PERFORMANCE OF STATE ATOMIC ENERGY CORPORATION ROSATOM IN 2019
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Report Profile</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CHAPTER 1. OUR ACHIEVEMENTS</strong></td>
<td>6</td>
</tr>
<tr>
<td>History of the Russian Nuclear Industry</td>
<td>8</td>
</tr>
<tr>
<td>ROSATOM Today</td>
<td>10</td>
</tr>
<tr>
<td>Key Results in 2019</td>
<td>14</td>
</tr>
<tr>
<td>Key Events in 2019</td>
<td>15</td>
</tr>
<tr>
<td>Address by the Chairman of the Supervisory Board</td>
<td>16</td>
</tr>
<tr>
<td>Address by the Director General</td>
<td>17</td>
</tr>
<tr>
<td>Address by a Stakeholder Representative</td>
<td>18</td>
</tr>
<tr>
<td>Financial and Economic Results</td>
<td>20</td>
</tr>
<tr>
<td><strong>CHAPTER 2. STRATEGY FOR A SUSTAINABLE FUTURE</strong></td>
<td>22</td>
</tr>
<tr>
<td>2.1. Business Strategy until 2030</td>
<td>24</td>
</tr>
<tr>
<td>2.2. Sustainable Development Management</td>
<td>28</td>
</tr>
<tr>
<td>2.3. Value Creation and Business Model</td>
<td>34</td>
</tr>
<tr>
<td><strong>CHAPTER 3. CONTRIBUTION TO GLOBAL DEVELOPMENT</strong></td>
<td>40</td>
</tr>
<tr>
<td>3.1. Markets Served by ROSATOM</td>
<td>42</td>
</tr>
<tr>
<td>3.2. International Cooperation</td>
<td>55</td>
</tr>
<tr>
<td>3.3. International Business</td>
<td>63</td>
</tr>
<tr>
<td><strong>CHAPTER 4. PERFORMANCE OF DIVISIONS</strong></td>
<td>74</td>
</tr>
<tr>
<td>4.1. Mining Division</td>
<td>76</td>
</tr>
<tr>
<td>4.2. Fuel Division</td>
<td>79</td>
</tr>
<tr>
<td>4.3. Mechanical Engineering Division</td>
<td>82</td>
</tr>
<tr>
<td>4.4. Engineering Division</td>
<td>84</td>
</tr>
<tr>
<td>4.5. Power Engineering Division</td>
<td>86</td>
</tr>
<tr>
<td><strong>CHAPTER 5. INNOVATIONS AND NEW PRODUCTS TO IMPROVE THE QUALITY OF PEOPLE’S LIFE</strong></td>
<td>90</td>
</tr>
<tr>
<td>5.1. Research and Innovations</td>
<td>92</td>
</tr>
<tr>
<td>5.2. Business Diversification</td>
<td>102</td>
</tr>
<tr>
<td><strong>CHAPTER 6. DIGITAL TRANSFORMATION</strong></td>
<td>108</td>
</tr>
<tr>
<td>6.1. Uniform Digital Strategy</td>
<td>113</td>
</tr>
<tr>
<td>6.2. Participation in Digitization in Russia</td>
<td>114</td>
</tr>
<tr>
<td>6.3. Digital products</td>
<td>116</td>
</tr>
<tr>
<td>6.4. Internal Digitization</td>
<td>120</td>
</tr>
<tr>
<td>6.5. Technological Development</td>
<td>121</td>
</tr>
<tr>
<td><strong>CHAPTER 7. DEVELOPMENT OF THE NORTHERN SEA ROUTE</strong></td>
<td>122</td>
</tr>
<tr>
<td>7.1. Escorting Vessels and Handling Cargo Traffic along the Northern Sea Route</td>
<td>127</td>
</tr>
<tr>
<td>7.2. Construction of New Icebreakers</td>
<td>128</td>
</tr>
<tr>
<td>7.3. New Products</td>
<td>128</td>
</tr>
<tr>
<td>7.4. Digitization of Operations</td>
<td>128</td>
</tr>
<tr>
<td>7.5. Activities of FSUE Hydrographic Enterprise</td>
<td>129</td>
</tr>
<tr>
<td>7.6. Plans for 2020 and for the Medium Term</td>
<td>130</td>
</tr>
<tr>
<td><strong>CHAPTER 8. EFFECTIVE MANAGEMENT OF RESOURCES</strong></td>
<td>132</td>
</tr>
<tr>
<td>8.1. Corporate Governance</td>
<td>135</td>
</tr>
<tr>
<td>8.2. Risk Management</td>
<td>141</td>
</tr>
<tr>
<td>8.3. Performance of Government Functions</td>
<td>155</td>
</tr>
<tr>
<td>8.4. Financial and Investment Management</td>
<td>158</td>
</tr>
<tr>
<td>8.5. ROSATOM Production System</td>
<td>164</td>
</tr>
<tr>
<td>8.6. Procurement Management</td>
<td>168</td>
</tr>
<tr>
<td>8.7. Internal Control System</td>
<td>172</td>
</tr>
<tr>
<td>8.8. Prevention of Corruption and Other Offences</td>
<td>174</td>
</tr>
<tr>
<td><strong>CHAPTER 9. DEVELOPMENT OF HUMAN POTENTIAL AND INFRASTRUCTURE</strong></td>
<td>176</td>
</tr>
<tr>
<td>9.1. Implementation of the HR Policy</td>
<td>178</td>
</tr>
<tr>
<td>9.2. Developing the Regions of Operation</td>
<td>194</td>
</tr>
<tr>
<td>9.3. Stakeholder Engagement</td>
<td>205</td>
</tr>
<tr>
<td><strong>CHAPTER 10. SAFETY AND ENVIRONMENTAL PROTECTION</strong></td>
<td>214</td>
</tr>
<tr>
<td>10.1. Nuclear and Radiation Safety; Occupational Safety and Health</td>
<td>216</td>
</tr>
<tr>
<td>10.2. RAW and SNF Management and Decommissioning of Facilities Posing Nuclear and Radiation Hazards</td>
<td>228</td>
</tr>
<tr>
<td>10.3. Environmental Safety</td>
<td>234</td>
</tr>
<tr>
<td><strong>CHAPTER 11. PARTNERSHIP FOR SUSTAINABLE DEVELOPMENT</strong></td>
<td>254</td>
</tr>
<tr>
<td>11.1. Public Reporting System</td>
<td>256</td>
</tr>
<tr>
<td>11.2. Dialogues with Stakeholders</td>
<td>258</td>
</tr>
<tr>
<td>11.3. Incorporation of Stakeholders’ Proposals</td>
<td>259</td>
</tr>
<tr>
<td>11.4. Statement of Public Assurance</td>
<td>260</td>
</tr>
<tr>
<td>Appendices</td>
<td>264</td>
</tr>
<tr>
<td>Contact Details and Useful Links</td>
<td>284</td>
</tr>
</tbody>
</table>
The Public Annual Report ‘Performance of State Atomic Energy Corporation Rosatom’ (hereinafter referred to as the Corporation or ROSATOM) for 2019 (the Report) has been prepared on a voluntary basis and is intended for a broad range of stakeholders.

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

STANDARDS AND REGULATORY REQUIREMENTS
The Report has been prepared in accordance with the following documents:
- The Public Reporting Policy and the Public Reporting Standard of ROSATOM and its organizations;
- The International Integrated Reporting Framework (International <IR> Framework);
- The Global Reporting Initiative Sustainability Reporting Standards (GRI SRS, Core option);
- The AccountAbility AA1000 Series of Standards (AA 1000 AP 2018, AA1000 SES 2015);

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

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

For details on the Report and the process of determining its content, see Appendix 1.
Research in the field of nuclear physics in the USSR dates back to the first half of the 20th century. In 1921, the Radium Laboratory (now the Khlopin Radium Institute) was established under the Academy of Sciences. In 1933, the 1st Nationwide Conference on Nuclear Physics was held in Leningrad. In 1939, Yakov Zeldovich, Yuli Kharton and Alexander Leptunsky proved that a nuclear fission chain reaction in uranum was possible. In 1940, Konstantin Petrshuk and Georgiy Flyorov, researchers at the Radium Institute, discovered spontaneous fission of heavy nuclei (without neutron bombardment), as exemplified by uranum.

