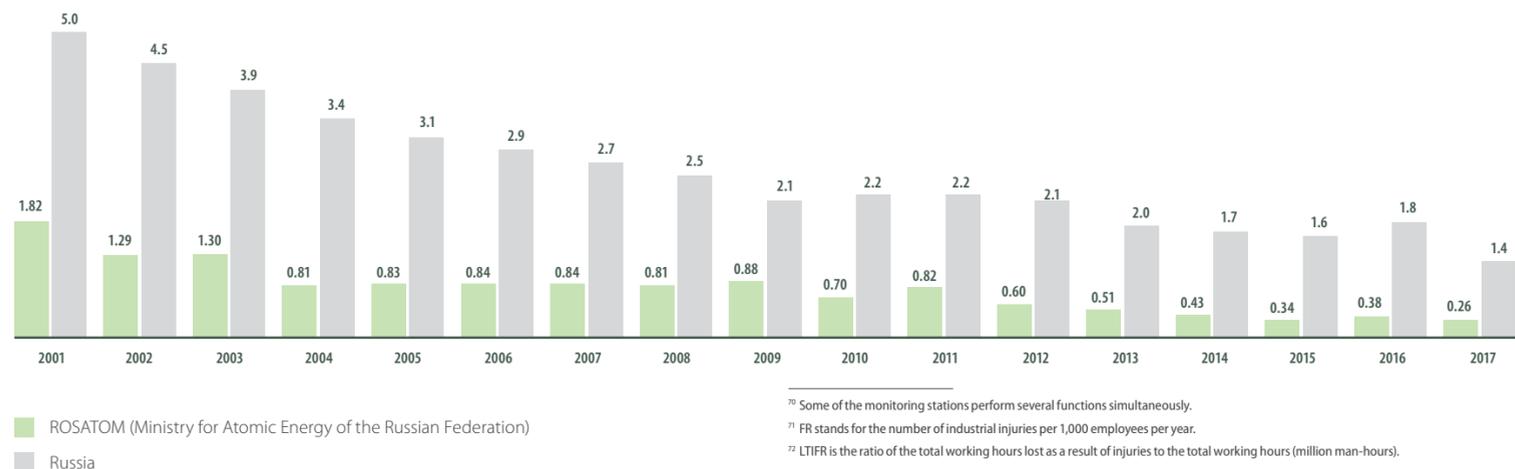
Concentrations of the ruthenium-106 radionuclide found in the atmosphere of some regions of the Russian Federation in late September and early October 2017 did not exceed the threshold set for the sensors of the IARMS, did not pose a danger to population and the environment and did not require protective measures.

### 8.1.6. Industrial safety

As of December 31, 2017, 104 of ROSATOM's organizations operated 757 hazardous industrial facilities (775 facilities in 2016, 773 facilities in 2015), including 8 hazard class 1 facilities, 32 hazard class 2 facilities, 296 hazard class 3 facilities and 421 hazard class 4 facilities. In 2017, there were no events classified as 'accidents at a hazardous industrial facility' at ROSATOM's industrial facilities.

The system of industrial safety management in the organizations of the industry continues to be improved. The Power Engineering Division is introducing an automated process control system for the monitoring of compliance with industrial safety requirements at its facilities. The Engineering Division is implementing an integrated management system aimed at standardizing approaches, procedures and measures to ensure industrial safety in the Division's organizations. All equipment operated at the Corporation's facilities undergoes timely technical inspection and industrial safety assessment. Employees operating hazardous industrial facilities are provided with special clothing and personal protective equipment of proper quality.

Fig. Comparative data on industrial injuries in Russia and ROSATOM, injury frequency rate (FR)



### 8.1.7. Occupational safety and health

One of the fundamental priorities for ROSATOM is to protect the life and health of employees in the industry. Organizations in the industry have in place an Occupational Safety and Health Management System, which is an important element of mutual obligations undertaken by ROSATOM, the Russian Union of Employers in the Nuclear 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 (the current version of the agreement is in force for the period from 2015 through 2017).

Internal regulations adopted in the Corporation's organizations are designed to prevent accidents and occupational diseases, facilitate systematic monitoring of working conditions and occupational safety and health performance and support occupational safety and health not only in ROSATOM, but also in contractor and subcontractor organizations engaged in the operation of nuclear facilities.

One of the effective mechanisms of increasing the level of safety is a system to motivate ROSATOM's employees through key performance indicators, which is being implemented at ROSATOM. In particular, the LTIFR indicator is included in the KPI maps of all Division heads.

In 2017, organizations in the industry continued to work systematically towards increasing the level of safety, including efforts to reduce the number of occupational injuries and employee exposure to occupational hazards, as well as to ensure the safety of employees in contractor organizations.

Table. Occupational safety and health indicators

Indicator	2015	2016	2017
Number of people injured in accidents	91	98	67
Number of fatalities	4	10	10
Injury frequency rate (FR) <sup>71</sup>	0.34	0.38	0.26
LTIFR <sup>72</sup>	0.20	0.19	0.13
Number of people newly diagnosed with an occupational disease	50	55	37

### Industrial injuries, accidents, occupational diseases

In 2017, the injury frequency rate across the industry was relatively low compared to major Russian companies. The injury frequency rate (FR) stood at 0.26, which is more than five times lower than the national average (FR = 1.4). The total number of injured persons decreased from 98 people in 2016 to 67 people in 2017. The main causes of injuries included falling on flat surfaces on the same level, road accidents and the impact of moving objects.

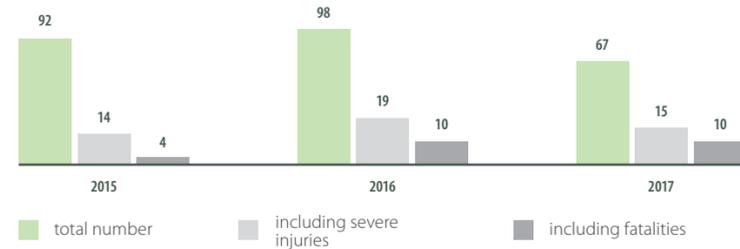
At the same time, the number of deaths due to industrial injuries is a major problem: 10 people died in 2017 (the causes include road accidents, objects falling on the victims, falling from a height and electric shock). In 2017, the responsibility of the heads of enterprises for fatalities was increased. They are required to report to the Operations Committee on the causes of accidents and on measures taken to prevent them in the future.

<sup>70</sup> Some of the monitoring stations perform several functions simultaneously.

<sup>71</sup> FR stands for the number of industrial injuries per 1,000 employees per year.

<sup>72</sup> LTIFR is the ratio of the total working hours lost as a result of injuries to the total working hours (million man-hours).

### Number of injured persons



### Table. Causes of industrial injuries

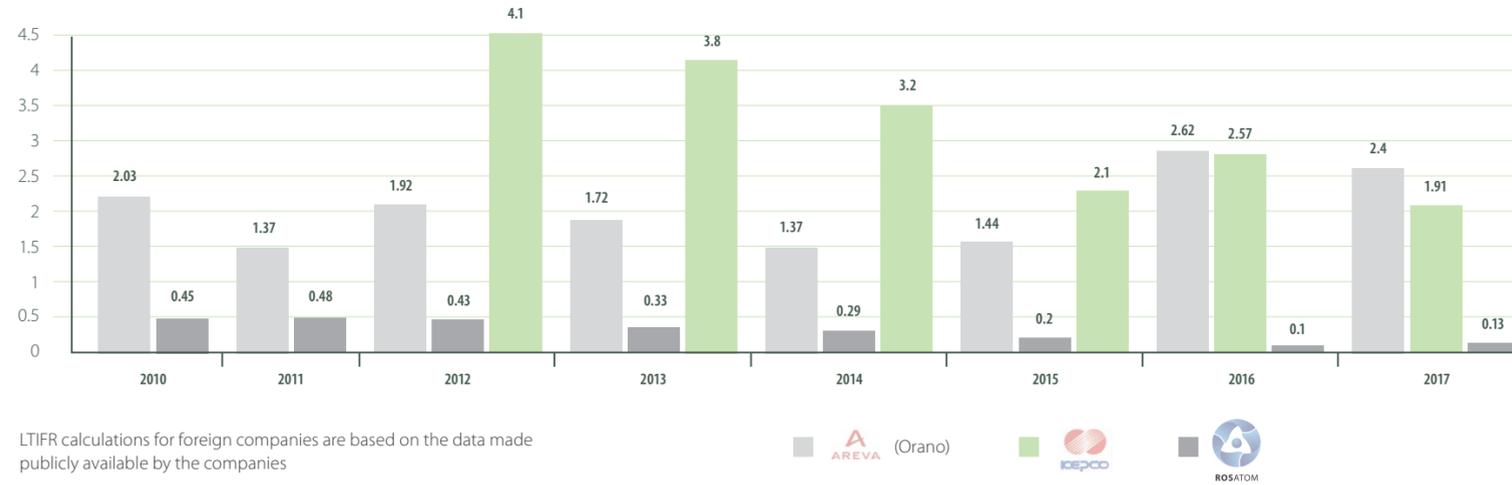
	2015	2016	2017
Falls on surfaces of the same level	37	32	21
Falling from a height	3	3	3
Road incident	8	13	15
Electric shock	2	8	4
Fall of an object on the victim	2	9	10
Impact of moving objects, structures, parts	33	22	13
Illegal actions and other unclassified factors	3	8	1
Burn (thermal, etc.)	4	3	0
<b>Total</b>	<b>92</b>	<b>98</b>	<b>67</b>

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. 0.5 is accepted as the reference value of the LTIFR for Divisions, units and holding companies and ROSATOM as a whole, which is a good result for any company in any country of the world. The target for 2017 for ROSATOM as a whole has been set at 0.4, which is better than the reference value. Individual values not exceeding the basic values (a three-year average) have been accepted as target LTIFR values for Divisions, units and holding companies within ROSATOM. In 2017, the LTIFR across the Corporation and its organizations stood at 0.13.

### Table. Changes in LTIFR

ROSATOM's divisions/complexes	2015	2016	2017
Nuclear Weapons Division	0.22	0.20	0.14
Mining Division	0.23	0.44	0.28
Fuel Division	0.14	0.09	0.06
Power Engineering Division	0.02	0.065	0.08
Engineering Division	0.16	0.21	0.06
Life Cycle Back-End Division	0.10	0.32	0.05
Innovation Management Unit	0.10	0.048	0.00
Mechanical Engineering Division	0.42	0.25	0.21
<b>Total across the Corporation</b>	<b>0.20</b>	<b>0.19</b>	<b>0.13</b>

### LTIFR in ROSATOM benchmarked against foreign companies



LTIFR calculations for foreign companies are based on the data made publicly available by the companies

In 2017, 37 employees in the industry were diagnosed with occupational diseases (55 people in 2016, 49 people in 2015):

- 30 people in the Mining Division (PJSC PIMCU);
- 5 people in the Fuel Division;
- One person in the Nuclear Weapons Division;
- One person in the Life Cycle Back-End Division.

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 workers' rehabilitation, if necessary (provision of health food and milk, health resort treatment).

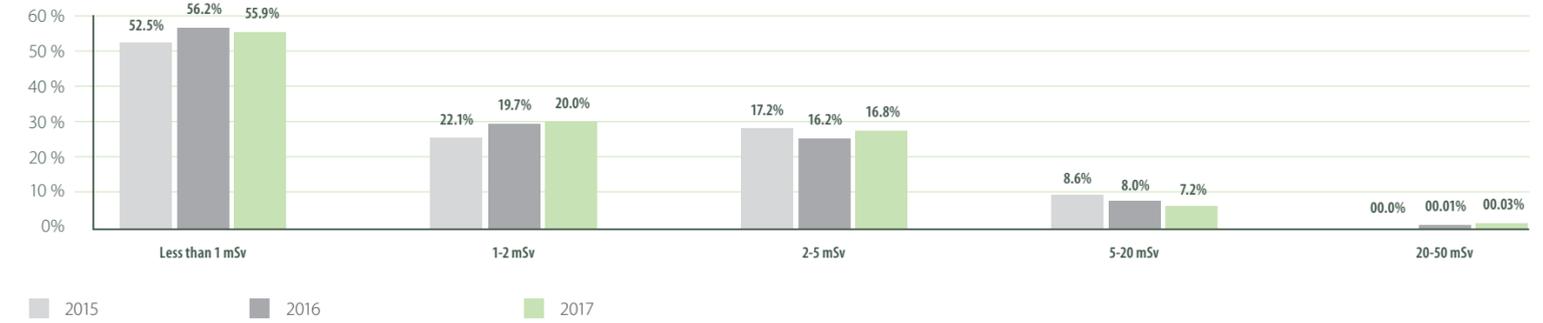
### 8.1.8. Radiation exposure of employees

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. Most enterprises in the industry 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

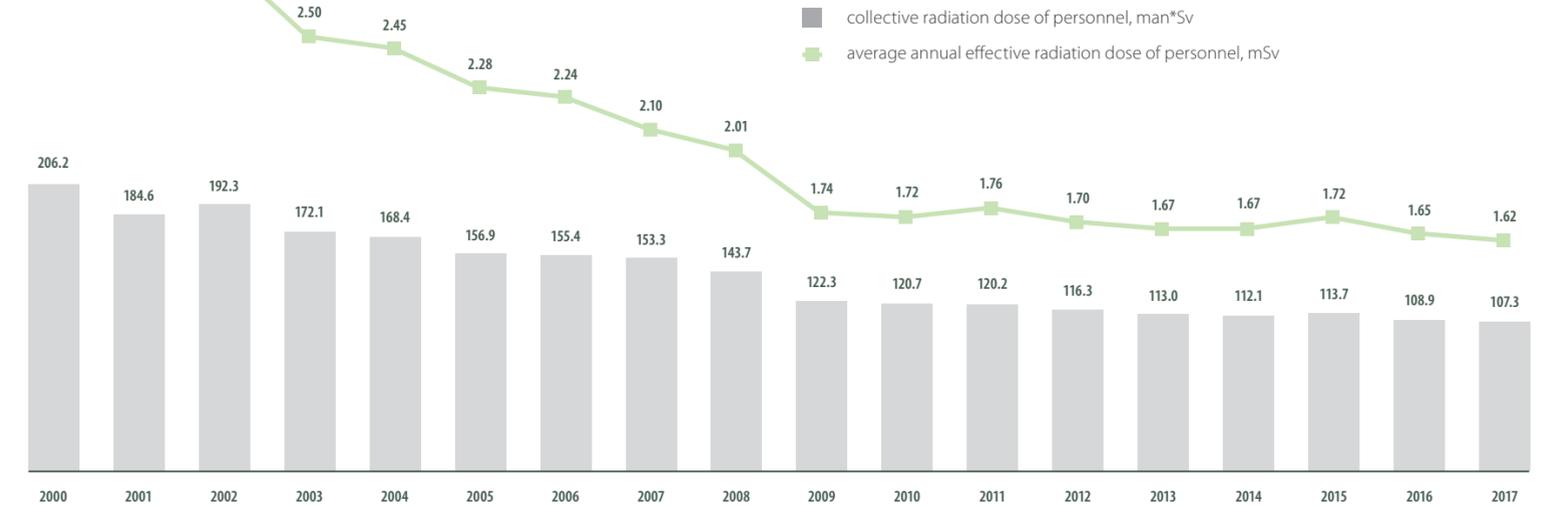
As of December 31, 2017, 66,116 people (group A personnel) were under individual radiation exposure monitoring in ROSATOM's organizations. The number remained almost unchanged compared to 2016.