In the 1940s, the military ‘nuclear project’ gave powerful impetus to the development of the industry. On September 28, 1942, the First nuclear power plant, at Obrinsk, was put into operation. In 1959, the world’s first nuclear power plant, Obninsk NPP, was put into operation. In 1999, the world’s first nuclear icebreaker, Lenin, was put into operation. In 1964, the first VVER reactor with a capacity of 210 MW was put into operation at Novovoronezh NPP. In 1974, the first RBMK reactor with a capacity of 1,000 MW was put into operation at Leningrad NPP. By the end of the 1980s, the total NPP capacity in the USSR reached 37 GW. Soviet atomic scientists laid the groundwork for the future: they built incredibly powerful particle accelerators, nuclear fusion facilities for research on plasma compression and numerous other facilities. The Chernobyl nuclear disaster in 1986 hindered the development of the nuclear power industry. But at the same time, this tragic accident encouraged a fundamental review of approaches to safety, including the development of a safety culture. The 1990s, which were a challenging period for Russia, also marked a period of stagnation in the industry. But the nuclear industry survived and retained its unique research and production capabilities and, most importantly, its human resources. In the 2000s, the commissioning of new NPP power units was resumed, with power unit No. 1 of Rostov NPP and power unit No. 3 of Kalinin NPP put into operation in 2001 and 2004 respectively.

In 1945, a decree was signed on establishing a governing body responsible for managing the work on uranum: the Special Committee under the State Defence Committee of the USSR. It is considered that this date marked the emergence of the nuclear industry. In 1946, a self-sustained nuclear chain reaction in uranum was achieved in the F-1 reactor in Laboratory No. 2. F-1 was the first nuclear reactor in the USSR and in Europe. In 1949, the USSR conducted its first successful nuclear weapon test, followed by the test of the first Soviet thermonuclear bomb in 1953. In 1958, the first Soviet nuclear submarine, Lenin, Komsomo was built. The country’s ‘nuclear shield’ helped accomplish a global objective: historians believe that the nuclear parity between the USSR and the US helped to avoid the third world war, while nuclear weapons became a means of peaceful containment. Apart from the defence capability, another focus area was the use of nuclear energy in the civilian sector of the Soviet economy. In 1993, the Ministry of Medium Machine-Building was established. In 1957, the Ministry was headed by Efim Slavsky, the famous ‘nuclear minister’, who held this position until 1986. Academicians Igor Kurchatov and Anatoly Alexandrov led the development of a programme to develop the nuclear power industry in the USSR, which involved a wide use of nuclear energy in power generation, transportation and other areas of the national economy.

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To learn more about the history of the nuclear industry, visit the website at http://www.biblioatom.ru
ROSATOM is a diversified corporation owning assets and possessing competences at all stages of the nuclear production chain: uranium exploration and mining, uranium conversion and enrichment, nuclear fuel fabrication, mechanical engineering, NPP design and construction, power generation, decommissioning of nuclear facilities, spent nuclear fuel and radioactive waste management.

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

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

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

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

The Corporation’s research activities are aimed at developing new solutions for the power industry and innovative technologies that will improve the quality of people’s lives. ROSATOM’s key project in the sphere of nuclear power is the Proryv (Breakthrough) project, which is aimed at demonstrating the possibility of closing the nuclear fuel cycle using fast neutron reactors and developing the relevant technologies. A closed nuclear fuel cycle will significantly improve the efficiency of usage of natural uranium and will help solve the problem of nuclear waste accumulation and provide humankind with a reliable long-term source of clean energy.
**KEY RESULTS IN 2019**

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

**KEY EVENTS IN 2019**

- Power unit No. 2 of Novovoronezh NPP-2 started commercial operation ahead of schedule.
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**Indicators**

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

4 Calculated as net cash flow from day-to-day operations adjusted for proceeds from the disposal of non-core assets, dividends and interest, before lease payments and reserve funds.
5 The calculation includes the number of foreign patents, revenue from sales of innovative products and the results of implementation of ROSATOM’s new innovative development programme. The target for the reporting period was set at 100%.
Dear colleagues,

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

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

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

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

ADDRESS BY THE CHAIRMAN OF THE SUPERVISORY BOARD

SERGEY KIRIENKO
Chairman of the Supervisory Board of ROSATOM

ADDRESS BY THE DIRECTOR GENERAL

ALEXEY LIKHACHEV
Director General of ROSATOM

Dear colleagues,

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

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

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

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

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

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

The era of the peaceful atom began in 1954, when the world’s first nuclear power plant was built in Obninsk under the supervision of the Ministry of Medium Machine-Building of the USSR. Our country produced the first nuclear icebreaker. We gave the world tokamaks; we were the first to adopt centrifuge technology for uranium enrichment and to commission an industrial fast neutron reactor. Nuclear technology has enabled us to create a large fleet of nuclear submarines and launch a successful space exploration programme. The nuclear industry is an undisputed leader in the use of nuclear energy; it creates world-class scientific and technical know-how, not only for its own needs but also for related industries. The nuclear industry is an undisputed leader in the use of nuclear energy; it creates world-class scientific and technical know-how, not only for its own needs but also for related industries.

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

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

I am proud that once again, we are entrusted with the most challenging tasks in today’s Russia. ROSATOM has become the operator of the Northern Sea Route and missile personnel in the Strategic Missile Forces of Russia. We support the crews of the world’s largest nuclear submarine, Dmitry Donskoy, the world’s largest diesel-electric submarine, Sarov, and the 11th Nuclear Submarine Division, as well as the personnel of the State Central Marine Test Site, where state-of-the-art weapons are tested. We also support the 42nd Division of the Strategic Missile Forces based in Nizhny Tagil. I would like to express my deep respect for veterans that were pioneers of the nuclear industry.

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

KEY FINANCIAL RESULTS, RUB BILLION

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2019/2018</th>
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<tbody>
<tr>
<td>Revenue</td>
<td>967.8</td>
<td>1,033.9</td>
<td>1,151.9</td>
<td>+11.4%</td>
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<tr>
<td>Assets</td>
<td>3,437.7</td>
<td>3,802.2</td>
<td>4,292.6</td>
<td>+12.9%</td>
</tr>
<tr>
<td>Intangible assets</td>
<td>103.5</td>
<td>194</td>
<td>170.9</td>
<td>-11.9%</td>
</tr>
</tbody>
</table>

An 11.4% increase in revenue compared to 2018 was driven mainly by:
- An increase in revenue from electricity and heat generation and capacity (including power generation by new power units at Rostov and Leningrad NPPs);
- An increase in revenue from NPP construction projects.

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

PROFITABILITY RATIOS, %

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return on sales (ROS)</td>
<td>10.81</td>
<td>20.34</td>
<td>11.3</td>
</tr>
<tr>
<td>Return on assets (ROA)</td>
<td>3.04</td>
<td>5.53</td>
<td>3.03</td>
</tr>
<tr>
<td>Return on equity (ROE)</td>
<td>4.59</td>
<td>8.45</td>
<td>4.99</td>
</tr>
</tbody>
</table>

Profitability ratios decreased in 2019, primarily due to a year-on-year decrease in profit.
2.1. BUSINESS STRATEGY UNTIL 2030

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

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

We continue to focus on the key areas outlined in the 2014 Strategy as we are working to accomplish our objectives and expanding their list. In the new version of the Strategy, we have supplemented ROSATOM’s three strategic goals (developing new products) with a fourth goal: achieving global leadership in their list. In the new version of the Strategy, we have supplemented ROSATOM’s three strategic goals (developing new products) with a fourth goal: achieving global leadership.

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

— What will ROSATOM be like in 2030?

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

The first one comprises economic goals. By 2030, we intend to increase revenue to RUB 4 trillion, with more than half of this revenue coming from overseas orders. We intend that, in addition to our core business, namely nuclear power generation, other sources of revenue will include an increase in the output of new products, which should account for at least 40% of the total revenue. It should be pointed out that we have set ourselves the goal of effectively expanding the scope of our business, which is reflected in a multiple increase in EBITDA.

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

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

2.1.1. BUSINESS CONTEXT

Trends in the development of the nuclear industry

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

- Global population growth from 7.8 billion people in 2019 to 10 billion people in 2050 and an increase in the share of urban population from 55–56% to 68% by 2050;
- Global GDP growth by an average of 2.4% per year until 2050;
- Growth of global electricity consumption. Global electricity consumption is expected to increase by 25% compared to 2019 and reach 34.1 TWh as early as in 2030. Asian countries will lead the growth due to increases in the electricity consumption in the region, increasing by a factor of 1.4 (from 13 TWh to 18 TWh). In Russia, electricity consumption is expected to grow by 0.9% per year until 2030;
- Accelerating greenhouse gas accumulation. Global carbon dioxide emissions total about 33 billion tonnes per year and continue to grow. By 2030, carbon dioxide emissions are projected to exceed 34 billion tonnes per year. This drives the development of low-carbon power generation, which includes nuclear power.

In recent years, environmental aspects of the electricity industry have come under closer scrutiny, which has resulted in an increase in the share of low-carbon power in the global energy mix. The levelized cost of electricity (LCOE) for renewable energy sources has almost matched that of conventional power generation facilities, ranging from USD 60 to USD 90 per megawatt-hour. These factors, as well as a reduction of fossil fuel reserves, contribute to the long-term demand for nuclear energy. Leading global think tanks predict an increase in installed capacity in the nuclear power industry to about 450-500 GW by 2050. 