Fig. Distribution of group A personnel by dose ranges



In 2017, the average annual effective radiation dose of the Corporation's personnel totalled 1.62 mSv. Over the past nine years, average effective employee radiation exposure and the number of people exposed to radiation have been varying insignificantly and remain low.

Fig. Average annual effective radiation dose of the personnel



In 2017, 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.

#### Individual radiation risks

In 2017, ROSATOM continued to monitor radiation risks for group A personnel using the IRAW occupational radiation risk assessment system. Individual risk was calculated for 65,614 people, or 99.4% of the total number of group A employees. The absolute majority of group A employees work in conditions of acceptable occupational risk. For 795 people (1.21% of the number of employees included in the IRAW system), individual risk exceeded the regulatory level of 10<sup>-3</sup>. The high-risk group comprises mainly veterans of the industry, whose average age is more than 60 years.

#### Table. Changes in key indicators of the IRAW system, %

	<b>2015</b>	<b>2016</b>	<b>2017</b>
Share of employees in the negligible and acceptable occupational risk areas	98.64	98.78	98.79
Share of employees in the high risk area	1.36	1.22	1.21
Share of employees in the industry undergoing individual radiation exposure monitoring and included in the IRAW system	94.3	97.9	99.4

Over the last four years, the average individual radiation risk across ROSATOM did not exceed 8% of the regulatory limit, while the maximum individual risk has been decreasing steadily.

#### Assessment of the overall risk of potential exposure

In 2017, the overall risk of potential exposure was assessed in 66 organizations in the industry. The results of radiation risk monitoring form the basis for management decisions on the optimization of the radiation protection of personnel in order to prevent an increase in the size of the group characterized by high occupational risk. According to the results of monitoring over the last two years, the average radiation risk in the industry has not changed and remains at an acceptable level.

#### Table. Results of radiation risk monitoring

	<b>2015</b>	<b>2016</b>	<b>2017</b>
Power Engineering Division	1.20·10 <sup>-4</sup>	1.20·10 <sup>-4</sup>	1.10·10 <sup>-4</sup>
Fuel Division	3.10·10 <sup>-5</sup>	2.80·10 <sup>-5</sup>	2.70·10 <sup>-5</sup>
Nuclear Weapons Division	5.00·10 <sup>-5</sup>	4.40·10 <sup>-5</sup>	4.50·10 <sup>-5</sup>
Mining Division	2.00·10 <sup>-5</sup>	2.00·10 <sup>-5</sup>	2.30·10 <sup>-5</sup>
Life Cycle Back-End Division	6.80·10 <sup>-5</sup>	4.30·10 <sup>-5</sup>	4.40·10 <sup>-5</sup>
Innovation Management Unit	1.00·10 <sup>-4</sup>	9.20·10 <sup>-4</sup>	9.10·10 <sup>-5</sup>
Mechanical Engineering Division	8.50·10 <sup>-5</sup>	6.20·10 <sup>-5</sup>	5.10·10 <sup>-5</sup>
Engineering Division	–	6.00·10 <sup>-6</sup>	2.40·10 <sup>-5</sup>
<b>Total</b>	<b>7.90·10<sup>-5</sup></b>	<b>7.00·10<sup>-5</sup></b>	<b>7.00·10<sup>-5</sup></b>

The safety index of potential exposure (SIPE) obtained as a result of the monitoring takes into account the limit on the overall risk (no more than 2·10<sup>-4</sup> per year) and makes it possible to monitor the potential exposure level and predict the radiation protection status in an organization. The state of radiation protection against potential exposure in an enterprise is considered optimized if the index value exceeds 50% and does not decrease over time. In 2017, all organizations of the industry reported a SIPE value above the optimization level. The index value for ROSATOM's main divisions has remained above 50% over the last three years. In the reporting year, the average SIPE across the Corporation stood at 80%.

#### Table. Safety index of potential exposure, %

	<b>2015</b>	<b>2016</b>	<b>2017</b>
Power Engineering Division	67	79	79
Fuel Division	76	85	86
Nuclear Weapons Division	65	79	79
Mining Division	48	66	65
Life Cycle Back-End Division	77	87	86
Innovation Management Unit	67	80	78
Mechanical Engineering Division	74	83	79
Engineering Division	–	78	74
<b>Total</b>	<b>67</b>	<b>80</b>	<b>80</b>

## 8.2. RAW and SNF Management and Decommissioning of Facilities Posing Nuclear and Radiation Hazards

Key results in 2017:

- The second stage of creation of the Integrated National System for Radioactive Waste Management was completed.
- All irradiated DAV-90 units were removed from the site of FSUE Mining and Chemical Plant.
- Eight facilities posing nuclear and radiation hazards were decommissioned.
- Two nuclear submarines were dismantled.

#### 8.2.1. 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)<sup>73</sup>

In 2017, as part of the implementation of FTP NRS 2, large-scale work was started on 24 sites to decommission facilities posing nuclear and radiation hazards. This will enable a significant reduction of costs in the future and will help to prevent man-made accidents, natural disasters, and acts of terrorism at the decommissioned facilities posing nuclear and radiation hazards.

In 2017, eight facilities posing nuclear and radiation hazards were decommissioned. ROSATOM rehabilitated radiation-contaminated sites with a total area of 29,000 m<sup>2</sup> and with a volume of radiation-contaminated soil of ~8,600 m<sup>3</sup>. More than 46,000 tonnes of clean soil were brought to the rehabilitated sites.

The decommissioning of the open RAW storage pond at FSUE Mining and Chemical Plant and the mothballing of the storage ponds at JSC SCC continued.

FSUE Mayak continued to reprocess spent nuclear fuel from power and industrial reactors, propulsion units and research reactors.

The development of infrastructure for SNF and RAW management continued at Leningrad, Smolensk and Kursk NPPs. Dismantling of the Sibir nuclear icebreaker, which has reached the end of its service life, continued; the unloading of nuclear reactors and steam generators was completed. Dismantling of the Lepse floating maintenance base was completed. In 2017, geomigration models were developed and updated for 11 enterprises in the nuclear industry: long-term consequences of chemical and radioactive contamination of groundwater and surface waters in areas potentially impacted by ‘nuclear legacy’ facilities were assessed. This will significantly reduce the future costs of eliminating chemical and radioactive contamination at these enterprises and ensure their sustainable development.

#### 8.2.2. Development of an integrated national system for radioactive waste management

In 2017, the second stage of creation of the Integrated National System for Radioactive Waste Management (INS RAW) was completed.

As part of construction of capacities for the disposal of class 3 and 4 radioactive waste:

- Designs were approved for the renovation of the near-surface RAW disposal facility (RWDF) in Novouralsk (Sverdlovsk Region). A positive opinion of the state environmental review board was obtained for materials providing a rationale for a licence for construction (renovation) and operation of the first stage of the near-surface RAW disposal facility;
- Designs were developed for two disposal facilities for class 3 and 4 solid RAW in the CATFs of Seversk (Tomsk Region) and Ozersk (Chelyabinsk Region). Sets of materials providing a rationale for a licence were prepared.

#### 8.2.3. RAW generation and disposal

In 2017, 1.63×10<sup>6</sup> m<sup>3</sup> of RAW were generated in Russia, of which 6.34×10<sup>4</sup> m<sup>3</sup> were placed in long-term storage facilities.

The volume of RAW accumulated as of December 31, 2017 totalled 5.64×10<sup>8</sup> m<sup>3</sup>, of which 5.53×10<sup>8</sup> m<sup>3</sup> were classified as ‘nuclear legacy’.

#### Table. RAW generation in 2017, m<sup>3</sup>

	<b>Very low-level waste</b>	<b>Low-level waste</b>	<b>Intermediate-level waste</b>	<b>High-level waste</b>
Solid RAW	7.88·10 <sup>5</sup>	4.14·10 <sup>3</sup>	1.12·10 <sup>3</sup>	2.51·10 <sup>2</sup>
Liquid RAW	–	7.11·10 <sup>5</sup>	9.76·10 <sup>4</sup>	2.35·10 <sup>4</sup>

In 2017, ROSATOM proceeded with the disposal of class 3 and 4 RAW in a radioactive waste disposal facility (RWDF) in Novouralsk, Sverdlovsk Region: 225 m<sup>3</sup> of RAW were accepted for disposal. 4,273.87 m<sup>3</sup> of RAW from Balakovo and Smolensk NPPs, FSUE Atomflot and the Ministry of Defence of the Russian Federation were transferred for disposal to FSUE National Operator for Radioactive Waste Management<sup>74</sup>.

#### 8.2.4. Spent nuclear fuel management

As of December 31, 2017, the volume of accumulated spent nuclear fuel (SNF) in Russia totalled 23,091.88 tonnes (including 16,784.42 tonnes of SNF forming part of the ‘nuclear legacy’), of which 654.88 tonnes were accumulated in 2017.

In 2017, removal of highly enriched DAV-90 SNF from industrial uranium-graphite reactors from the site of FSUE Mining and Chemical Plant and its reprocessing at FSUE Mayak Production Association was completed.

The transportation of SNF from AMB reactors from storage facilities of Beloyarsk NPP to FSUE Mayak Production Association for storage and subsequent reprocessing was started.

Spent nuclear fuel from VVER-1000 reactors was brought to FSUE Mayak Production Association in TUK-1410 packaging specially designed for SNF with a high level of initial enrichment and higher fuel burnup. Spent nuclear fuel from VVER-1000 reactors was reprocessed.

Spent nuclear fuel from VVER-440 and VVER-1000 reactors was imported from Ukraine and Bulgaria for reprocessing to FSUE Mayak Production Association and FSUE Mining and Chemical Plant.

Removal of spent fuel assemblies from Russian nuclear power plants continued:

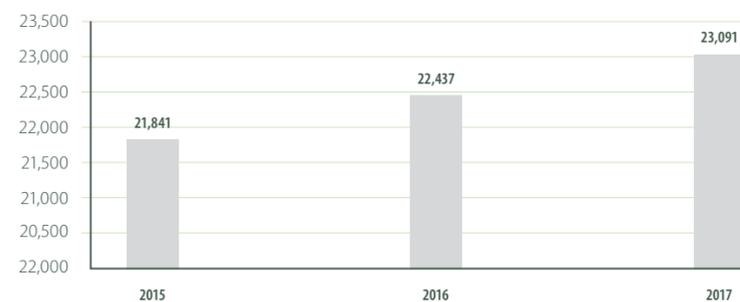
- 6,912 spent fuel assemblies from RBMK-1000 reactors were removed and placed in dry storage at FSUE Mining and Chemical Plant;
- 306 substandard spent fuel assemblies from RBMK-1000 reactors were removed from Leningrad NPP;
- 317 spent fuel assemblies from VVER-1000 reactors were removed and placed in temporary storage for subsequent reprocessing at FSUE Mining and Chemical Plant;
- 41 spent fuel assemblies from VVER-1000 reactors were removed and transported to FSUE Mayak Production Association; all spent fuel was reprocessed;
- 378 spent fuel assemblies from VVER-440 reactors and 267 spent fuel assemblies (including 22 spent fuel assemblies containing MOX fuel) from BN-600 reactors were removed and transported for reprocessing to FSUE Mayak Production Association.

As part of the Russian-US RRRFR programme, 153 spent fuel assemblies from research reactors in the Republic of Kazakhstan were removed and transported to FSUE Mayak Production Association for reprocessing.

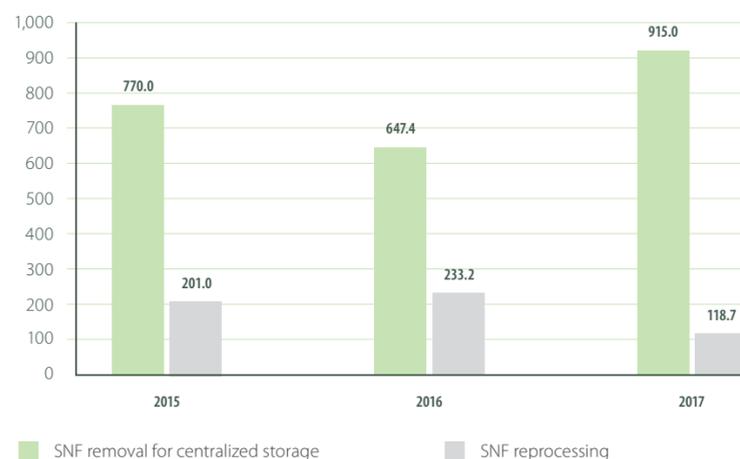
<sup>[1]</sup> For more information about the goals and objectives of FTP NRS 2, see the report for 2016 and the website: http://xn---2030-bwe0hj7au5h.xn--p1ai/.