The global nuclear power industry will remain competitive in the long run compared to other energy sources. Thermal power generation will yield to nuclear energy primarily because of CO2 emissions. Data from the World Bank, the UN, the IEA, the IAEA, McKinsey, the Energy Research Institute of the Russian Academy of Sciences and the General Layout Plan of Power Facilities until 2023 have been used.
Assistance in securing funding (including under the BOO scheme) and building project infrastructure (legal framework, employee training, community relations, etc.).

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

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

ROSATOM’s competitive position

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

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

To develop new products for the Russian and international markets. Given the accumulated knowledge and technologies of the ‘nuclear project’ in civilian sectors, the Corporation plans to increase the share of new businesses in revenue significantly by 2030.

To achieve global leadership in state-of-the-art technologies. ROSATOM seeks to extend its global leadership beyond the nuclear industry. The Corporation intends to leverage its existing capabilities, the understanding of nuclear technologies and accumulated experience in order to diversify into new segments. In the future, ROSATOM aims to rank among international companies perceived as global technological leaders. In order to implement the strategy, the following objectives must be met:
- Ensuring safe use of nuclear energy;
- Non-proliferation of nuclear technologies and materials;
- Preventing the negative environmental impact;
- Ensuring that the development of nuclear power is socially acceptable;
- Developing the Corporation’s innovative potential;
- Shaping a corporate culture focused on results and performance improvement;
- Ensuring that the state defence order is fulfilled;
- Ensuring full compliance with Russian legislation, including the Law on State Secrets.

ROSATOM sets a framework for development.

ROSATOM has set itself four long-term strategic goals to be achieved by 2030:
- To increase the international market share. To assert its leadership on the global nuclear power market, ROSATOM is currently expanding its footprint in over 50 countries around the world and the long-term portfolio of overseas orders and increasing the corresponding revenue. For details, see the sections ‘International Cooperation’ and ‘International Business’;
- To reduce production costs and the lead time. In order to develop the most competitive products, the Corporation will take further steps to reduce the duration of NPP construction and the levelized cost of electricity (LCOE),
2.2. SUSTAINABLE DEVELOPMENT MANAGEMENT

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

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

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

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

Implementation of sustainability practices in the industry covers the following areas:
- Strategy;
- Operational processes;
- Stakeholder engagement (see the sections ‘Stakeholder Engagement’ and ‘Public Reporting System’).

2.2.1. STRATEGY

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

ROSATOM’S CONTRIBUTION TO ACHIEVING THE SUSTAINABLE DEVELOPMENT GOALS

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

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

**Environmental aspect (E)**

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

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

A number of corporate environmental documents have been approved in the industry and are updated on a regular basis. The main document in this area is the Uniform Industry-Wide Environmental Policy (2008)10. For details, see the section ‘Environmental Safety’.

**Social aspect (S)**

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

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

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

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

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

**Governance aspect (G)**

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

---

10 Hereinafter in this section, the years of approval of the first versions of the documents are stated.
On average, about 10,000 people are employed in the construction of an NPP with two power units, while its Nuclear power generation is a source of low-carbon energy that provides considerable environmental benefits. NPP construction and operation involves building the relevant infrastructure and developing fundamental and The nuclear power industry offers solutions for different stakeholders: the government, local communities, all this contributes to GDP through industry and tax payments. NPP construction and operation provides employment for several thousand people, both at the plant itself and in the sphere of nuclear infrastructure.

Detailed description of contribution of the nuclear power industry to the achievement of the SDGs

Goal

Detailed description

NPPs ensure stable low-carbon power generation for 60 years, with a potential for further life extension.

7

On average, about 10,000 people are employed in the construction of an NPP with two power units, while its operation provides about 3,000 jobs. Stable large-scale power generation makes a positive systemic impact on the development of local industry in the country where the NPP is located.

8

NPP construction and operation involves building the relevant infrastructure and developing fundamental and applied science and a national personnel training system.

9

In NPP construction and operation projects, special focus is given to the management of spent nuclear fuel (SNF), SNF processing products and operational radioactive waste (RAW), as well as to the decommissioning of facilities posing nuclear and radiation hazards. Waste management efforts are focused on preserving the environment and improving environmental safety.

12

Nuclear power generation is a source of low-carbon energy that provides considerable environmental benefits. The operation of all Russian-design NPPs globally helps to prevent emissions totalling about 210 million tonnes of CO₂ equivalent per year.12

13

The nuclear power industry offers solutions for different stakeholders: the government, local communities, industrial enterprises, etc. An open dialogue between all stakeholders is an integral part of successful implementation of NPP projects. The sustainable development agenda is actively discussed on international platforms: at conferences held by the IAEA and the World Nuclear Association (WNA), the World Association of Nuclear Operators (WANO), the World Energy Council, etc.

17

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

2.2.3. Technologies for sustainable development and their contribution to the achievement of the SDGs

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

The Corporation’s product portfolio comprises not only conventional solutions in the sphere of nuclear power, but also new areas involving the use of nuclear technology, such as nuclear medicine, radiation processing facilities, nuclear research and technology centres based on research reactors, etc. In addition, the Corporation is developing its business in a number of related non-nuclear areas: water treatment, wind power, polymer composite materials, etc. Sustainable new products accounted for 77% of ROSATOM’s total revenue from new businesses in 2019.

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

9 100% of nuclear power generation is replaced with other electricity sources in proportion to their shares in the global power generation structure, with emissions of CO₂ equivalent reassessed accordingly by type of generation.
WIND POWER

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

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

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

NUCLEAR MEDICINE

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

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

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

2.3. VALUE CREATION AND BUSINESS MODEL

ROSATOM manages the assets of the Russian nuclear industry at all stages of the nuclear fuel cycle, the cycle of NPP construction, operation and decommissioning and in other segments related to the use of nuclear energy. Realizing the importance of its operations for the economy and society, ROSATOM seeks to develop its business sustainably, including by increasing its total value for the Corporation and a wide range of its stakeholders. The term ‘value’ refers not only to products created, services rendered and financial results achieved by ROSATOM, but also to the combination of economic, social and environmental impacts of ROSATOM on its stakeholders, society as a whole and the environment.

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

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

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

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

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

ROSATOM’S CAPITALS

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

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

- **Capitals available as at December 31, 2018**
  - **Capitals available as at December 31, 2019**

**Capitals available as at December 31, 2018**

- **Development of the Northern Sea Route**
  - **TOTAL CARGO TRAFFIC ALONG THE NORTHERN SEA ROUTE:**
    - **31.5 MILLION TONNES**

**Capitals available as at December 31, 2019**

- **REVENUE FROM NEW BUSINESSES:** **RUB 227.9 BILLION**
  - **10-YEAR ORDER PORTFOLIO:** **RUB 1,169.1 BILLION**

**Capitals available as at December 31, 2018**

- **NEW BUSINESSES IN RUSSIA AND ABROAD**
  - **10-YEAR PORTFOLIO OF OVERSEAS ORDERS:** **USD 140.1 BILLION**
    - **FOREIGN REVENUE:** **USD 7.2 BILLION**
  - **Construction of small and medium-power reactors and research reactors**
  - **Services in the back-end segment**
  - **NPP servicing**

**Capitals available as at December 31, 2019**

- **URANIUM PRODUCTION:** **2,911 TONNES**
  - **Power machine engineering (Mechanical Engineering Division)**
  - **NPP design and construction (Engineering Division)**
  - **SIMULTANEOUS CONSTRUCTION OF FIVE NPP POWER UNITS AND A FLOATING NUCLEAR POWER PLANT**

**Capitals available as at December 31, 2018**

- **URANIUM PRODUCTION:** **2,911 TONNES**
  - **Electricity generation (Power Engineering Division)**
  - **ECLECTRICITY OUTPUT:** **208.8 BILLION KWH**
  - **Power unit No. 2 of Novovoronezh NPP-2 started commercial operation**
  - **The floating thermal nuclear power plant was connected to the power grid**

**Capitals available as at December 31, 2019**

- **NUMBER OF INTERNATIONAL APPLICATIONS SUBMITTED AND PATENTS OBTAINED IN THE REPORTING YEAR:** **439**
  - **INTERNATIONAL APPLICATIONS SUBMITTED AND PATENTS OBTAINED IN THE REPORTING YEAR:** **439**
  - **CONSOLIDATED LABOUR PRODUCTIVITY:** **RUB 6.7 MILLION PER PERSON**
  - **INTERNAL R&D EXPENSES:** **2.9% OF REVENUE**

- **Taxes paid to Russian budgets:** **RUB 207.4 billion**
  - **Revenue under IFRS:** **RUB 1,151.9 billion**
  - **Expenses on environmental protection:** **RUB 23.55 billion**
  - **Expenditure on corporate social programmes for employees:** **RUB 9.8 billion**
  - **Average salary:** **RUB 84,100**
<table>
<thead>
<tr>
<th>Capital Indicator</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2019/2018</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Value Creation Results</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted free cash flow, RUB billion</td>
<td>308.7</td>
<td>321.5</td>
<td>328.7</td>
<td>+2.2%</td>
</tr>
<tr>
<td>Revenue under IFRS, RUB billion</td>
<td>967.8</td>
<td>1,033.9</td>
<td>1,151.9</td>
<td>+11.4%</td>
</tr>
<tr>
<td>Manufactured</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of power units in operation during the year, pcs.</td>
<td>35</td>
<td>37</td>
<td>36</td>
<td>-2.7%</td>
</tr>
<tr>
<td>Capacity factor of Russian NPPs, %</td>
<td>83.3</td>
<td>79.9</td>
<td>80.4</td>
<td></td>
</tr>
<tr>
<td>Intellectual</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intangible assets under IFRS, RUB billion</td>
<td>103.5</td>
<td>194</td>
<td>170.9</td>
<td>-11.9%</td>
</tr>
<tr>
<td>Share of innovative products in revenue, %</td>
<td>13.5</td>
<td>17.5</td>
<td>20.6</td>
<td></td>
</tr>
<tr>
<td>Number of foreign patents obtained by ROSATOM, applications for foreign patents submitted and registered under the established procedure, registered trade secrets (know-how), pcs.</td>
<td>443</td>
<td>417</td>
<td>439</td>
<td>+5.3%</td>
</tr>
<tr>
<td>Human</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average headcount, '000 people</td>
<td>247.3</td>
<td>255.4</td>
<td>266.4</td>
<td>+4.3%</td>
</tr>
<tr>
<td>Personnel turnover rate, %</td>
<td>10</td>
<td>12.7</td>
<td>13.2</td>
<td></td>
</tr>
<tr>
<td>Average training hours per employee</td>
<td>29.5</td>
<td>23.7</td>
<td>28.4</td>
<td></td>
</tr>
<tr>
<td>LTIFR</td>
<td>0.13</td>
<td>0.12</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Social and relationship</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level of support for the nuclear industry in Russia, %</td>
<td>73.9</td>
<td>74.5</td>
<td>73.7</td>
<td></td>
</tr>
<tr>
<td>10-year portfolio of overseas orders, USD billion</td>
<td>133.5</td>
<td>133.2</td>
<td>140.1</td>
<td>+5.2%</td>
</tr>
<tr>
<td>Taxes paid, RUB billion</td>
<td>148.5</td>
<td>188.2</td>
<td>207.4</td>
<td>+10.2%</td>
</tr>
<tr>
<td>Natural</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uranium resources (Russian assets), kt</td>
<td>523.9</td>
<td>520.7</td>
<td>512.7</td>
<td>-1.5%</td>
</tr>
<tr>
<td>Uranium resources (foreign assets), kt</td>
<td>216.2</td>
<td>197.1</td>
<td>192</td>
<td>-2.6%</td>
</tr>
<tr>
<td>Water withdrawal from natural sources, million m³</td>
<td>7,411</td>
<td>7,317.8</td>
<td>6,531.3</td>
<td>-10.7%</td>
</tr>
</tbody>
</table>
3.1. Markets Served by ROSATOM
3.2. International Cooperation
3.3. International Business
3.1. MARKETS SERVED BY ROSATOM

In 2019, ROSATOM ranked:

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

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

MARKETS SERVED BY ROSATOM AND VALUE CHAINS

<table>
<thead>
<tr>
<th>Markets</th>
<th>Value chain</th>
<th>Products/services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural uranium market</td>
<td>Mineral resource base development</td>
<td>Natural uranium</td>
</tr>
<tr>
<td>Uranium conversion and enrichment service market</td>
<td>Conversion</td>
<td>Enrichment</td>
</tr>
<tr>
<td>Nuclear fuel market</td>
<td>Natural uranium</td>
<td>Conversion</td>
</tr>
<tr>
<td>Power machine engineering market</td>
<td>Design/construction</td>
<td>Manufacture</td>
</tr>
<tr>
<td>Electricity and capacity market</td>
<td>Operation</td>
<td>Wholesale distribution</td>
</tr>
</tbody>
</table>

3.1.1. TRADITIONAL MARKETS

NATURAL URANIUM MARKET

Forecast for changes in uranium demand by 2030

After 2011, there was a significant drop in prices on the nuclear fuel cycle front-end markets, including a long-term decline in quotations for natural uranium. Throughout most of 2019, the natural uranium market was characterized by a low level of consumer activity amid political and trade uncertainty. In the reporting year, spot market quotations averaged USD 25.8/lb of U₃O₈, which is 5% higher than in 2018.
In 2019, global reactor demand for uranium totalled 64,300 tonnes. At the same time, global demand taking into account commercial and strategic stockpiling not intended for current consumption is estimated at 72,000 tonnes.

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

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

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

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

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

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

**FORECAST FOR CHANGES IN URANIUM DEMAND, KT**


<table>
<thead>
<tr>
<th>Year</th>
<th>Best case scenario</th>
<th>Base case scenario</th>
<th>Worst case scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>2024</td>
<td>65.42</td>
<td>69.85</td>
<td>73.16</td>
</tr>
<tr>
<td>2030</td>
<td>73.16</td>
<td>81.81</td>
<td>94.16</td>
</tr>
</tbody>
</table>

**LARGEST PLAYERS ON THE NATURAL URANIUM MARKET IN 2019**

- **NAC Kazatomprom**
- **ROSATOM**
- **CNNC and CGN**
- **Orano**
- **Cameco**
- **BHP**
- **Navo Mining and Metallurgical Plant**
- **Rio Tinto**
- **Other**

Source: company reports, UxC

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

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

15. Report by UxC (UxC UMO 1Q 2020).

16. Report by UxC (UxC UMO 1Q 2020).
URANIUM CONVERSION AND ENRICHMENT MARKET

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

Forecast for changes in demand for uranium conversion services by 2030

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

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

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

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

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

Forecast for changes in demand for uranium enrichment services by 2030

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

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

AVERAGE ANNUAL SPOT MARKET QUOTATIONS FOR ENRICHMENT, USD/SWU

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

Uranium conversion and enrichment market overview

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

The main players on the global market for uranium enrichment services include ROSATOM (38% of the global market), URENCO (UK, Germany, Netherlands; 29%), Orano (France; 14%) and Chinese companies (10%). Together, they control about 90% of the market. At present, all players use modern gas centrifuge technology for uranium enrichment.
According to ROSATOM, in 2019, the global nuclear fuel market capacity totalled about 11,000 tonnes of heavy metal (tHM). This includes:
- Fuel for light-water reactors requiring uranium enrichment accounting for 7,400 tHM (including over 1,000 tHM of fuel for water-cooled water-moderated power reactors (VVERs));
- Fuel for heavy-water reactors accounting for 3,500 tHM.

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

Global suppliers on the fabrication market include Westinghouse Electric Company fabricating nuclear fuel for near-
up energy reactors operating on other markets. The company only produces fuel for BWR reactors and holds 10% of the market.

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

In 2019, ROSATOM’s share on the global nuclear fuel fabrication market totalled 21%. The French Framatome produces fuel for PWR and BWR reactors and holds 21% of the global fabrication market, with Western Europe being its main end market.

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

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

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

POWER MACHINE ENGINEERING MARKET

The modern power machine engineering market is characterized by long lead times, high capital intensity and design for manufac-
turability. The global power machine engineering market is affected by trends in the development of the global electrici-
ty industry (improved energy efficiency, environmental pro-
grames, etc.) and the commissioning of new generating ca-
pacities.

In 2019, 9% of the global fuel market for commissioned pow-
er generation equipment totalled about 221 GW.

According to a survey by the Industrial Marketing Research Group: Power Generation Equipment Market in 2020. See also the section ‘Research and Innovations’.

The Russian power machine engineering market is affected by trends in the development of the global power machine engi-
neering market, the economic situation in Russia and the DPM-2 modernization programme. According to the Federal State Sta-
tistics Service, in 2019, the production of new power generation equipment on the Russian power machine engineering market decreased by 12% to 20.6 GW. However, not all market seg-
ments saw a decline. The production of industrial gas turbines increased by 11% to 704 MW. By contrast, the steam turbine seg-
ment declined by 52% to 974 MW; the production of hydraulic turbines and water wheels decreased by 47% to 336 MW, while the production of central heating boilers (including hot-water and low-pressure steam boilers) decreased by 7% to 18.4 GW.

According to the Federal State Statistics Service, in 2019, the shares of key players on the Russian power machine engineering market remained unchanged. JSC Atomenergomash (the Corpo-
ration’s Mechanical Engineering Division) accounted for 38% of production of key types of power generation equipment, rank-
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Entering new nuclear fuel markets

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According to forecasts by international agencies and analysts, an acceleration in the shift towards low-carbon energy is becoming the key trend in the development of global energy markets. Renewable energy is expected to replace carbon-based energy in the energy mix by 2030. In 2019, the nuclear power industry accounted for about 11% of the global electricity supply. According to the IAEA, in 12 states, more than a quarter of the electricity demand is met by nuclear power generation. Countries with the largest share of nuclear power generation include France (70.6%), Slovakia (53.9%) and Ukraine (53.9%).