<sup>[2]</sup> Under the resolution of the Russian Government, Federal State Unitary Enterprise National Operator for Radioactive Waste Management has been appointed national operator for the management of radioactive waste; it is the only organization authorized to carry out permanent isolation of radioactive waste and other related functions. The enterprise addresses the issues of accumulated ‘nuclear legacy’ and newly generated RAW and is essentially a state-owned manufacturing and environmental enterprise whose key objective is to ensure permanent isolation of RAW taking into account any potential environmental risks.

#### SNF accumulation in Russia, tonnes



#### SNF removal for storage and reprocessing, tonnes



#### 8.2.5. Development of a system for decommissioning of facilities posing nuclear and radiation hazards

In 2017, eight facilities posing nuclear and radiation hazards were decommissioned:

- Building 53 at JSC A.A. Bochvar National Research Institute for Inorganic Materials;
- A MATR-2 critical test facility at JSC A.I. Leypunsky Institute for Physics and Power Engineering;
- An EBR-L research nuclear reactor at FSUE Russian Federal Nuclear Centre – E. I. Zababakhin All-Russian Research Institute of Technical Physics (RFNC – VNIITF);
- A Sigma-Aralia test facility at JSC Institute of Reactor Materials;
- Fuel assembly production capacities (buildings 73 and 17V) at JSC Novosibirsk Chemical Concentrate Plant;
- The Lepse floating maintenance base;
- Building No. 3 of the 12<sup>th</sup> Central Research Institute of the Russian Ministry of Defence.

Preparations for the decommissioning of the U-5 research reactor unit at JSC A.A. Bochvar National Research Institute for Inorganic Materials were completed (the necessary infrastructure was created; process equipment, utility systems and floor structures were dismantled; accumulated RAW was transferred to the specialized organization for reprocessing, conditioning and temporary storage for up to five years).

The decommissioning of the AD industrial uranium-graphite reactor continued at FSUE Mining and Chemical Plant (the undervessel space was concreted; the remainder of the filling between the walls of the concrete reactor shaft was removed).

In 2017, the introduction of RPS tools and process optimization enabled an additional 10% year-on-year reduction in the amount of time required in order to form the reactor compartment of a dismantled nuclear submarine and prepare it for storage. This made it possible to form one additional reactor compartment unit in long-term storage facilities in Sayda Bay (Murmansk Region) and on Cape Ustrichny (Primorsky Territory).

#### 8.2.6. Dismantling of nuclear submarines

In 2017, two nuclear submarines were dismantled.

22 units from reactor compartments of dismantled nuclear submarines were formed, prepared and put in long-term onshore storage. 12 floating reactor units were prepared and transferred from the Kamchatka Territory to the Primorsky Territory for subsequent dismantling and formation of one-compartment reactor units.

The construction of the shelter building for the tanks of the dry storage unit for spent nuclear fuel in the temporary storage facility in Andreev Bay was completed; permission was obtained for the commissioning of the facility and the start of SNF extraction.

645 m<sup>3</sup> of RAW were conditioned, and more than 1,331.0 m<sup>3</sup> of liquid radioactive waste accumulated during construction, operation and decommissioning of nuclear propulsion units of Navy ships were reprocessed.

Dismantling of the Ural large nuclear reconnaissance vessel, a project 671RTM large nuclear submarine and two nuclear maintenance ships continued.

Using international funding for technical assistance (in 2017, a total of RUB 1.97 billion was received):

- The formation of block packaging for the storage of SNF from the Lepse floating maintenance base was completed; the tool for SNF removal from storage cells was made;
- An SNF treatment facility was commissioned in Andreev Bay, and unloading of SNF was started;
- SNF was unloaded from the reactors of the Admiral Ushakov nuclear-powered cruiser, which had been removed from active service.

#### 8.2.7. New products for the Russian and international markets

REMIX-NFC is a new product in the field of SNF management; it is designed primarily for international markets. REMIX-NFC is a comprehensive service covering SNF reprocessing, the production of uranium-plutonium fuel from regenerated materials for use in thermal-neutron reactors and the minimization of RAW volumes. A distinctive feature and competitive advantage of REMIX-NFC is the possibility of multiple recycling of uranium and plutonium in existing thermal reactors. Thus, REMIX-NFC is a unique product that enables the customer to effectively prevent the accumulation of SNF. Three combined experimental fuel assemblies with REMIX uranium-plutonium fuel were manufactured and loaded into the reactor of power unit No. 3 at Balakovo NPP for the first time in the history of the Russian nuclear power industry. Reactor research in the MIR reactor and post-irradiation examination continue in order to provide evidence of efficiency of REMIX fuel.

In 2017, ROSATOM resolved to approve the programme titled 'Obtaining References for REMIX Fuel to Organize its Promotion on Foreign Markets'.

#### 8.2.8. Plans for 2018

In 2018, ROSATOM will continue to implement the Federal Target Programme (FTP) on Nuclear and Radiation Safety for the Period from 2016 through 2020 and for the Period until 2030, including:

- Establishment of a pilot and demonstration centre (second start-up facility) for SNF reprocessing based on innovative technologies at FSUE Mining and Chemical Plant;
- Construction of facilities for permanent isolation of class 3 and 4 radioactive waste;
- Removal of accumulated spent nuclear fuel from NPPs for reprocessing;
- Removal of RAW from storage sites, preparation for disposal, transportation to the disposal site and transfer for disposal;
- Decommissioning of Site 4 (building No. 804) at JSC Angarsk Electrolysis Chemical Complex.

As part of the implementation of the subprogramme titled 'Industrial Dismantling of Nuclear Submarines', in 2018, it is planned to:

- Complete the dismantling of one nuclear maintenance ship;
- Form 22 reactor sections of dismantled nuclear submarines and put them in long-term storage;
- Reprocess 2.77 tonnes of spent nuclear fuel from dismantled nuclear submarines.

## 8.3. Environmental Safety

Key results in 2017:

- Expenditure on environmental protection totalled RUB 22.5 billion.
- Energy costs were reduced by 6.8% compared to 2015 as the base year.
- As part of the Year of the Environment, ROSATOM's organizations carried out over 1,700 organizational, operational, technical, public awareness, information and research initiatives across Russia.

#### Vladimir Grachev, Adviser to the Director General



— In 2017, ROSATOM's Environmental Policy was updated. What were the key changes made in the document?

— The environmental policy of the industry and the system for its implementation are continuously improved and updated in accordance with new objectives of the government and the industry, ensuring a high degree of compliance of ROSATOM and its organizations with the latest requirements.

The update to the Environmental Policy was necessitated by fundamental changes in environmental legislation of the Russian Federation and the need to align the timing of adjustments made by ROSATOM and its organizations with the time when the new environmental requirements come into force. A new environmental regulation system was introduced, which includes general and differentiated requirements. In addition, in 2017, which was declared the Year of the Environment in Russia, the Environmental Security Strategy of the Russian Federation for the Period until 2025 was approved, and the updated Environmental Policy incorporates the provisions of this fundamental strategic planning document. A distinctive feature of the new industrial Environmental Policy is that it places greater emphasis on

environmental safety. Ensuring environmental safety is an absolute priority in the course of operations of ROSATOM's organizations.

As part of the update, the main objectives of ROSATOM's environmental policy and the mechanisms for their achievement were revised. We are faced with new challenges such as the application of the best available technologies and innovative environmentally efficient technologies that help to address environmental issues and ensure environmental safety of nuclear facilities. We have significantly expanded the range of commitments that ROSATOM is undertaking to achieve the strategic goal of promoting the environmentally-oriented development of ROSATOM.

— How would you assess ROSATOM's progress in reducing its environmental footprint in recent years? What are ROSATOM's medium-term targets for reducing its environmental footprint?

— Implementation of the Environmental Policy and introduction of innovative environmental technologies at nuclear facilities made it possible to achieve a high level of environmental safety in the industry and reduce the negative impact on the environment. Between 2012 and 2017, the discharge of contaminated wastewater decreased by a factor of 1.7. During the last five years, emissions of pollutants into the atmosphere decreased by a factor of 1.5, while generation of hazard class 1 and 2 waste decreased by a factor of 7.5. At the same time, the share of ROSATOM in the total volume of pollutant emissions, discharges of contaminated wastewater and generation of industrial and consumer waste across the Russian Federation is negligible and amounts to a fraction of a percentage point.

In 2017, the Plan of Priority Actions to Reduce the Negative Environmental Impact of ROSATOM's Organizations for the Period until 2020 was adopted. It includes operational and technical measures aimed at reducing discharges of polluting substances into water bodies, protecting the atmosphere, reducing the volume of industrial and consumer waste, protecting the soil and subsoil. We are constantly working to improve the quality of environmental protection and environmental safety management and improve the planning and reporting system as part of the implementation of ROSATOM's Environmental Policy. We are rolling out the practice of conducting environmental audit in ROSATOM's organizations, improving the environmental management

systems and enabling their integration with quality management, occupational health and safety, and energy management systems. In addition, industrial environmental control and monitoring systems (including the automated ones) are being improved.

And all this produces results: in the medium term we expect a reduction in emissions and discharges of pollutants into the environment, the volume of waste generation, as well as a reduction in our environmental footprint in general.

### 8.3.1. Environmental safety and environmental protection management

ROSATOM attaches great importance to environmental safety and environmental protection. One of its major priorities is to minimize the negative environmental impact of nuclear facilities. The Uniform Sectoral Environmental Policy of ROSATOM and Its Organizations<sup>75</sup> is the main regulatory document on environmental safety and environmental protection. In 2017, the Policy was updated and approved by the Federation Council Committee on Agriculture and Food Policy and Environmental Management, the State Duma Committee on Ecology and Environmental Protection, the Civic Chamber of the Russian Federation and the Public Council of ROSATOM with assistance from the Minister of Natural Resources and Environment of the Russian Federation.

ROSATOM compiles a list of environmentally relevant organizations on an annual basis (48 organizations in 2017<sup>76</sup>). Such organizations include industrial enterprises that may have a negative impact on the environment and the health of the population. ROSATOM's management pays particular attention to the operations of environmentally relevant organizations; on an annual basis, these organizations issue public environmental reports<sup>77</sup>.

To improve environmental safety and the efficiency of environmental protection measures, ROSATOM's organizations that make a considerable impact on the environment introduce environmental management, quality management, occupational health and safety management and energy management systems.

In 2017, integrated management systems were in place in nine enterprises in the industry. They comprise:

- Environmental management systems compliant with the ISO 14001 standard;
- Quality management systems compliant with the ISO 9001 standard;
- Occupational health and safety systems compliant with the OHSAS 18001 standard, and energy management systems compliant with the ISO 50001 standard.

ROSATOM offers high-technology solutions that enable a transition to sustainable production and consumption models and a reduction of the negative environmental impact of industry and transport. ROSATOM's research team have developed an efficient technology for car tyre recycling (in Russia alone, up to 1.5 million tyres are discarded every year). During an environmentally friendly liquid metal pyrolysis process, rubber is processed into a number of useful products (including limonene, which is in demand in the chemical industry and perfumery) which can then be used in other production cycles.

19 organizations were issued with certificates of compliance with the requirements of the ISO 14001 standard for environmental management systems, and 37 enterprises were issued with certificates of compliance with the requirements of the ISO 9001 standard for quality management systems.

21 organizations in the nuclear industry continued to implement environmental management systems and subsequently transitioned to an integrated management system. In addition, as new versions of the ISO 9001 and ISO 14001 standards were published in 2016, organizations in the nuclear industry developed plans for a switchover to the new versions of the standards.

### 8.3.2. Year of the Environment in Russia

Pursuant to the decree of the President of the Russian Federation, 2017 was declared the Year of the Environment in Russia, and ROSATOM's organizations carried out over 1,700 initiatives aimed at:

- Reduction of discharges of polluting substances into water bodies;
- Reduction of industrial and consumer waste generation and its safe handling;
- Protection of the atmosphere;
- Energy conservation;
- Ensuring environmental safety at operating and decommissioned facilities.

At the end of the Year of the Environment, ROSATOM was awarded with a Certificate of Appreciation from the Federation Council of the Federal Assembly of Russia for a major contribution to reducing the negative environmental impact.

### 8.3.3. Industry-wide system for on-site subsoil condition monitoring

The industry-wide system for on-site subsoil condition monitoring (IS OSCM) ensures continuous radiation and chemical monitoring of the geological environment (groundwater, surface water and aquifers) in ROSATOM's organizations. The system covers 55 of ROSATOM's enterprises, including all 48 environmentally relevant organizations. A total of 3,657 observation wells are used for monitoring the condition of the subsoil.

To provide information support for the decommissioning of facilities posing nuclear and radiation hazards and nuclear legacy facilities, 28 industry organizations have been selected, for which geoenvironmental information packages (GEIPs)<sup>78</sup> will be developed based on the data from OSCM systems. In 2017, GEIPs were developed for JSC SSC RF-IPPE and JSC Ural Electrochemical Integrated Plant (UEIP). In 2018, ROSATOM plans to develop GEIPs for PJSC Machine-Building Plant and JSC SSC RIAR.

### 8.3.4. Improved energy efficiency

In accordance with the requirements of the federal legislation and in order to achieve the targets set in the state programme 'Development of the Nuclear Power and Industry Complex, ROSATOM's organizations are implementing energy conservation and energy efficiency improvement measures.