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

According to the IAEA, new nuclear power generation capacities connected to the grid globally in 2019 totalled 5.2 GW. At present, demand for NPP construction comes primarily from Asian countries, which is due to rapidly growing electricity consumption in this region. ROSATOM is actively expanding its global footprint: it is currently the largest global player in terms of the number of NPP construction projects in its portfolio of overseas projects (74% of the market)18.

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

According to the PRIS, the Corporation provides maintenance services for 49 Russian operating NPPs, including a floating thermal nuclear power plant, which was in pilot operation at the end of 2019.

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The maximum profitability of composite products is achieved by 2024 and 2030 respectively.

The market is highly competitive, with the top five players accounting for 74% of the total installed capacity of onshore and offshore WPPs in 2019.
Until recently, the practice of managing highly and extremely hazardous industrial and consumer waste was virtually non-existent in Russia. The country is facing a shortage of capacities for the processing and storage of hazard class 1 and 2 waste. Only a small part of such waste is treated and recycled in an environmentally safe manner by operators that have licences for the relevant operations and the required capacities.

To achieve a fundamental transformation in the sphere of hazardous waste management, a Federal Project titled ‘Infrastructure for the Management of Hazard Class 1 and 2 Waste’ has been developed and approved as part of the Ecology National Project, with ROSATOM appointed as contractor under the Project. As the federal operator tasked with managing hazard class 1 and 2 waste, ROSATOM is creating environmental technology parks for waste management, and is developing and implementing a federal scheme and a state information system for managing extremely and highly hazardous waste. The development of a system for hazard class 1 and 2 waste management will result in the emergence of a new market with a volume of up to RUB 20 billion per year.

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

See also the section ‘Business Diversification’.

3.2. INTERNATIONAL COOPERATION

Key results in 2019

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

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

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

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

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

NIKOLAY SPASSKIY
Deputy Director General
for International Relations
Performance of State Atomic Energy Corporation ROSATOM in 2019

ROSSATOM’s international activities are aimed at creating a favourable international legal and political environment to promote Russian nuclear technologies on the global market, strengthen the nuclear safety and non-proliferation regimes and actively cooperate with international organizations and forums.

3.2.1. STRENGTHENING THE INTERNATIONAL LEGAL FRAMEWORK FOR COOPERATION

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

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

COOPERATION WITH KEY PARTNERS IN STRENGTHENING THE INTERNATIONAL LEGAL FRAMEWORK

<table>
<thead>
<tr>
<th>Country</th>
<th>Key Agreements/Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congo</td>
<td>Framework IGAs were signed with Congo, Uganda and Ethiopia, providing a framework for nuclear cooperation with these countries; Agreement on the construction of a Nuclear Research and Technology Centre and memorandum on personnel training and on shaping a positive public opinion on nuclear power were signed with Rwanda; Road maps were signed with Congo, Rwanda and Ethiopia. These documents stipulate key milestones and areas of further bilateral cooperation on nuclear projects.</td>
</tr>
<tr>
<td>Rwanda</td>
<td>A framework IGA was signed, providing a legal framework for nuclear cooperation; A joint statement on strategic partnership was issued, outlining plans for the construction of a Centre for Nuclear Science, Technology and Innovation in Serbia; the relevant IGA was concluded, and a Road Map was signed, which stipulates the key stages of the project preceding the signing of the general contract. The Centre is expected to become the largest facility of this kind in Europe; it will be used for a wide range of fundamental and applied research projects; Memoranda were signed on shaping a positive public opinion on nuclear power and on cooperation in personnel training in the peaceful use of nuclear energy based on proven and innovative technologies.</td>
</tr>
<tr>
<td>Uganda</td>
<td>A framework IGA was created for joint practical projects on the peaceful use of nuclear energy: A framework IGA was signed, providing a legal framework for nuclear cooperation; A joint statement on strategic partnership was issued, outlining plans for the construction of a Centre for Nuclear Science, Technology and Innovation in Serbia; the relevant IGA was concluded, and a Road Map was signed, which stipulates the key stages of the project preceding the signing of the general contract. The Centre is expected to become the largest facility of this kind in Europe; it will be used for a wide range of fundamental and applied research projects; Memoranda were signed on shaping a positive public opinion on nuclear power and on cooperation in personnel training in the peaceful use of nuclear energy based on proven and innovative technologies.</td>
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<td>Ethiopia</td>
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<td>Serbia</td>
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</tr>
<tr>
<td>Sweden</td>
<td>An IGA on amendments to the IGA on early notification of nuclear accidents and exchange of information on nuclear facilities dated January 13, 1988 was signed through an exchange of notes. The new IGA details the scope of information to be provided by each party. The document specifies that ROSATOM has been appointed as competent authority representing the Russian party under the Agreement.</td>
</tr>
<tr>
<td>Vietnam</td>
<td>An interdepartmental memorandum was signed on the schedule of the project to build a Nuclear Research and Technology Centre; the document stipulates prioritized activities and their timing.</td>
</tr>
<tr>
<td>Dominican Republic</td>
<td>The following interdepartmental agreements were signed: Framework memorandum of cooperation in the peaceful use of nuclear energy with Slovakia and the Dominican Republic; Memoranda of cooperation in personnel education and training for the nuclear power industry with Cuba and Laos; A memorandum on shaping a positive public opinion on nuclear power with Laos. The signing of these documents makes it possible to expand the scope of cooperation with Slovakia and initiate the development of nuclear power infrastructure in these countries.</td>
</tr>
<tr>
<td>Bolivia</td>
<td>A memorandum of cooperation in the development of the lithium industry was signed. The aim of the document is to examine opportunities for joint exploration and development of lithium deposits, exchange of information and scientific research on lithium mining and the manufacture of lithium products.</td>
</tr>
</tbody>
</table>
Support was provided for the project implementation, including in the context of Belarus. Working consultations were regularly held on current emergency Situations and other government agencies of the Republic in cooperation with the Ministry of Energy, the Ministry of Emergency Authority and the National Energy Administration of the Republic of Belarus. Regular contact was maintained with the Ministry of Energy, the Ministry of Emergency Authority and the National Energy Administration of the Republic of Belarus. Support was provided for the implementation of a physical protection system of the NPP, as well as the right of the Russian party to provide assistance in the operation and maintenance of power units throughout their life cycle were addressed.

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

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

Belarusian NPP construction project

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

Japan

An Executive Agreement on Cooperation in the Construction of a Regional Centre for Radioactive Waste Conditioning and Long-Term Storage in the Primorsky Territory was signed. Under the Agreement, the Government of Japan will provide financing for the purchase of RAW management equipment necessary for the construction of the Regional Centre.

The aim of the Agreement is to enable solid radioactive waste processing in the Far East without additional budget allocations.

US

An Administrative Arrangement was signed between ROSATOM and the US Department of Energy under the framework IGA on cooperation in the peaceful use of nuclear energy. The document establishes the procedure for accounting for and tracking nuclear materials with the US obligation codes supplied to Russian nuclear enterprises for processing and subsequent handover under contracts with third-party countries, including to US customers.

Under the Agreement, the Government of Japan will provide financing for the purchase of RAW management equipment necessary for the construction of the Regional Centre.

Cooperation with China

ROSATOM continued to cooperate closely with the Atomic Energy Authority and the National Energy Administration of the PRC. Steps were taken to complete a strategic package deal with Chinese partners: the Corporation signed general contracts for the construction of power units No. 7 and 8 of Tianwan NPP and power units No. 3 and 4 of Xudabao NPP. A dialogue was opened on expanding the agenda for bilateral cooperation in the field of nuclear power. A number of areas were discussed, including closing the nuclear fuel cycle, spent nuclear fuel reprocessing and closer cooperation in the field of science and technology, including fundamental research.

Kudankulam NPP construction project (India)

Support was provided for work related to the operation of the first stage (power units No. 1 and 2), delivery of equipment for the second stage of the NPP (power units No. 3 and 4), handover of documentation and commencement of production of equipment for the third stage (power units No. 5 and 6) of Kudankulam NPP. ROSATOM continues to hold consultations with the Indian party on the technical aspects of the project to build an NPP equipped with a VVER-1200 reactor unit at a new site.

Rooppur NPP construction project (Bangladesh)

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

NPP construction projects in Finland, Hungary, Turkey and Egypt

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

Cooperation with Iran

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

NPP construction project in Uzbekistan

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

Cooperation with Cuba

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

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

Cooperation with Germany

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

See also the section ‘International Business’.