#### ■ Energy efficiency management system

The energy management system compliant with the ISO 50001 standard has been implemented in the Power Engineering Division (JSC Rosenergoatom Concern) and the Fuel Division (JSC TVEL) of ROSATOM.

Organizations whose energy consumption exceeds RUB 50 million per year in monetary terms conduct mandatory energy surveys at least once every five years. Based on the findings of the surveys, the organizations develop and implement consolidated energy conservation and energy efficiency programmes for a five-year period.

To monitor progress on measures to improve energy efficiency and evaluate their results, an Automated Energy Efficiency Management System is in place in the industry. 78 organizations are connected to the System.

#### ■ Results in 2017

When assessing the impact of measures aimed at improving energy efficiency, the Corporation uses 2015 as the base period (2015 marked the completion of the first five-year period of implementation of energy conservation programmes).

<sup>75</sup> <http://www.rosatom.ru/upload/iblock/74e/74eb9c650aa73e74d0b9b9aadea0c1f8.pdf>.

<sup>76</sup> The list of organizations is available on the corporate website: <http://www.rosatom.ru/en/about-us/public-reporting/>

<sup>77</sup> <http://www.rosatom.ru/social-respons/environmental-management>.

<sup>78</sup> A GEIP is a set of data on the natural and man-made environment and the radiation and environmental conditions at the location of nuclear facilities.

Table. Energy consumption in 2017 in physical terms (in comparable conditions)

Division/complex/unit	Heat		Water		Electricity	
	'000 Gcal	%	'000 m <sup>3</sup>	%	'000 kWh	%
Fuel Division	2,072.58	29.82	470,728.50	6.78	2,853,354.78	18.02
Power Engineering Division <sup>79</sup>	1,274.99	18.35	6,355,508.43	91.57	10,798,979.27	68.19
Mechanical Engineering Division	64.55	0.93	4,577.39	0.07	162,536	1.03
Mining Division	625.38	9	4,057.13	0.06	563,476.48	3.56
Nuclear Weapons Division	1,982.74	28.53	66,477.01	0.96	866,541.48	5.47
Life Cycle Back-End Division	624.07	8.98	31,446.57	0.45	340,855.32	2.15
Innovation Management Unit	255.76	3.68	7,342.72	0.11	181,945.11	1.15
Other	49.07	0.71	293.74	0.0001	69,287.15	0.44
<b>Total for ROSATOM</b>	<b>6,949.14</b>	<b>100</b>	<b>6,940,431.49</b>	<b>100</b>	<b>15,836,975.59</b>	<b>100</b>

In 2017, energy costs in the industry totalled RUB 32.4 billion.

In 2017, the annual energy conservation target of 4% was exceeded (the target set in the state programme 'Development of the Nuclear Power and Industry Complex'). The cumulative total reduction in energy consumption across ROSATOM against 2015 as the base year amounted to 6.8%, or RUB 2.5 billion.

The largest relative reductions in energy costs were achieved in the following organizations:

- JSC Nuclear Power Plant Equipment Research and Testing Centre – by 47.2% (RUB 1.1 million);
- JSC TENEX – by 35.6% (RUB 1.3 million);
- JSC Experimental Refractory Metals and Hard Alloys Plant – by 33.2% (RUB 10.8 million);
- JSC Atomenergoremont – by 29.5% (RUB 10.2 million).

Table. Energy cost reduction in 2017

Division/complex/unit	Cumulative total compared to 2015, RUB million	
	Cumulative total compared to 2015, RUB million	Cumulative total compared to 2015, %
Fuel Division	834.0	8.4
Power Engineering Division	403.2	2.9
Mechanical Engineering Division	114.3	10.9
Mining Division	209.3	11.6
Nuclear Weapons Division	484.4	7.7
Life Cycle Back-End Division	316.8	13.3
Innovation Management Unit	51.1	5.4
Other	65.1	From 6.3 to 23.3
<b>Total for ROSATOM</b>	<b>2,478.3</b>	<b>6.8</b>

#### ■ Plans for 2018

Starting from 2018, a differentiated target for annual reduction in energy consumption (expressed as a percentage) will be set for each division.

Table. Energy conservation targets for 2018

Division/complex/organization	Target values, %
JSC Rosenergoatom Concern	4.0
JSC TVEL	6.0
Nuclear Weapons Division	6.0
Life Cycle Back-End Division	5.4
JSC Atomredmetzoloto	9.0
JSC Atomenergomash	6.0
JSC Rusatom Healthcare	2.0
JSC RPC Khimpromengineering	5.0
JSC ASE EC	1.0
JSC TENEX	3.0
JSC Science and Innovations	6.0

In the medium term, ROSATOM plans to replicate the best practices of the incentive system implemented at JSC Atomredmetzoloto in order to encourage employee involvement in energy conservation and energy efficiency initiatives.

### 8.3.5. Financing of environmental measures

In 2017, expenditure on environmental protection totalled RUB 22.46 billion, including operating expenses totalling RUB 14.37 billion and fixed asset investment totalling RUB 8.09 billion.

Table. Distribution of environmental protection costs at ROSATOM

	Amount, RUB billion		
	2015	2016	2017
Operating expenses related to environmental protection	12.84	13.10	14.37
Fixed asset investment related to environmental protection	18.60	13.61	8.09
<b>Total</b>	<b>31.44</b>	<b>26.71</b>	<b>22.46</b>

Operating expenses related to environmental protection were allocated primarily for ensuring radiation safety (46.1%), collection and treatment of wastewater (25.4%), management of industrial and consumer waste (9.9%), protection of the atmosphere and climate change prevention (7.7%), protection and rehabilitation of land, surface water and groundwater (2.2%).

67.9% of fixed asset investment related to environmental protection was allocated for protection of the atmosphere, 28.0% for protection and efficient use of water resources, 1.6% for protection and efficient use of land and 2.5% for other measures. Investments decreased by RUB 5.5 billion year on year due to the completion of the main planned stages of construction of environmental infrastructure at power units of Leningrad NPP-2 that are under construction.

### 8.3.6. Environmental charges

In 2017, charges for the negative environmental impact totalled RUB 82.4 million, including charges for allowable emissions and discharges of pollutants, disposal of industrial and consumer waste totalling RUB 36.4 million (44.2%), and charges for excess emissions and discharges totalling RUB 46.0 million (55.8%).

The total amount of charges decreased by RUB 54.1 million compared to 2016. This is mainly due to the conversion of part of the companies' waste into solid municipal waste<sup>80</sup>, as well as recalculation of the charges taking into account the advance payments made.

<sup>79</sup> The data for 2017 on the Power Engineering Division is not comparable with the data for the previous years, because the method of calculating the indicator has changed (between 2014 and 2016, only consumption for operational needs was taken into account, while starting from 2017, total energy consumption was taken into account).

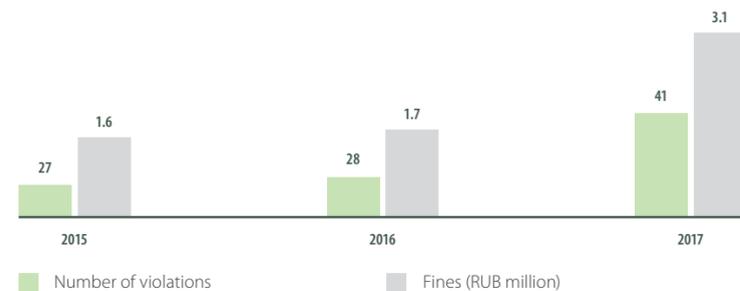
<sup>80</sup> According to paragraph 5 of Article 23 of Federal Law No. 89-FZ on Industrial and Consumer Waste: 'Charges for the negative environmental impact of solid municipal waste disposal shall be paid by solid municipal waste management operators and regional operators responsible for waste disposal'.

**Table. Charges for the negative environmental impact (environmental charges) paid by ROSATOM's organizations**

	Payment amount, RUB million		
	2015	2016	2017
<b>Charges for allowable emissions (discharges) of pollutants (disposal of industrial and consumer waste), total</b>	<b>49.8</b>	<b>77.5</b>	<b>36.4</b>
including:			
into water bodies	5.3	6.7	7.2
into the atmosphere	6.3	5.2	1.9
for disposal of industrial and consumer waste	34.9	65.6	27.3
underground formations	3.3	0.0	0.0
<b>Charges for excess emissions (discharges) of pollutants (disposal of industrial and consumer waste), total</b>	<b>74.5</b>	<b>59.0</b>	<b>46.0</b>
including:			
into water bodies	34.0	40.1	13.6
into the atmosphere	5.0	2.1	6.1
for disposal of industrial and consumer waste	35.5	16.8	26.3
underground formations	0.008	0.0	0.0
<b>Charges for allowable and excess emissions (discharges) of pollutants (disposal of industrial and consumer waste), total</b>	<b>124.3</b>	<b>136.5</b>	<b>82.4</b>

Compliance with regulatory limits on the environmental impact remains a priority for all organizations in the nuclear industry. In 2017, the amount of payments for excess emissions (discharges) of pollutants (disposal of industrial and consumer waste) decreased by 22.0% year on year mainly due to the reduction of charges for excess discharges of pollutants at JSC SCC (by RUB 26.9 million). In 2017, environmental regulators revealed 41 violations, for which they imposed administrative penalties on ROSATOM's organizations in the form of fines totalling RUB 3.1 million.

**Fig. Administrative offences in the field of environmental protection and the amount of fines**



The increase in the amount of fines and the number of violations revealed in 2017 was due to the annual tightening of regulatory requirements and closer attention of the government to environmental problems as part of the Year of the Environment in Russia. However, the violations revealed by supervisory government bodies did not pose significant threats to the population or the environment and did not necessitate restrictions on the operations of the organizations. In 2017, there were no instances of non-financial sanctions against ROSATOM's organizations for non-compliance with environmental legislation and regulatory requirements.

### 8.3.7. Water use

The nuclear industry is a large user of water. In 2017, water withdrawal from natural sources by ROSATOM's organizations made up 10.5% of the total water withdrawal in Russia. The main consumers of water among ROSATOM's organizations and enterprises are Leningrad NPP, Kola NPP and JSC SCC (87.3% of the total water withdrawal).

In the reporting year, water consumption by ROSATOM's organizations totalled 7,411.0 million m<sup>3</sup>, down by 342.8 million m<sup>3</sup> compared to 2016 (with sea water consumption down by 255.9 million m<sup>3</sup> and fresh water consumption reduced by 62.5 million m<sup>3</sup>).

### Implementation of initiatives to reduce the environmental impact on water sources in 2017

■ Kola NPP: modernization of industrial and storm water runoff treatment plants helped to reduce the content of suspended pollutants and petroleum products by 74% and 39% respectively.

■ JSC Angarsk Electrolysis Chemical Complex: creation of a recycled water supply system enabled a reduction in water consumption by 12 million m<sup>3</sup>.

■ JSC Novosibirsk Chemical Concentrate Plant: the installation of a storm water treatment system on the industrial site helped to increase the efficiency of removal of suspended particles and petroleum products from storm water to 99%.

■ FSUE RFNC VNIIEF: renovation of the wastewater drainage system and the installation of wastewater treatment facilities enabled a 75% reduction in the discharge of pollutants.

■ JSC Afrikantov OKBM: due to the modernization of local wastewater treatment facilities at the car wash, the efficiency of removal of petroleum products increased from 20 to 80%.

■ JSC SSC RIAR: the commissioning of local wastewater treatment facilities resulted in an increase in treatment efficiency to 99%, which ensured compliance of the quality of wastewater with established standards.

**Table. Total water withdrawal**

Source	Volume, million m <sup>3</sup>		
	2015	2016	2017
Sea water	5,237.6	5,317.0	5,061.1
Fresh surface water, including rivers, marshes and lakes	2,247.8	2,301.6	2,239.1
Groundwater	100.4	92.2	87.7
Rainwater	2.5	2.1	2.0
Water from third-party organizations	43.8	40.9	21.1
<b>Total</b>	<b>7,632.1</b>	<b>7,753.8</b>	<b>7,411.0</b>

**Table. Volume of recycled and reused water**

	Volume, million m <sup>3</sup>		
	2015	2016	2017
Total volume of recycled and reused water	32,807.3	34,122.2	34,159.7
Water withdrawal (% of the volume of recycled and reused water)	7,632.1 (23.2%)	7,753.8 (22.7%)	7,411.0 (21.7%)
<b>Total</b>	<b>40,439.4</b>	<b>41,876.0</b>	<b>41,570.7</b>
Share of recycled and reused water in water withdrawal	429.9%	440.1%	460.9%

The volume of water used by organizations in the nuclear industry for operational needs totalled 7,185.5 million m<sup>3</sup>, which is 318.0 million m<sup>3</sup> less than in 2016. This was mainly due to a reduction in the amount of water used at Leningrad NPP (by 264.9 million m<sup>3</sup>).

**Table. Water consumption by ROSATOM's organizations for their own needs**

Type of consumption	Volume, million m <sup>3</sup>		
	2015	2016	2017
Drinking and sanitary purposes	39.5	89.5	41.6
Operational needs	7,356.4	7,403.0	7,125.9
Other types	13.9	11.0	18.0
<b>Total</b>	<b>7,409.8</b>	<b>7,503.5</b>	<b>7,185.5</b>

### Water discharge

In 2017, total wastewater discharge in the nuclear industry decreased by 319.3 million m<sup>3</sup> compared to 2016 and amounted to 6,716.4 million m<sup>3</sup>, due to a decrease in power generation at Leningrad NPP.

Share in the total wastewater discharge:

- Clean water compliant with regulatory requirements – 98.3%;
- Treated wastewater compliant with regulatory requirements – 0.5%;
- Contaminated wastewater – 1.2%.

The main wastewater discharge destinations are seas (74.0%), lakes (18.1%) and rivers (7.6%).

In 2017, discharges of contaminated wastewater by ROSATOM's organizations accounted for 0.5% of the total volume of discharges in the Russian Federation.

**Table. Total wastewater discharge**

Water category	Volume, million m <sup>3</sup>		
	2015	2016	2017
Clean water compliant with regulatory requirements	6,775.7	6,902.6	6,600.1
Treated wastewater compliant with regulatory requirements	31.6	36.6	37.3
Contaminated wastewater	112.8	96.5	79.0
<b>Total</b>	<b>6,920.1</b>	<b>7,035.7</b>	<b>6,716.4</b>

In the reporting year, discharge of treated wastewater compliant with regulatory requirements totalled 37.3 million m<sup>3</sup>, of which 36.3% of wastewater was treated using the biological method, while wastewater treated using the physical and chemical method and the mechanical method accounted for 2.4% and 61.3% of the total volume respectively.

### 8.3.8. Pollutant emissions into the atmosphere

In 2017, pollutant emissions into the atmosphere totalled 36,400 tonnes; the pollutant capture rate reached 88.2%.

Actual pollutant emissions into the atmosphere by ROSATOM's organizations totalled 31.6% of the permitted amount. In 2017, ROSATOM's organizations accounted for 0.1% of the total emissions in the Russian Federation.

Pollutant emissions into the atmosphere decreased by 9,200 tonnes compared to 2016. The emission reduction was achieved mainly due to a more than fivefold reduction of emissions at JSC SCC (as solid fuel combustion at CHPPs was reduced).

### Implementation of initiatives to reduce the environmental impact on the atmosphere in 2017

JSC PA ECP implemented a project to modernize the cooling and conditioning system at separation facilities, including the transition from the use of Freon-12 in the refrigeration unit to ozone-safe Freon-134a. As a result, in 2017, emissions of ozone-depleting substances decreased by 0.2 tonnes compared to 2016. In addition, the operation of this equipment can significantly reduce the consumption of process water and electricity.

**Table. Pollutant emissions into the atmosphere<sup>81</sup>, kt**

	2015	2016	2017
<b>Total (excluding CO<sub>2</sub>), including:</b>	<b>46.4</b>	<b>45.6</b>	<b>36.4</b>
emissions of solid particles	15.7	16.1	12.8
NO <sub>x</sub> emissions	11.1	11.1	9.2
SO <sub>x</sub> emissions	12.6	11.4	8.6
CO emissions	4.6	4.5	3.6
carbon emissions	2.4	2.2	1.8
including: methane emissions	0.3	0.3	0.3
including: volatile organic compounds	1.3	1.5	1.2

In 2017, emissions of ozone-depleting substances into the atmosphere decreased by 4.81 tonnes compared to 2016. The decrease was achieved mainly through the implementation of projects to modernize the cooling and air conditioning systems in the fuel division.

**Table. Emissions of major ozone-depleting substances, tonnes of chlorofluorocarbon-11 equivalent**

Substance	2015	2016	2017
Dichlorodifluoromethane (Freon-12)	83.40	77.10	74.84
Chlorodifluoromethane (Freon-22)	0.85	0.74	0.47
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	3.38	3.25	0.40
Chlorotrifluoromethane (Freon-13)	164.21	164.21	164.48
<b>Total</b>	<b>251.84</b>	<b>251.24</b>	<b>246.43<sup>82</sup></b>

<sup>81</sup> Emissions of pollutants are estimated by ROSATOM's organizations using chemical methods of analysis or automatic gas analysers.

<sup>82</sup> The total amount for emissions of major ozone-depleting substances for 2017 includes 6.24 tonnes of tetrafluoromethane in chlorofluorocarbon-11 equivalent.

### 8.3.9. Industrial and consumer waste

In 2017, organizations in the nuclear industry produced 28.0 million tonnes of industrial and consumer waste, which is 447,000 tonnes less than in 2016 (28.4 million tonnes). 99.97% of generated waste is hazard class 4 and 5 waste (low-hazard and practically non-hazardous waste). In 2017, industrial and consumer waste generated by ROSATOM's organizations accounted for 0.5% of the total waste generation in Russia. Most of the waste was generated by PJSC PIMCU (22.5 million tonnes, or 80.4%; most of this waste is hazard class 5 waste, which is the least hazardous class).

The weight of waste transferred to other organizations amounted to 155,600 tonnes. 83.1% of the total amount of waste generated in ROSATOM's organizations and received from other organizations was recycled. This was mainly achieved by placing overburden in the pits of the Urtuysky brown coal strip mine at PJSC PIMCU.

Table. Industrial and consumer waste management, kt

Year	Amount at the beginning of the year	Waste generated and received during the year	Disposal and treatment of generated and received waste		Transfer to third-party organizations	Storage at enterprises	Amount at the end of the year
			Amount	%			
2015	399,256.8	27,601.0	26,187.6	94.88	1,070.2	400.3	399,401.5
2016	399,885.6	28,412.2	27,181.6	95.67	239.7	392.7	400,708.8
2017	399,497.0	27,965.1	23,229.1	83.06	155.6	58.7	404,019.0

Table. Industrial and consumer waste management in 2017 by hazard class, kt

Hazard class	Amounts of January 1, 2017	Waste generated and received in 2017	Disposal of generated and received waste		Treatment of generated and received waste		Transfer to third-party organizations	Storage at enterprises		Amounts of December 31, 2017
			kt	%	kt	%		Total	including disposal	
I	0.022	0.180	0.0003	0.017	0.00008	0.04	0.163	0.0001	0.0	0.038
II	0.055	1.178	0.00005	0.004	0.0011	0.09	1.204	0.001	0.0008	0.027
III	6.401	5.667	0.061	1.08	0.042	0.74	6.659	0.065	0.060	5.246
IV	15.027	83.323	17.549	21.06	1.361	1.63	60.121	10.289	8.812	9.042
V	399,475.511	27,874.722	23,210.05	83.27	0.000	0.0	87.475	48.375	47.528	404,004.620
<b>Total</b>	<b>399,497.016</b>	<b>27,965.070</b>	<b>23,227.660</b>	<b>83.06</b>	<b>1.404</b>	<b>0.01</b>	<b>155.622</b>	<b>58.729</b>	<b>56.401</b>	<b>404,018.973</b>

### 8.3.10. Rehabilitation of disturbed areas

By the end of 2017, the area of land disturbed by ROSATOM's organizations totalled 5,100 ha (5,600 ha in 2016 and 5,500 ha in 2015).

This included land disturbed during the following operations:

- Mining: 3,000 ha;
- Construction: 2,000 ha;
- Disposal of industrial waste (including construction waste) and solid household waste: 5.7 ha;
- Survey work: 4.6 ha;
- Other operations: 96.9 ha.

In 2017, ROSATOM's organizations implemented a set of measures to restore the productivity and economic value of disturbed land and improve the environment. In the reporting year, the area of restored land totalled 59.83 ha.

Table. Area of restored land, ha per year

Organization	2015	2016	2017
PJSC PIMCU	0.038	0.00	0.00
JSC SCC	52.60	12.75	9.60
PJSC NCCP	0.68	0.00	0.00
Rostov NPP	15.5	0.00	0.00
JSC SSC RIAR	0.00	0.00	0.00
JSC ASE EC	29.42	0.00	0.00
JSC Lunnoye	0.00	80.60	47.60
Siberian Territorial District Branch of FSUE RosRAO	20.15	0.00	0.00
FSUE Elektrokhimpribor Integrated Plant	4.26	0.12	0.05
FSUE Russian Federal Nuclear Centre – E. I. Zababakhin All-Russian Research Institute of Technical Physics (RFNC-VNIITF)	0.00	0.00	2.46
FSUE M.V. Protsenko FRDC Start PA	0.43	0.00	0.00
FSUE PA Sever	0.00	0.00	0.02
FSUE RFNC VNIIEF	0.00	0.00	0.10
<b>Total</b>	<b>123.08</b>	<b>93.47</b>	<b>59.83</b>

### 8.3.11. Rehabilitation of contaminated territories

As of December 31, 2017, 18 nuclear organizations had areas contaminated with radionuclides. Their area totalled 113.19 km<sup>2</sup>, including:

- 24.7 km<sup>2</sup> at industrial sites;
- 88.07 km<sup>2</sup> in buffer areas;
- 0.42 km<sup>2</sup> in monitored areas.

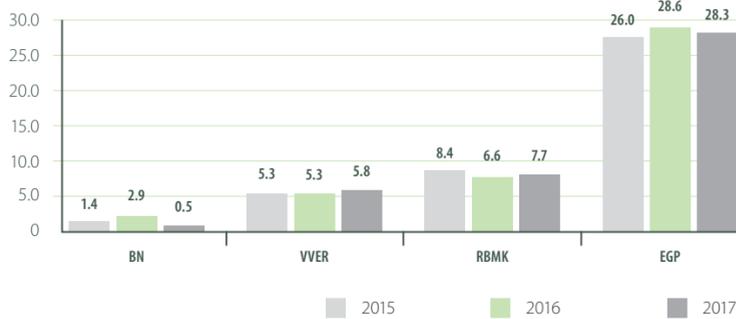
The main sources of radioactive contamination include nuclides of caesium-137, strontium-90 and natural uranium and its decay products. About 77% (77.15 km<sup>2</sup>) of areas contaminated with radionuclides are located in the vicinity of FSUE Mayak Production Association (they were contaminated during the accident in 1957).

Over the last five years, 4.42 km<sup>2</sup> of contaminated areas were rehabilitated.

### 8.3.12. Emissions and discharges of radionuclides

In 2017, radiation burden on the environment was almost unchanged compared to the previous year. The total activity of radionuclides emitted into the atmosphere by ROSATOM's enterprises amounted to 4.78·10<sup>16</sup> Bq. Emissions of beta-emitting nuclides accounted for 99.06% of the total activity (4.74·10<sup>16</sup> Bq), with the share of inert radioactive gases reaching 96.74% (4.58·10<sup>16</sup> Bq), while the share of tritium totalled 2.98%. Emissions of beta-emitting nuclides increased by 1.90% year on year.

Fig. Changes in emissions of inert radioactive gases into the atmosphere by type of nuclear reactors, % of permitted amount



Radon-222 produced by uranium mining enterprises accounts for 96.82% of emissions of alpha-emitting radionuclides (4.51·10<sup>14</sup> Bq). Emissions of alpha-emitting nuclides decreased by 11.90% year on year.

Overall across the industry, emissions of alpha-emitting and beta-emitting nuclides totalled 21.82% and 2.43% of the permitted volume respectively. Emissions of cobalt-60, strontium-90, zirconium-95, ruthenium-103 and ruthenium-106, iodine-131, caesium-134 and caesium-137 across the industry total less than 1.5% of the permitted amount.

Table. Ratio between actual and permitted emission of radionuclides by organizations and enterprises in the industry in 2017, Bq

Type of radionuclides	Permitted emission	Actual emission
Alpha-emitting	2.07·10 <sup>15</sup>	4.51·10 <sup>14</sup>
Beta-emitting	1.95·10 <sup>18</sup>	4.74·10 <sup>16</sup>

Enterprises in the industry discharged 227.42 million m<sup>3</sup> of wastewater with the activity of 4.87·10<sup>13</sup> Bq into surface water bodies. Wastewater discharge decreased by 33.17% compared to 2016, while the total activity increased by 16.23% due to an increase in the duration of tests at the test facilities of FSUE A.P. Alexandrov Research Institute of Technology.

Natural radionuclides accounted for 71.20% of the total amount of alpha-emitting radionuclides (2.41·10<sup>19</sup> Bq) discharged into an open drainage system.

Tritium accounted for 99.58% of the amount of beta-emitting radionuclides (4.87·10<sup>13</sup> Bq) discharged with wastewater into surface water bodies. The remaining radionuclides account for 0.42%, with strontium-90 and caesium-137 accounting for 0.31% and 0.02% of the total amount respectively.

Overall, the amount of radionuclides discharged with wastewater into an open drainage system totalled about 22.31% of the statutory limit for alpha-emitting nuclides and 0.22% of the limit for beta-emitting nuclides.

Table. Ratio between actual and permitted discharge of radionuclides by organizations and enterprises in the industry in 2017, Bq

Type of radionuclides	Permitted discharge	Actual discharge
Alpha-emitting	1.08·10 <sup>11</sup>	2.41·10 <sup>10</sup>
Beta-emitting	2.17·10 <sup>16</sup>	4.87·10 <sup>15</sup>

### 8.3.13. Radiation impact on the population and the environment

Emissions from nuclear power plants result in negligible radiation exposure of the population in the areas where the nuclear power plants 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 of NPPs by the regional departments of the FMBA, in 2017, as in previous years, the radiation risk for the population living in the areas where NPPs are located did not exceed the limits set in the NRB-99/2009 Radiation Safety Standards. Radiation risk is within the limits of unconditionally acceptable risk, i.e. it does not exceed 10<sup>-6</sup> instances of occurrence of stochastic effects per year. The average individual exposure of the population does not exceed the minimum significant dose equal to 10 μSv per year.

The gamma radiation dose (background radiation) in buffer areas and observation areas of NPPs is monitored by automated radiation monitoring systems and portable radiation monitoring devices that have undergone calibration certification.

The analysis of data on the gamma radiation dose rate in the areas shows that the gamma radiation doses in buffer and protected 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.

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 the monitored areas, as well as in fish and other aquatic organisms living in cooling ponds of NPPs. We monitor the specific activity of dose-forming radionuclides 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 Environmental 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

### Contribution to the conservation of biodiversity

JSC TENEX, an organization of ROSATOM, is involved in a programme implemented under the patronage of the President of the Russian Federation to preserve rare and endangered species of animals. Funds are allocated annually for projects to upgrade the infrastructure of national reserves and parks, develop protected areas and conduct research on the genetics and behaviour of unique animals.

In 2017, the work was continued to upgrade the infrastructure of the Lazovsky Nature Reserve, the Zov Tigra National Park and the Sikhote-Alin Nature Reserve.

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.