Nuclear Research and Technology Centre construction project in Bolivia

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

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

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

International Atomic Energy Agency (IAEA)

ROSATOM took part in all high-level events: the 63rd session of the International Atomic Energy Agency (IAEA) of international organizations.

In 2019, ROSATOM continued to actively participate in international conferences, including through an agreement with the IAEA was signed.

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

Budgetary and special-purpose contributions were made in full; their total amount exceeded EUR 17 million. Financing and participation of Russian organizations in major projects continued as part of the Technical Cooperation Programme, the Nuclear Energy Agency of the Organization for Economic Cooperation and Development (OECD NEA)

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

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

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

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

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

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

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

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

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

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

Support was provided for the ratification of the Agreement on Cooperation between the CIS Member States to Ensure Preparedness in the Event of a Nuclear Accident or a Radiation Emergency (signed on November 2, 2018). The Agreement will simplify the procedures for the cross-border movement of specialists and special equipment in the event of a crisis, which will help to speed up the response to any potential incidents.

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

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

In 2019, ROSATOM expanded the geographic footprint of its representative offices abroad. New positions were introduced at the Russian embassies in Uzbekistan and Egypt. As at December 31, 2019, ROSATOM’s representatives abroad worked in 15 countries around the world in embassies and trade missions of the Russian Federation, as well as under the Permanent Mission of the Russian Federation to International Organizations in Vienna (Austria) and the Permanent Mission of the Russian Federation to the European Union in Brussels (Belgium).

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

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

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

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

In 2019, ROSATOM expanded the geographic footprint of its representative offices abroad. New positions were introduced at the Russian embassies in Uzbekistan and Egypt. As at December 31, 2019, ROSATOM’s representatives abroad worked in 15 countries around the world in embassies and trade missions of the Russian Federation, as well as under the Permanent Mission of the Russian Federation to International Organizations in Vienna (Austria) and the Permanent Mission of the Russian Federation to the European Union in Brussels (Belgium).
In 2019, ROSATOM worked to promote Russian nuclear technologies on the global markets in an extremely challenging environment. Efforts to create a favourable environment for the development of the Russian nuclear power industry were made in close cooperation with the relevant ministries and agencies of the Russian Federation.

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

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

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

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

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

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

3.2.7. PLANS FOR 2020 AND FOR THE MEDIUM TERM

Key results in 2019

The 10-year portfolio of overseas orders totalled USD 140.1 billion (USD 133.2 billion in 2018).

The portfolio of overseas orders covering the entire NPP life cycle totalled USD 203.3 billion (USD 202.4 billion in 2018).

Revenue from overseas orders reached USD 7.2 billion (USD 6.5 billion in 2018).

The overseas NPP construction project portfolio included 36 power units in 12 countries around the world.

Projects were underway in more than 50 countries worldwide.

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

— Indeed, we have succeeded in maintaining a sizeable portfolio of overseas orders for years. But to do so, we have to work increasingly hard and systematically. This is due to the fact that most of our NPP construction projects are entering the on-site work stage, which drives an increase in our foreign revenue (at year-end 2019, it totalled USD 7.2 billion). As a result, the volume of the order portfolio decreases significantly, and we need to compensate for this decline by finding new projects to be implemented on the international market. At present, we have documented commitments to build 36 power units in 12 countries, with 25 power units in nine countries currently at the active implementation stage. We also maintain a foothold on the market for nuclear fuel cycle products. We are cautiously optimistic about continuing price growth on the global natural uranium market: in 2020, spot quotations moved above the psychologically important level of USD 30/lb of U₂O₅.

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

KIRILL KOMAROV

First Deputy Director General

for Corporate Development and International Business

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

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

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

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

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

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

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

In 2019, ROSATOM established the Project Office for Sustainable Development Programmes, which is tasked with incorporating sustainable development approaches into operational processes and the business agenda in the industry. We are implementing pilot projects to systematize sustainable development practices adopted in the industry. The outcomes of these efforts include a report on the contribution of nuclear power to the achievement of the SDGs (it is available on ROSATOM’s website 22) and the Supplier Code of Conduct developed by JSC TENEX and aligned with global best practices. We are also participating in the development of government regulations to support the implementation of the Paris Agreement on climate change, which Russia ratified in 2019.

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

3.3.1. PROMOTING ROSATOM’S TECHNOLOGIES ON FOREIGN MARKETS

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

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

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

As at December 31, 2019, the foreign regional network 33 established in order to increase international sales and promote the Corporation’s products comprised 34 regional offices and country offices in 65 countries around the world (including offices opened in the reporting year in Uzbekistan and Belarus).

It should be noted that the main trends facing ROSATOM as it is entering international markets include the global economic slowdown, a trend towards protectionism, geopolitical factors influencing decision-making by potential customers for the Corporation’s products and services, and a growing market for new materials and new production solutions.

See also the section ‘Stakeholder Engagement’.

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

22 https://www.rosatom.ru/upload/iblock/69b/69b71ebf50d0a1271f33b005062033.pdf
23 http://www.rosatominternational.com/en

33 PERFORMANCE OF STATE ATOMIC ENERGY CORPORATION ROSATOM IN 2019

Russian nuclear organizations have a track record in NPP construction spanning more than 60 years. The first nuclear power plant to be commissioned overseas was Rheinsberg NPP launched in 1966 in the German Democratic Republic. ROSATOM’s specialists have designed and built a total of 92 NPP power units in 14 countries globally. Over the past 14 years, 15 NPP power units were commissioned: 8 in Russia and 7 in three foreign countries. In addition, the Corporation has provided assistance in building 20 research reactors worldwide.
PERFORMANCE OF STATE ATOMIC ENERGY CORPORATION ROSATOM IN 2019

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

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

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

As at December 31, 2019, the Corporation had official commitments to build 36 nuclear power units abroad. 25 power units in 9 countries worldwide are currently at the implementation stage. Russian-design nuclear reactors that are currently under construction fully meet international safety requirements.

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

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOVEMENT IN THE PORTFOLIO OF OVERSEAS ORDERS, USD BILLION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-year portfolio of overseas orders, including:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPP construction abroad</td>
<td>97.0</td>
<td>92.0</td>
<td>97.4</td>
</tr>
<tr>
<td>Uranium products</td>
<td>15.0</td>
<td>13.9</td>
<td>13.2</td>
</tr>
<tr>
<td>Nuclear fuel assemblies and other activities</td>
<td>21.5</td>
<td>27.3</td>
<td>29.5</td>
</tr>
<tr>
<td>MOVEMENT IN OVERSEAS REVENUE, USD MILLION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overseas revenue, including:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPP construction abroad</td>
<td>2,458</td>
<td>2,820</td>
<td>3,595</td>
</tr>
<tr>
<td>Uranium products</td>
<td>1,724</td>
<td>1,717</td>
<td>1,742</td>
</tr>
<tr>
<td>Nuclear fuel assemblies and other activities</td>
<td>1,920</td>
<td>1,926</td>
<td>1,892</td>
</tr>
</tbody>
</table>

3.3.3. NPP CONSTRUCTION ABROAD

As at December 31, 2019, the Corporation had official commitments to build 36 nuclear power units abroad. 25 power units in 9 countries worldwide are currently at the implementation stage. Russian-design nuclear reactors that are currently under construction fully meet international safety requirements.

KEY RESULTS OF NPP CONSTRUCTION PROJECTS IN 2019

<table>
<thead>
<tr>
<th>NPP, country</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rooppur NPP, Bangladesh</td>
<td>Concreting of foundation slabs of the turbine hall of power units No. 1 and 2 was completed. Concreting of the first layer of the internal containment vessel in the reactor building was completed at power unit No. 1. The core catcher was moved into final position, and the cantilever truss was installed at power unit No. 2.</td>
</tr>
<tr>
<td>Kudankulam NPP, India</td>
<td>The core catcher and the cantilever truss were installed at power unit No. 3.</td>
</tr>
<tr>
<td>Tianwan NPP, China</td>
<td>A general contract for the construction of power units No. 7 and 8 was signed.</td>
</tr>
<tr>
<td>Xudabao NPP, China</td>
<td>A general contract for the construction of power units No. 3 and 4 was signed. An engineering design contract was signed for power units No. 3 and 4.</td>
</tr>
<tr>
<td>Paks II NPP, Hungary</td>
<td>The engineering design of the future NPP was developed and approved by the foreign customer. The construction of the first construction and installation facilities was started. Contracts were signed for the supply of main APCS components. A contract was concluded for the manufacture and supply of the core catcher.</td>
</tr>
<tr>
<td>Belarusian NPP, Belarus</td>
<td>The commissioning of power unit No. 1 was commenced. Installation of main equipment was completed, and the equipment airlock was installed at power unit No. 2.</td>
</tr>
<tr>
<td>Hanhikivi NPP, Finland</td>
<td>Preparatory work continued, and further steps were taken to prepare the necessary licensing documents. A contract was signed for the supply of main APCS components.</td>
</tr>
<tr>
<td>El Dabaa NPP, Egypt</td>
<td>Engineering surveys were completed at the site of the future NPP. A contract was signed for preparatory work at the site.</td>
</tr>
<tr>
<td>Akkuyu NPP, Turkey</td>
<td>Concreting of the foundation slab of the reactor building of power unit No. 1 was completed, and the core catcher was moved into final position. A licence was obtained for the construction of power unit No. 2. A package of licensing documents was submitted to the Turkish regulator to obtain a licence for the construction of power unit No. 3. The Republic of Turkey Transmission Grid Connection Agreement was signed.</td>
</tr>
</tbody>
</table>

38 RUB 8.1 trillion at the weighted average RUB/USD exchange rate for 2018.
39 RUB 467.9 billion at the weighted average RUB/USD exchange rate for 2019.
In 2019, the Corporation signed a contract for engineering surveys on the NPP construction site in Uzbekistan to prepare engineering designs of the NPP (a contract for the construction of an NPP with two power units is being negotiated).

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

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

### 3.3.4. NPP SERVICING ABROAD

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

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

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

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

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

### 3.3.5. URANIUM MINING ABROAD

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

In the reporting year, the mineral resource base of Uranium One enterprises under international reporting standards totalled 192,000 tonnes (197,100 tonnes in 2018).

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

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

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

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

### 3.3.6. EXPORT OF URANIUM PRODUCTS AND NATURAL URANIUM ENRICHMENT SERVICES

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

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

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


### 3.3.7. NUCLEAR FUEL EXPORT

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

In the reporting year:

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

CONSTRUCTION OF NUCLEAR RESEARCH AND TECHNOLOGY CENTRES (NRTCS)

As part of the NRTC construction project in Zambia, in 2019, work was completed under contracts for the preparatory period. Construction of an NRTC was underway in Bolivia. The first and second stages of the Centre were nearing completion, as main equipment for a cyclotron radiopharmacy preclinical complex and a multipurpose irradiation centre was delivered to the construction site.

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

PRoMOTING LIFE CYCLE BACK-END SERVICES

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

In 2019, a National Strategy for SNF Management based on conversion and a significant decrease in the volume and radioactivity level of radioactive waste sent for disposal. This is achieved through spent fuel reprocessing and recycling.

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

3.3.9. PLANS FOR 2020 AND FOR THE LONG TERM

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

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

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

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

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

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

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

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

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

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

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

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

SUPPLY OF ISOTOPE PRODUCTS

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

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

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

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

In 2019, after completing research on forecasting changes in corium properties during its ageing, JSC TENEX was appointed as a contractor under the second project in this field.

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

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

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

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

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

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PERFORMANCE OF DIVISIONS

4.1. Mining Division
4.2. Fuel Division
4.3. Mechanical Engineering Division
4.4. Engineering Division
4.5. Power Engineering Division
4.1. MINING DIVISION

Key results in 2019
- Uranium resources totalled 512,700 tonnes.
- 2,911 tonnes of uranium were produced (the production programme was 105% completed).
- Uranium production at JSC Khiagda reached design capacity.

The Mining Division of ROSATOM (its holding company is JSC Atomredmetzoloto) consolidates Russian uranium mining assets in the Zabaykalsky Territory (JSC PIMCU), the Republic of Buryatia (JSC Khiagda), the Kurgan Region (JSC Dalur) and the Sakha Republic (Yakutia) (JSC Elkon MMP)16.

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

The Division is implementing a number of non-uranium projects, including the construction of a lead and zinc concentrate plant in the Novaya Zemlya Archipelago, scandium mining (as a by-product), geological exploration and pilot production of gold at the Severnoye deposit, pyrite cinder processing, etc.

4.1.1. OPERATING RESULTS

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mineral resource base, kt</td>
<td>523.9</td>
<td>520.7</td>
<td>512.7</td>
</tr>
<tr>
<td>Uranium production, tonnes, including:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIMCU</td>
<td>1,631</td>
<td>1,456</td>
<td>1,300</td>
</tr>
<tr>
<td>Dalur</td>
<td>592</td>
<td>590</td>
<td>595</td>
</tr>
<tr>
<td>Khiagda</td>
<td>694</td>
<td>858</td>
<td>1,016</td>
</tr>
</tbody>
</table>

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

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

4.1.2. NEW PRODUCTS

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

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

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

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

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

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

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

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

See also the section ‘Business Diversification’.
4.1.3. SOCIAL PROJECTS

In the reporting year, the annual competition of charity and social projects was held for the sixth time in Krasnokamensk (Zabaykalsky Territory). The aim of the competition is to support social entrepreneurship and foster self-employment. Following the competition, 28 important social projects received financial support totalling RUB 2.5 million. In addition, the Division held the Social Entrepreneur's Day, which included:
- A crash programme titled Regional Social Development Accelerator;
- A forum titled From Social Initiatives to Social Entrepreneurship;
- A Path to the Future career guidance project for teenagers.

4.1.4. PLANS AND DEVELOPMENT PROSPECTS

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

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

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

4.2. FUEL DIVISION

Key results in 2019
- The Division fulfilled all commitments related to the supply of nuclear fuel to Russian and foreign customers.
- Industrial production of MOX fuel for fast neutron reactors was started.
- The Division was assigned the functions of an integrator for a new business area of ROSATOM in the sphere of decommissioning of facilities posing nuclear and radiation hazards.

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

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

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

The Division comprises enterprises in ten regions of Russia.

4.2.1. OPERATING RESULTS

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

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

A unit for separating zirconium chloride and hafnium chloride was put into operation, and a technology for fractional distillation of zirconium tetrachloride was introduced. This project will enable the Corporation to start producing zirconium sponges, which some foreign NPP operators require to be used in nuclear fuel fabrication.

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

4.2.2. NEW PRODUCTS

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

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

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

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

The Division completed a contract for the supply of strands for a prototype superconducting dipole magnet for upgrading the Super Proton Synchrotron (SPS) at the European Organization for Nuclear Research (CERN) in Switzerland. In 2019, the Division was appointed as integrator for a new business area of ROSATOM in the sphere of decommissioning of facilities posing nuclear and radiation hazards. The relevant competence centres were formed in the Division’s enterprises.

See also the section ‘Business Diversification’.

4.2.3. SOCIAL PROJECTS

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

In 2019, a cooperation agreement was signed with the Agency for Strategic Initiatives to implement a programme titled ‘Future Talent for the Region’ in Glazov and the CATFs of Zelenogorsk, Novouralsk and Seversk. The aim of the project is to form and develop leader teams comprising proactive, ambitious and passionate school students who are able and willing to participate in designing and implementing social and economic projects crucial for their home region. Following the completion of the programme, authors of the best projects were awarded trips to the Artek International Children’s Centre (with five people selected from each town).

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

4.2.4. PLANS AND DEVELOPMENT PROSPECTS

To participate in competitive tendering for nuclear fuel supply for European NPPs;

To sign contracts for the supply of nuclear fuel and its components for Western-design research reactors;

To produce MOX fuel assemblies for the first full reloading of the BN-800 reactor and to start the transition of the BN-800 reactor to fully operating on MOX fuel;

To expand lithium metal production capacities.

To develop the production of additive manufacturing equipment at LLC RME Centrotech and JSC UEIP (organizations forming part of the Division);

To conclude new contracts with third-party customers for the supply of energy storage systems for logistical electric vehicles;

To form technological centres for the development of candidate nuclear reactors for the West.

To expand the high-temperature superconducting technology development in the industrial area of PJSC NCCP, an organization forming part of the Division.

To develop the production of additive manufacturing equipment at LLC RME Centrotech and JSC UEIP (organizations forming part of the Division).

To conclude new contracts with third-party customers for the supply of energy storage systems for logistical electric vehicles.

To expand lithium metal production capacities.

To develop the production of additive manufacturing equipment at LLC RME Centrotech and JSC UEIP (organizations forming part of the Division).

To conclude new contracts with third-party customers for the supply of energy storage systems for logistical electric vehicles.

To expand lithium metal production capacities.
4.3. MECHANICAL ENGINEERING DIVISION

Key results in 2019

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

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

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

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

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

4.3.1. OPERATING RESULTS

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

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

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

4.3.2. NEW PRODUCTS

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

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

4.3.3. SOCIAL PROJECTS

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

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

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


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

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

See also the section ‘Business Diversification’.

4.4. ENGINEERING DIVISION

Key results in 2019

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

The Engineering Division of ROSATOM (its holding company is JSC ASE EC) has extensive capabilities for managing the construction of complex engineering facilities. The main business areas of the Division include the following: Design and construction of large NPPs in Russia and abroad; Developing digital technologies for managing complex engineering facilities based on the Multi-D platform.

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

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

4.4.3. PLANS AND DEVELOPMENT PROSPECTS

The design and construction of large NPPs remains the main business focus of the Engineering Division; its main priority is to strictly comply with the terms and conditions of all contracts (primarily those related to the duration and cost of construction). The key objective is to make the Division more competitive on the international market (including in terms of the LCOE).