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 decrease (e.g. in the 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 technical 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 spend 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.

### 8.3.14. Forecast for the environmental impact of ROSATOM and its organizations and plans for changing the impact and ensuring environmental safety in 2018 and the medium term

ROSATOM attaches great importance to environmental safety and environmental protection. One of the top priorities of ROSATOM and its organizations is to minimize their negative environmental impact. ROSATOM's organizations carry out large-scale upgrades and overhaul of gas scrubbing and wastewater treatment equipment every year; reused and recycled water supply systems are commissioned. The implementation of the Environmental Policy and introduction of innovative environmental technologies at nuclear facilities have made it possible to achieve a high level of environmental safety in the industry and reduce its negative environmental impact.

Discharge of contaminated wastewater in the nuclear industry decreases every year. This trend is forecast to continue through 2020. The reduction is due to plans of ROSATOM's organizations to put new wastewater treatment facilities into operation and renovate the existing ones.

Like in previous years, emissions of pollutants into the atmosphere from stationary sources in the industry are expected to be reduced through the renovation of existing and installation of new dust collectors and gas scrubbers.

Implementation of the project to upgrade the cooling and air conditioning system of the separation facilities at JSC Production Association Electrochemical Plant has helped to reduce emissions of ozone-depleting substances. Emissions of ozone-depleting substances are forecast to further decrease slightly by 2020.

The generation of industrial and consumer waste by organizations in the industry is driven by production cycles and the manufacture of new products. In the medium term, the generation of industrial and consumer waste is expected to remain at the current levels. The bulk (99.7%) of waste is made up of overburden and enclosing rocks mined during the extraction of non-metallic minerals and is classified as hazard class 5 waste which is subject to further disposal (use). By 2020, the amount of waste used by ROSATOM will remain at the level of 2017. As for the most hazardous waste, the current trend in its generation is forecast to continue until 2019.

# 9.0. Partnership for Sustainable Development

Key results in 2017:

- 15 integrated annual reports were prepared (for 2016).
- 6 reports were prepared in accordance with the Global Reporting Initiative Sustainability Reporting Standards (GRI SRS), with 3 reports prepared in accordance with the Comprehensive option.
- 6 and 34 awards were won in Russian and international report contests respectively.

## 9.1. Public Reporting System

Since 2009, ROSATOM has been developing a public reporting system whereby the Corporation and its organizations prepare 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 reports<sup>83</sup>. 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 AA1000 AccountAbility Principles Standard. They provide the basis for the Uniform Industry-Wide Public Reporting Policy and the Public Reporting Standard of ROSATOM and Its Organizations<sup>84</sup>. In 2017, 15 integrated annual reports were published in the industry. Their preparation included a set of stakeholder engagement measures (opinion polls, questionnaire surveys, dialogues and public assurance procedures) aimed at identifying material aspects to be disclosed in the reports and increasing their usefulness for users.

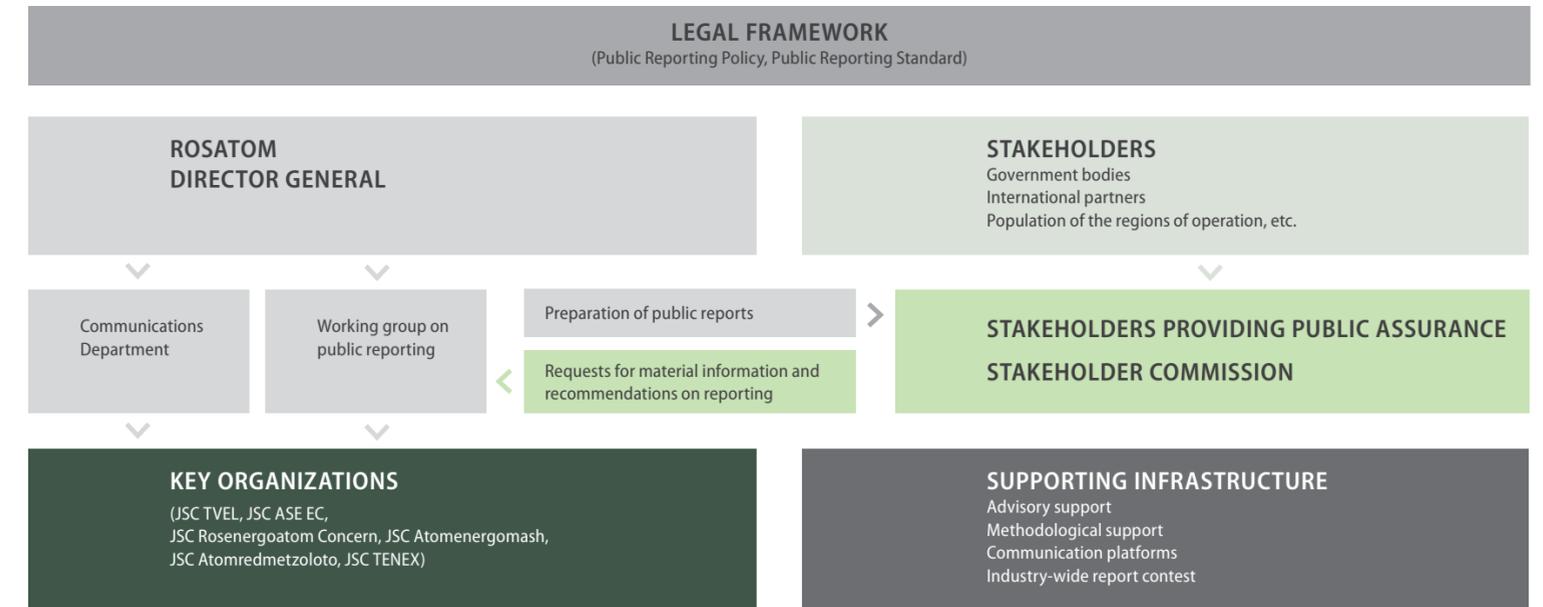
The overall goal of public reporting in the Russian nuclear industry is to improve ROSATOM's openness and transparency, strengthen its image and business reputation, make it more competitive and provide information support for the promotion of its products and services both in Russia and abroad.

In 2017, ROSATOM's representatives participated in the work of the Interdepartmental Working Group supporting the implementation of the action plan to implement the Conceptual Framework for the Development of Public Non-Financial Reporting in Russia. The key outcome of its work was the draft Federal Law on Public Non-Financial Reporting.

<sup>83</sup> <http://www.rosatom.ru/social-respons/environmental-management>.

<sup>84</sup> <http://www.rosatom.ru/about/publichnaya-otchetnost>.

### Public Reporting System



### Reporting structure of ROSATOM and its organizations

#### ROSATOM

Report to the Russian Government



Public report for a wide range of stakeholders



#### Reports of organizations and enterprises

Reports of JSCs (including key organizations)



#### Environmental reports



### 9.1.1. Awards in national and international rankings and contests

In 2017, the reports of four organizations in the nuclear industry, including ROSATOM, were awarded 5 stars (the highest quality of annual reports) in the ranking of annual reports compiled by RAEX Agency (Expert RA).

Five organizations, including ROSATOM, were ranked in the top 10 in the annual corporate transparency ranking of the largest Russian companies compiled by the Russian Regional Integrated Reporting Net-work.

In 2017, the reports of the Corporation and its organizations won 6 awards in national annual report contests and 34 awards in international contests.

Overall, since the introduction of the public reporting system in the industry, Russian nuclear organizations have won 180 awards in various Russian and international contests.

In the annual contest of annual reports held by the Expert RA international rating agency, ROSATOM won a prize in the Best Annual Report (Non-Financial Sector) category, while JSC ASE EC won a prize in the Best Integrated Annual Report category.

### 9.1.2. Industry-wide contest of public reports of ROSATOM's organizations

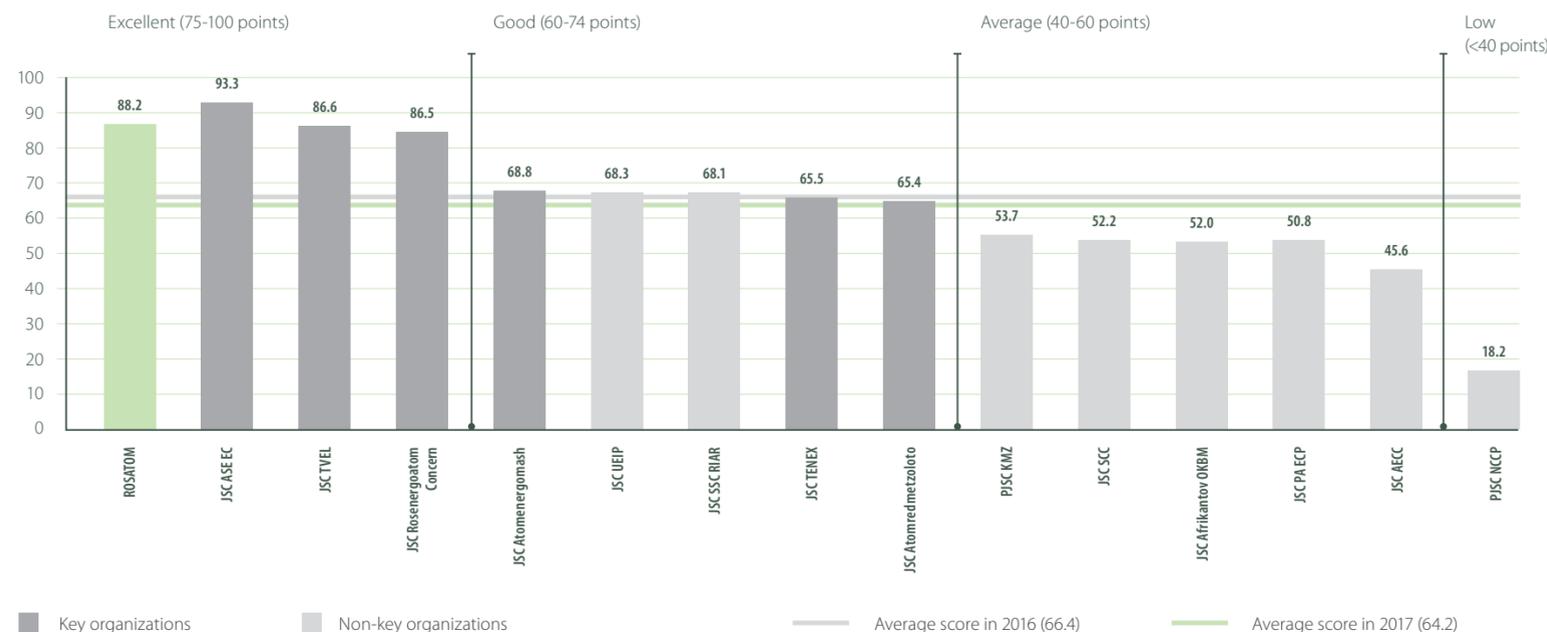
The annual contest of annual reports is an important mechanism for ensuring the quality of reporting in the industry. It covers ~100 organizations divided into several groups with different assessment criteria. The reports are assessed by an independent panel comprising experts in reporting and sustainable development (including ecology).

In 2017, the eighth industry-wide contest was held. The following companies won in the main categories:

- JSC ASE EC in the Best Public Annual Report of ROSATOM's Division and Efficiency of Public Reporting categories;
- JSC UEIP in the Best Public Annual Report of an Organization of ROSATOM's Division category;
- JSC N.A. Dollezhal Research and Development Institute of Power Engineering in the Best Public Annual Report of ROSATOM's Enterprise category.

JSC Rosenergoatom Concern won in the Best Public Annual Report according to Stakeholders category. JSC SSC RIAR was awarded a special certificate 'For Constructive Communication with Various Stakeholder Groups'.

Overall ranking of reports for 2016



## 9.2. 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 2017 report.

In order to improve the transparency and accountability at ROSATOM and to meet the requirements of international standards, during the preparation of the Report, ROSATOM held two dialogues with stakeholders (a discussion on the priority subject of the Report, ROSATOM's Contribution to Sustainable Devel-

opment, on March 30, 2018 in Moscow and Public Consultations on the Draft Report on May 31, 2018 in Moscow). In addition, ROSATOM conducted a special questionnaire survey to identify material aspects of the Corporation's business to be reflected in the Report (see Appendix 1 'Report Profile and the Process of Determining the Report Content and Materiality of Information').

In the course of discussion, stakeholder representatives voiced their requests and provided recommendations as to what information should be disclosed in the annual report, and put forward proposals for developing the public reporting system (minutes of the dialogues are available on the corporate website)<sup>85</sup>.

<sup>85</sup> <http://www.rosatom.ru/about/publichnaya-otchetnost/>.

## 9.3. Incorporation of Stakeholders' Proposals

Table. Fulfilment of obligations assumed by ROSATOM during the preparation of the 2016 report

Stakeholders' requests and proposals	Fulfilment of obligations by ROSATOM
To align the wording of ROSATOM's strategic goals with the UN Sustainable Development Goals.	Incorporated in the section 'Sustainable Development Agenda'.
To disclose the information on how ROSATOM is going to optimize and control the duration of NPP construction abroad.	Partly incorporated in the section 'Engineering Division'.
To revise the typology of products shown on the 'map of new products'.	Incorporated in the section 'Business Diversification'.
To calculate the reduction in the Corporation's impact on the climate ('carbon footprint') and disclose it in the report.	The proposal was submitted to specialized divisions of ROSATOM responsible for environmental impact assessment and is being reviewed.
To disclose information on the reduction of carbon dioxide emissions in the report.	The proposal was submitted to specialized divisions of ROSATOM responsible for environmental impact assessment and is being reviewed.
To disclose information on personnel development programmes in the report.	Incorporated in the section 'Implementation of the HR Policy'.
To disclose information on ROSATOM's demand for experts in specific areas of training with a forecast for 5 to 10 years in the report.	Partly incorporated in the section 'Implementation of the HR Policy'.
To disclose information on international and governmental awards and prizes received by ROSATOM's employees in the reporting year.	Incorporated in the section 'Implementation of the HR Policy'.
To disclose information on ROSATOM's involvement in investment in external research and development projects, including university projects.	Partly incorporated in the section 'Research and Innovations'.

Table. Incorporation of stakeholders' main proposals voiced during the preparation of the 2017 Report

Stakeholders' requests and proposals	ROSATOM's response
To single out Sustainable Development Goals that are most important to ROSATOM.	Incorporated in the section 'Sustainable Development Agenda'.
To add information on the closed nuclear fuel cycle as a contribution to the achievement of UN Sustainable Development Goal 12 ('Responsible Consumption and Production').	Incorporated in the section 'Sustainable Development Agenda'.
To add UN Sustainable Development Goal 4 ('Quality Education') in the list of ROSATOM's priorities.	Incorporated in the section 'Sustainable Development Agenda'.
To disclose information on social partnership mechanisms in ROSATOM's reports; to highlight the importance of cooperation with the industry trade union.	Incorporated in the section 'Implementation of the HR Policy'.
To include in the report information on ROSATOM's contribution to the development of the civil society in Russia, including information on the formation of a network of public experts in ROSATOM's regions of operation.	Incorporated in the section 'Developing the Regions of Operation'.
To disclose information on the demand of ROSATOM's organizations for university graduates of various specialisms in the medium and long term.	Incorporated in the section 'Implementation of the HR Policy'.
To specify the countries of origin of main rival companies.	Incorporated in the section 'Markets served by ROSATOM'.

In addition, during the dialogue on the priority subject of the report, stakeholder representatives made a number of suggestions and recommendations on the development of ROSATOM's Sustainable Development Agenda. These suggestions and recommendations will also be considered by ROSATOM as part of the work on the Agenda.

Table. ROSATOM's obligations to incorporate proposals voiced during the preparation of the 2017 report

Stakeholders' proposals	ROSATOM's obligations
To provide statistics on third-party injuries at ROSATOM's enterprises.	The proposal will be considered during the preparation of the concept of the 2018 report.
To provide a table on human resources with a breakdown by gender and age and information on gender equality (including prevention of workplace harassment) in the section on labour relations.	The proposal will be considered during the preparation of the concept of the 2018 report.
To reflect ROSATOM's role in Russia's technological development and establishment of high-technology centres in universities.	The proposal will be incorporated in the report for 2018.
To add a comparison of nuclear power generation with wind and solar power generation to the report.	The proposal will be considered during the preparation of the concept of the 2018 report.
To disclose ROSATOM's strategy on scientific research.	The proposal will be considered during the preparation of the concept of the 2018 report.
To develop indicators for information disclosure on the quality of life in order to enable an assessment of the Corporation's contribution to its improvement (through the introduction of new technologies and innovations, etc.).	The proposal will be considered during the preparation of the concept of the 2018 report.
To give more focus to the market overview, including not only the current situation and market shares of major players, but also market analysis and forecasts.	The proposal will be considered during the preparation of the concept of the 2018 report.
To add more information on the 'green square' concept in the energy industry.	The possibility of providing detailed information will be considered during the preparation of the concept of the 2018 report.
To participate in the sustainable development competition organized by the UN, with a focus on the public reporting system.	ROSATOM will consider participating in the competition.
To reflect climate risks in financial statements.	The proposal will be considered in 2019.

## 9.4. Statement of Public Assurance

### Background

ROSATOM has suggested that we assess the report on the performance of State Atomic Energy Corporation Rosatom in 2017 (the Report). To do so, we and our representatives were offered an opportunity to participate in a dialogue with stakeholders on the priority subject of the Report, ROSATOM's Contribution to Sustainable Development (Moscow, March 30, 2018), and in public consultations on the draft Report (Moscow, May 31, 2018). We also participated in the determination of material topics to be disclosed in 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 a comparative analysis of two versions of the Report (the draft Report for public consultations and the final version of the Report), materials provided to us following the dialogues (minutes of the dialogues and tables reflecting the incorporation of stakeholders' proposals) and the feedback provided by ROSATOM's management and employees during public assurance of the Report.

We received no remuneration from the Corporation 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 business development. Through a detailed examination of the Corporation's business model, the Report clearly presents the complex value chain, the Corporation's governance system, strategic goals and management approaches, its 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 AA1000 AccountAbility Principles 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) and ROSATOM's Uniform Industry-Wide Public Reporting Policy and Public Reporting Standard.

### Materiality of information

To incorporate stakeholders' requests as fully as possible, ROSATOM 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 priority subject of the Report, ROSATOM's Contribution to Sustainable Development, was selected appropriately since this topic was of the greatest interest to stakeholders in the reporting year. This was due to an update to the sustainable development agenda on global, national and corporate levels.

### 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.

### Responding to stakeholders' requests and proposals

At the request of stakeholders' representatives, the final version of the Report was updated and supplemented with additional information (or substantiated explanations were provided as to why the requested information could not be disclosed). Chapter 9 of the Report provides information on the incorporation of stakeholders' main proposals voiced during the preparation of the 2017 report, as well as ROSATOM's obligations to consider and incorporate stakeholders' comments during the preparation of the 2018 report.

To summarize, we would like to point out that in recent years ROSATOM has made significant progress in public reporting and, as a result, continues to improve its transparency and, consequently, the 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 provide information on the contribution of its business in this area, including the achievement of the 2030 Sustainable Development Goals set by the United Nations.

### Persons who took part in the public assurance of ROSATOM's public annual report for 2017

#### 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

#### Marina Vashukova

Executive Director of the Association National Network of the Global Compact

#### Alexey Dmitrienko

Member of the Council of the Federation Committee on Economic Policy

#### Alexander Makarenko

Executive Director of the Association of CATFs in the Nuclear Industry

#### Denis Moskvina

Deputy of the State Duma of the Russian Federation, member of the Committee on Economic Policy, Industry, Innovative Development and Entrepreneurship

#### Vladimir Ognev

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

#### Gennady Sklyar

Deputy of the State Duma of the Russian Federation, member of the 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

# Appendices

## Appendix 1. Report Profile and the Process of Determining the Report Content and Materiality of Information

The Public Annual Report of State Atomic Energy Corporation Rosatom for 2017 (the Report) 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 environment;
- The approach of ROSATOM's executives to managing various business aspects.

The Report focuses on ROSATOM's contribution to sustainable development; this topic has been selected 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 July 2017. The Report covers the Corporation's operations during the period from January 1, 2017 through December 31, 2017.

### Standards and regulatory requirements

The Report has been prepared in accordance with:

- 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)<sup>86</sup>;
- AccountAbility's AA1000 Series of Standards;
- 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. To identify material aspects to be disclosed in the Report, a poll was carried out and two dialogues with stakeholders were held, including public consultations on the draft Report. The Report incorporates key requests voiced by stakeholder representatives during these dialogues (see the section 'Incorporation of Stakeholders' Proposals').

### Verification of reporting information

The reporting information was certified as reliable by:

- The Auditing Commission of ROSATOM (see Appendix 2);

- 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 APS principles (see Appendix 4).

ROSATOM's Internal Audit Department conducted an internal audit of the business process 'Public Reporting Procedure in ROSATOM' (see Appendix 3). 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. Information on the operations of the Nuclear Weapons Division is not disclosed in full due to the special nature of ROSATOM's business and its obligation to keep the state secret.

The Report covers several scopes of consolidation (the list of organizations within various scopes of consolidation is provided on the corporate website<sup>87</sup>). Integrated performance indicators are disclosed for the Corporation's organizations within the scope of budget consolidation as of December 31, 2017 (174 organizations)<sup>88</sup>. 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 environmental protection in statistical reporting forms (117 organizations). Financial and economic indicators in the section 'Financial and Economic Results' are disclosed for organizations included in the scope of ROSATOM's consolidated IFRS financial statements (195 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.

### 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 2017 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.

<sup>86</sup> The GRI content index and information on correspondence to the RSPP basic performance indicators are available on the Corporation's website at <http://www.rosatom.ru/about/publicchnaya-otchetnost/>.

<sup>87</sup> <http://www.rosatom.ru/about/publicchnaya-otchetnost/>.

<sup>88</sup> Hereinafter, not including State Atomic Energy Corporation Rosatom.

The materiality of information was determined through the following process:

- A working group compiled a list of material topics related to ROSATOM's operations;
- 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);
- Following the 'two-stage filtering', a list of material topics to be disclosed in the Report was compiled.

**Table. Ranking map of material topics to be disclosed in the Report<sup>89</sup>**

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>Outcomes of implementation of ROSATOM's strategy and contribution of performance in the reporting year to the achievement of strategic goals.</p> <p>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.</p>	<p>ROSATOM's performance in the sphere of international business and international cooperation.</p> <p>Ensuring nuclear and radiation safety during the operation of nuclear facilities (including international cooperation in this sphere) (GRI 416: Customer Health and Safety).</p> <p>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>Financial and economic performance of ROSATOM (GRI 201: Economic Performance).</p> <p>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>Radiation impact on the environment (including on biodiversity) (GRI 304: Biodiversity, GRI 305: Emissions, GRI 306: Effluents and Waste).</p> <p>Implementation of ROSATOM's Innovative Development Programme.</p> <p>Key business risks and opportunities.</p> <p>ROSATOM's performance in the sphere of business diversification (nuclear medicine, environmental protection, inspection systems and irradiation centres; non-nuclear mechanical engineering; NPP servicing, etc.).</p>	<p>Performance of ROSATOM's Divisions.</p> <p>Implementation of the Proryv project and the outcomes of the development of a new technological platform and transition to a closed nuclear fuel cycle in the nuclear power industry.</p> <p>RAW and SNF management (including the development of an integrated national system for radioactive waste management) and addressing 'nuclear legacy' issues.</p> <p>Implementation of international research and innovative projects.</p> <p>Environmental measures and expenses and their efficiency (GRI 307: Environmental Compliance).</p> <p>Financial management and implementation of ROSATOM's investment programme.</p> <p>ROSATOM's impact on local communities (social programmes, philanthropy) (GRI 413: Local Communities).</p> <p>Compliance of ROSATOM's organizations with national and international environmental and technical standards (GRI 307: Environmental Compliance).</p> <p>Emissions, waste and effluents (GRI 305: Emissions, GRI 306: Effluents and Waste).</p>	<p>Information security in ROSATOM.</p> <p>Career and performance management (equal opportunities, training and development, talent pool, assessment systems) (GRI 404: Training and Education).</p> <p>Performance of ROSATOM's Production System (RPS).</p> <p>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>Communication projects aimed at increasing employee engagement, recognition and motivation.</p> <p>Industry media coverage.</p>

<sup>89</sup> The map has been prepared based on the findings of a questionnaire survey conducted among internal and external stakeholders of ROSATOM in December 2017. 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).

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)
		<p>Performance of the nuclear-powered icebreaker fleet.</p> <p>Emergency preparedness.</p> <p>ROSATOM's contribution to the development of the digital economy in Russia.</p> <p>Management of disturbed and contaminated areas.</p> <p>Prevention of corruption and other offences (GRI 205: Anti-corruption).</p> <p>Occupational health and safety (including injury rates) (GRI 403: Occupational Health and Safety).</p> <p>Environmental stewardship (energy efficiency) (GRI 302: Energy, GRI 303: Water).</p> <p>Performance of government functions by ROSATOM: law drafting, implementation of federal target programmes and government programmes, provision of public services (GRI 415: Public Policy).</p> <p>ROSATOM's knowledge management system and protection of ROSATOM's intellectual property.</p> <p>Procurement management (including sustainability requirements for suppliers and contractors and measures to prevent unfair competition) (GRI 204: Procurement Practices).</p> <p>Outcomes of import substitution initiatives.</p> <p>Development of closed administrative and territorial formations (CATFs) and areas where NPPs are located.</p> <p>Implementation of the social policy with regard to employees (GRI 401: Employment), as well as personal charity work and volunteering.</p> <p>Cooperation with universities and recruitment of young professionals.</p> <p>Communication projects (nuclear energy information centres, online communication, the Forsazh forum, etc.).</p> <p>Performance of the Nuclear Weapons Division (civilian part).</p> <p>Key personnel characteristics (including staff costs).</p> <p>Improvement of corporate governance mechanisms, including the implementation of the Corporate Governance Code recommended by the Bank of Russia.</p> <p>Work of ROSATOM's Public Council.</p>	

#### 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. Extract from the report of the Auditing Commission on financial and business operations of State Atomic Energy Corporation Rosatom and its organizations for 2017

### Extract from the report of the Auditing Commission on the findings of the audit of financial and business operations of State Atomic Energy Corporation Rosatom (ROSATOM) for 2017

Moscow

May 4, 2018

#### The audit has been performed by the Auditing Commission comprising the following persons:

R.E. Artyukhin, Chairman of the Commission, Head of the Federal Treasury; members of the Commission:

A.A. 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;

V.S. Katrenko, Auditor of the Accounts Chamber of the Russian Federation;

A.V. Rozhnov, Deputy Head of the 12th Main Department of the Ministry of Defence of the Russian Federation;

V.K. Utkin, Office Head of the Department for the Defence Industry of the Government of the Russian Federation;

The Auditing Commission performed the audit pursuant to article 31 of Federal Law No. 317-FZ on State Atomic Energy Corporation Rosatom dated December 1, 2007 (hereinafter referred to as Federal Law No. 317-FZ) and the Regulations on the Auditing Commission of State Atomic Energy Corporation Rosatom approved by the Supervisory Board of ROSATOM (minutes No. 1 dated December 26, 2007 (as amended by minutes No. 18 dated May 27, 2010, minutes No. 53 dated September 25, 2013 and minutes No. 92 dated March 3, 2017).

Period of the audit: from April 9, 2018 through May 4, 2018.

### IX. Recommendations to the Supervisory Board and the Management Board of ROSATOM:

1. To enhance control over the intended use of special reserve funds and compliance in the course of execution of documents providing the rationale for the use of special reserve funds.

2. To establish the procedure for providing appropriate substantiation of a professional judgement on depreciation to zero roubles and for the verification of the professional judgement (determining the level of executives authorized to make the relevant decision); to carry out an additional review of the list of social facilities in order to exclude the security post from the list, and to provide a more detailed description of approaches to estimating the book value of these facilities under IFRS; to revise the method used for preparing consolidated IFRS financial statements in terms of rules on the impairment of assets (fixed assets and construction in progress).

3. To continue to monitor the status of accounts receivable under government contracts and impose penalties in a timely manner on contractors (suppliers) under government contracts if contractual obligations are not fulfilled on time and/or properly.

4. To inform the Chairman of ROSATOM's Supervisory Board of every instance when the Management Board of ROSATOM determines the position of a shareholder (member) of ROSATOM in governing bodies of business entities and other organizations in which ROSATOM is a shareholder (member) when they make a decision on voluntary dissolution of the said legal entities.

5. To amend the procedure for cooperation between ROSATOM's business units when receiving subsidies for the exercise of governmental authorities assigned to ROSATOM (order No. 1/725-P dated August 1, 2017) by adding rules for the allocation of funds from various sources of financing (ROSATOM's own funds, the federal budget) for the maintenance of private institutions.

Attachment: certificate on 67 pages in 1 copy.

Chairman of the Auditing Commission	/signature/	R.E. Artyukhin
Members of the Auditing Commission:	/signature/	A.A. Lipaev
	/signature/	V.S. Katrenko
	/signature/	A.V. Rozhnov
	/signature/	V.K. Utkin

## Appendix 3. 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 2018 signed off by the Chief Executive Officer of ROSATOM and approved 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.

On the whole, the business process 'Public Reporting Procedure in ROSATOM' complies with applicable legislation, international standards and internal regulatory requirements for public reporting. At the same time, the auditors would like to point out that the system for monitoring the completeness, accuracy and timeliness of information provided for the report needs to be improved by increasing the responsibility of executives of ROSATOM's business units for the quality and reliability of provided information.

Head of the Auditors' Group

I.S. Savushkina

Member of the Auditors' Group

A.P. Ivanova

# Appendix 4. Independent auditor's report on non-financial reports 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 nature and level of State Atomic Energy Corporation Rosatom (hereinafter referred to as ROSATOM) compliance with the principles of the AA1000 Accountability Principle Standard 2008 (hereinafter referred to as AA1000 APS 2008) in the process of stakeholder engagement in sustainability activities as well as compliance of the accompanying State Atomic Energy Corporation Rosatom Public Annual Report 2017 (hereinafter referred to as the Report) 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 the AA1000 APS 2008 in the process of stakeholder engagement in sustainability activities as well as 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 Code of Ethics for Professional Accountants 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 nature and level of ROSATOM compliance with the principles of the AA1000 APS 2008 in the process of stakeholder engagement in sustainability activities as well as compliance of the Report 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 complies with the principles of the AA1000 APS 2008 in the process of stakeholder engagement in sustainability activities 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):

- Nature and level of ROSATOM compliance with the principles of the AA1000 Accountability Principle Standard 2008 – inclusivity, materiality, responsiveness – in the process of stakeholder engagement in sustainability activities.

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.

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- 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.

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 procedures:

- Study and selective testing of systems and processes implemented by ROSATOM to ensure and analyze the compliance of the activities with AA1000APS 2008 principles; collection of evidence confirming practical implementation of these principles.
- Interviewing the management and employees of ROSATOM and obtaining documentary evidence;
- Study of minutes of public dialogues;
- Study of information available on the ROSATOM website 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 non-financial 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 2017.

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". In respect to the quantitative performance indicators the conformity assessment 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 action relating to the future; as well as statements based on expert opinion.

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 ROSATOM adherence to the principles of the AA1000 APS 2008 as well as about compliance of the Report, in all material respects, with the Criteria.

### Limited Assurance Conclusion

#### **Nature and extent of compliance of ROSATOM with AA1000 APS 2008 principles**

Based on the procedures performed and evidence obtained, nothing has come to our attention that causes us to believe that ROSATOM stakeholder engagement in sustainability activities has not complied, in all material aspects, with the criteria of AA1000APS 2008 in respect to adherence of ROSATOM to the principles (Inclusivity, Materiality, and Responsiveness).

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.

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**Compliance of the Report with the GRI Sustainability Reporting Standards (Core option)**

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 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**

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.

**Recommendations**

Based on the results of the limited assurance engagement we recommend:

- Increase the extent of disclosure of indicators in relation to which requirements of GRI Standards are not fully taken into account (disclosures with omissions).
- 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 is not intended to detract from the practitioner's conclusion. Our conclusion is not modified in respect of the matters referred to in the recommendations.



FBK, LLC

Practitioner  
 Partner

acting under Power of Attorney No. 101/17 of October 2, 2017  
 The Russian Federation, Moscow, November 8, 2018

  
 V.Y. Skobarev

# List of Abbreviations

ARMS	automated radiation monitoring system	LLW	low-level waste
CATF	closed administrative and territorial formation	LRW	liquid radioactive waste
CIS	Commonwealth of Independent States	LTOP	Long-Term Operational Programme of ROSATOM
CNFC	closed nuclear fuel cycle	NF	nuclear facility
CRMS	corporate risk management system	NFA	nuclear fuel assembly
EUP	enriched uranium product	NFC	nuclear fuel cycle
EurAsEC	Eurasian Economic Community	NFE	nuclear fuel element
FAIR	Facility for Antiproton and Ion Research (FAIR)	NPP	nuclear power plant
FMBA	Federal Biomedical Agency	NRS	nuclear and radiation safety
FTP	federal target programme	NS	nuclear submarine
GC	gas centrifuge	NWD	Nuclear Weapons Division
HCS	harmful chemical substances	OECD NEA	Nuclear Energy Agency of the Organization for Economic Cooperation and Development
HEU	highly enriched uranium	R&D	research and development
HLW	high-level waste	RAW	radioactive waste
IAEA	International Atomic Energy Agency	RBMK	high-power channel-type reactor
IGA	intergovernmental agreement	ROSATOM, Corporation	State Atomic Energy Corporation Rosatom
ILW	intermediate level waste	Rostekhnadzor	Federal Service for Environmental, Technological and Nuclear Supervision
INES	International Nuclear Event Scale (INES)	RR	research reactor
INPRO	International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO)	RSPP	Russian Union of Industrialists and Entrepreneurs
INS RAW	Integrated National System for Radioactive Waste Management	RTG	radioisotope thermoelectric generator
INS SNF	Integrated National System for Spent Nuclear Fuel Management	Russia	Russian Federation
IP	intellectual property	SNF	spent nuclear fuel
IRAW	individual risk assessment workstation	SRW	solid radioactive waste
ISRS	Integrated Standardized Remuneration System	SWU	separative work unit
ITER	International Thermonuclear Experimental Reactor (ITER)	UN	United Nations
IUEC	International Uranium Enrichment Centre	WANO	World Association of Nuclear Operators
JV	joint venture		
KPI	key performance indicator		
LC	life cycle		
LCBE	life cycle back-end		
LEU	low-enriched uranium		

# Glossary

<b>AA1000 Stakeholder Engagement Standard (AA1000SES)</b>	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
<b>Becquerel (Bq)</b>	A unit of nuclide activity in a radiation source equal to nuclide activity where one nucleus decays per second
<b>BOO (Build – Own – Operate) contract</b>	A contract imposing obligations related to the construction, ownership and operation of a facility
<b>Capacity factor</b>	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
<b>Closed nuclear fuel cycle</b>	A nuclear fuel cycle in which spent nuclear fuel is processed in order to extract uranium and plutonium for nuclear fuel refabrication
<b>Corporate business model</b>	A model comprising key business processes used by the organization to create and maintain its value in the short, medium and long term
<b>Corporate social responsibility</b>	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 operating regions, 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
<b>Depleted uranium</b>	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)
<b>Dialogue with stakeholders (as part of reporting processes)</b>	An event held in accordance with the international AA1000 standards to facilitate communication between the organization and representatives of key stakeholders when preparing and promoting its public reports
<b>Enrichment (isotopic)</b>	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
<b>EPC (Engineering – Procurement – Construction) contract</b>	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 a facility to be built
<b>EPCM (Engineering – Procurement – Construction – Management) contract</b>	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 a facility to be built
<b>Fast neutrons</b>	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
<b>First criticality</b>	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
<b>Fuel assembly</b>	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
<b>Global Reporting Initiative (GRI)</b>	An international system for reporting on economic, environmental and social performance based on the Sustainability Reporting Standards
<b>Global Reporting Initiative (GRI) Sustainability Reporting Standards</b>	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

<b>IAEA safeguards</b>	A verification system established as part of the international nuclear non-proliferation policy which is applied to the peaceful use of nuclear energy; the IAEA is responsible for the implementation of this policy
<b>IEPRS</b>	A functional subsystem for emergency prevention and response in organizations within the jurisdiction of ROSATOM
<b>Integrated report</b>	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
<b>International Integrated Reporting Council (IIRC)</b>	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
<b>ISAE 3000 standard (International Standard on Assurance Engagements)</b>	An international standard for the audit of non-financial reports
<b>Key organizations (for the purpose of public reporting)</b>	Organizations whose operations have major social and political importance and/or considerable importance for the positioning of ROSATOM on the Russian or international markets
<b>Key performance indicators (KPIs)</b>	Performance indicators consistent with the goals of the Corporation and reflecting the efficiency and performance of organizations, divisions and the individual performance of employees
<b>Natural background radiation</b>	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.)
<b>Non-financial reporting</b>	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.
<b>NPP safety</b>	An NPP characteristic that ensures radiation safety for personnel, the general public and the environment within required limits during normal operation and in the event of an accident
<b>Nuclear fuel</b>	Material containing fissionable nuclides which, after being placed in a nuclear reactor, enables a nuclear chain reaction
<b>Nuclear fuel cycle</b>	A sequence of manufacturing processes aimed at ensuring the operation of nuclear reactors, ranging from uranium production to radioactive waste disposal
<b>Nuclear fuel pellet</b>	A pellet of compressed uranium dioxide contained inside fuel elements. It forms the basis of nuclear fuel
<b>Nuclear power</b>	A branch of power engineering that uses nuclear energy for electricity and heat generation
<b>Nuclear safety</b>	The ability of nuclear facilities to prevent nuclear accidents and radioactive leaks
<b>Operator</b>	An organization that has obtained a permit from a regulator for the operation of an NPP or another nuclear facility
<b>Pilot operation</b>	A stage in the commissioning of a nuclear power plant from the power start-up to acceptance of the power plant for commercial operation
<b>Power start-up</b>	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
<b>Radiation burden</b>	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
<b>Radiation monitoring</b>	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)

<b>Radiation safety</b>	Protection of the current and future generations and the environment against the harmful impact of ionizing radiation
<b>Radioactive discharge</b>	Controlled release of radionuclides into industrial reservoirs as a result of the operation of a nuclear facility
<b>Radioactive release</b>	Controlled atmospheric emission of radionuclides by a nuclear facility
<b>Radioactive waste</b>	Materials and substances unsuitable for further use, as well as equipment and products with a radionuclide content above prescribed levels
<b>Radioactive waste disposal</b>	Safe disposition of radioactive waste in repositories or any places that rules out waste withdrawal or a possibility of radioactive releases into the environment
<b>Radioactive waste processing and conditioning</b>	Process operations aimed at ensuring that the physical form and condition of radioactive waste are appropriate for its disposal
<b>Recommendations of the Russian Union of Industrialists and Entrepreneurs (RSPP) for Use in Governance Practice and Corporate Non-Financial Reporting (basic performance indicators)</b>	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.)
<b>Research reactor</b>	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
<b>Separative work unit (SWU)</b>	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
<b>Spent nuclear fuel reprocessing</b>	A set of chemical engineering processes for removing fission products from spent nuclear fuel and for regeneration of fissionable material for reuse
<b>Stakeholder assurance of the report</b>	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
<b>Stakeholders</b>	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
<b>Sustainable development</b>	Development meeting the needs of the present without compromising the ability of future generations to meet their own needs
<b>Treaty on the Non-Proliferation of Nuclear Weapons</b>	An international treaty aimed at limiting the arms race; its objective is to prevent the emergence of new states possessing nuclear weapons. The treaty imposes an obligation on states possessing nuclear weapons, requiring them not to transfer nuclear weapons or control over such weapons to any party, while non-nuclear weapon states are obliged not to manufacture or acquire nuclear weapons or other nuclear explosive devices

<b>Uranium conversion</b>	A chemical engineering process involving the transformation of uranium-containing materials into uranium hexafluoride
<b>Uranium hexafluoride</b>	A chemical compound of uranium and fluorine (UF <sub>6</sub> ), 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
<b>Uranium ore enrichment</b>	A combination of processes for primary treatment of uranium-containing mineral resources in order to separate uranium from other minerals contained in the ore
<b>Water-cooled water-moderated power reactor (VVER)</b>	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 (EAMamy@rosatom.ru).

### 1. Please assess the report using the following criteria:

#### Accuracy and objectivity

Excellent  Good  Satisfactory  Poor

#### Was your opinion influenced by independent auditors' reports 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.

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### 3. Which topics do you think should be covered in the next report?

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### 4. Your recommendations and additional comments:

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### 5. Please specify which stakeholder group you represent:

- Employee of ROSATOM
- Employee of an organization of ROSATOM
- Representative of the federal government
- Representative of a regional government
- Representative of a local government
- Representative of a contractor/supplier
- Representative of a customer/consumer of goods and services
- Representative of a business partner
- Representative of a non-governmental organization
- Representative of the media
- Representative of the expert community
- Other (please specify)

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