4.4.1. OPERATING RESULTS

Kursk NPP-2

All 12 key construction milestones for 2019 were completed, including:
- The start of concreting of the second layer of the internal containment vessel at power unit No. 1;
- Moving the thrust truss at power unit No. 1 into position;
- Installation of the core catcher at power unit No. 1;
- The completion of concreting of the foundation slab of the reactor building at power unit No. 2.

Leningrad NPP-2

All six key milestones were completed, including:
- The start of trials and testing of power unit equipment;
- Moving diesel generators into final position;
- Completing the assembly of the reactor in order to carry out hot and cold trial runs.

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

4.4.2. SOCIAL PROJECTS

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

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

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

The key objective is to make the Division more competitive on the international market (including in terms of the LCOE).
Key results in 2019

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

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

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

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

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

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

4.5.1. OPERATING RESULTS

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

The increase in electricity output was driven mainly by the following factors:
- NPP power units commissioned in 2018 (power unit No. 4 of Rostov NPP and power unit No. 1 of Leningrad NPP-2) operating at rated capacity.
- Power unit No. 2 of Novovoronezh NPP-2 starting commercial operation ahead of schedule (this is the third state-of-the-art generation 3+ power unit in Russia, meeting the highest safety standards).

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

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

The Division is implementing a large-scale project to produce cobalt-60 on an industrial scale. This isotope is used for sterilization in agriculture, healthcare and industry, as well as for material modification. It is produced at seven power units equipped with RBMK reactors at Smolensk, Kursk and Leningrad NPPs. In late 2019, the loading of the first batch of cobalt absorbers was completed at Kursk and Smolensk NPPs. In addition, the Division started to produce medical isotopes (molybdenum-99, iodine-131 and iodine-125) in RBMK reactors.

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

4.5.2. NEW PRODUCTS

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

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4.5.4. PLANS AND DEVELOPMENT PROSPECTS

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

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

The Division’s long-term priorities include:

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

4.5.3. SOCIAL PROJECTS

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

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

32 The floating thermal nuclear power plant was commissioned in May 2020.
5 INNOVATIONS AND NEW PRODUCTS TO IMPROVE THE QUALITY OF PEOPLE’S LIFE

5.1. Research and Innovations
5.2. Business Diversification
5.1. RESEARCH AND INNOVATIONS

Key results in 2019

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

YURY OLENIN
Deputy Director General for Science and Strategy

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

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

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

Only two years ago, more than a third of young employees would leave science after a year of work. This not only led to a decrease in annual staffing needs, but also forced us to spend a lot of effort on the onboarding of new employees instead of their active development. But now the measures that we have taken have produced a significant improvement. Working conditions in the research department have improved considerably. Over the past two years, some organizations have more than doubled the salaries of their researchers. New housing benefits are now provided to young scientists. An expert career path has been introduced, which enables an employee to develop professionally and gain experience. I can confidently say that the profession of a scientist in ROSATOM is now a prestigious, well-paid and promising job.

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

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

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

YURI GLENN
Deputy Director General for Science and Strategy

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

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

As part of our cooperation with universities, we focus on high-quality technical education and subsequent practical application of knowledge gained during studies, as we know that in the high-technology industry it is impossible to become real professionals immediately after graduation. What is needed is experience of working on complex real-life tasks in a team of highly professional specialists. Today, a young scientist, regardless of his or her future specialization, needs a good command of information technology, a high level of proficiency in English, an understanding of economic theories, excellent communication and presentation skills.

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

– What measures does ROSATOM take to attract and retain young employees?

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

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– Has ROSATOM taken any measures to retain young employees?

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

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

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

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

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

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

<table>
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<tr>
<th></th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
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<tbody>
<tr>
<td>Share of innovative products and services in total sales of products and services in the industry, %</td>
<td>13.5</td>
<td>17.5</td>
<td>20.6</td>
</tr>
<tr>
<td>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</td>
<td>922</td>
<td>1,339</td>
<td>1,778</td>
</tr>
<tr>
<td>Share of work performed by universities, small and medium-sized enterprises and other organizations outside the industry, %</td>
<td>12.8</td>
<td>15.6</td>
<td>16.7</td>
</tr>
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</table>

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

- Establishment of a pilot and demonstration facility comprising a power unit equipped with a fast neutron reactor and an on-site unit for SNF reprocessing, fabrication and refabrication of dense fuel (on-site nuclear fuel cycle)
- Transition of the BN-800 reactor to operating with its core fully loaded with MOX fuel
- Participation in the project to create the International Thermonuclear Experimental Reactor (ITER)
- Research and development in the field of controlled thermonuclear fusion
- Design and construction of small NPPs
- Development of new materials and technologies
- Laser technology development

- Establishment of a regional centre for irradiation technologies
- Creation of a high-technology digitized facility for the production of high-precision products for the medical industry using additive manufacturing technologies
- Creation of an external beam radiotherapy facility based on a 6 MeV linear electron accelerator to substitute imported analogues
- Development of a new region for radiation technologies
- Organization of cobalt-60 isotope production in RBMK reactors
- Participation in the project to create the International Thermonuclear Experimental Reactor (ITER)
- Creation of an external beam radiotherapy facility based on a 6 MeV linear electron accelerator to substitute imported analogues
- Development of new materials and technologies
- Laser technology development
ITER is the world’s first experimental fusion reactor being built in France. The objective of the project is to demonstrate the scientific and technological feasibility of using fusion energy on an industrial scale and to master the relevant technological processes. Successful implementation of the ITER project will contribute to meeting the energy needs of humankind.

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

In 1956, scheduled work to manufacture 25 systems included in the list of Russia’s obligations under the project was performed in full. Special equipment manufactured for ITER as part of Russia’s obligations, including four central upper nozzles of the vacuum vessel and components of switching equipment, was delivered on schedule.

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

In 2019, 125 projects worth a total of more than RUB 5.5 billion were underway. More than two thirds of the projects progressed to the next technology readiness level (TRL). Researchers from ROSATOM will conduct experiments in inertial confinement fusion: in 2019, a target chamber, where targets will be irradiated by laser beams, was assembled for the world’s largest laser facility currently under construction in Sarov. The idea for this facility was proposed in 1961 by Nikolay Basov and Oleg Krelkin.
In the reporting year, a cooperation agreement was signed with the Russian Academy of Sciences to develop fundamental and applied research. Areas of cooperation include development of laser technologies and charged particle accelerators, design of modern diagnostic equipment, nuclear medicine and external beam radiotherapy, controlled thermoneutral fusion, nuclear power of the future, new materials, the nuclear fuel cycle and measures to close it, nuclear power safety, and environmental aspects of RAW management.

5.1.6. SCIENCE COMPETITIONS

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

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

In 2020, ROSATOM plans to:
1. Incorporate the Research and Technical Information Portal into the Digital Science concept;
2. Continue to implement the industry-wide programme to digitalize archives containing research and technical information until 2022;
3. Develop the knowledge management methodology and continue to develop the relevant corporate culture.

The 2019 Innovative Leader of the Nuclear Industry competition was won by employees of core organizations aged under 35 participating in the development and implementation of innovative projects were invited to participate in this event. Participants of the competition received 20 main prizes and 15 honourable mentions.

5.1.7. KNOWLEDGE MANAGEMENT SYSTEM

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

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

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5.1.8. PERSONNEL MANAGEMENT

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

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

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

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

See also the section ‘Implementation of the HR Policy’.

5.1.9. INTELLECTUAL PROPERTY MANAGEMENT

In 2019, protection of the industry’s key products and technologies abroad remained the main priority of the intellectual property management system. The number of international applications filed and foreign patents received in 2019 totalled 439 (against a target of 361). As at December 31, 2019, the number of patents obtained for inventions, utility models and industrial designs, certificates for computer software and databases, and registered items of know-how totalled 10,411.

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

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

In 2020, ROSATOM plans to:

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

In 2019, ROSATOM’s research organizations created a favourable environment for the development of young specialists:

- In 2019, number of patents obtained for inventions, utility models and industrial designs, certificates for computer software and databases, number of registered items of know-how totalled 10,411.

In 2020, ROSATOM plans to:

- Development of two-component nuclear power technologies with a closed nuclear fuel cycle;
- Development of controlled thermonuclear fusion technologies and innovative plasma technologies;
- Development of experimental test benches and infrastructure for the Russian thermonuclear facility;
- Establishment of an international consortium of users of the MBIR reactor.

### Table: Patent Activity

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<thead>
<tr>
<th>Indicator</th>
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<td>735</td>
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<td>535</td>
<td>735</td>
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</table>
5.2. BUSINESS DIVERSIFICATION

Key results in 2019

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

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

New businesses (those that cater primarily to markets outside the scope of the industry) are developed first and foremost in those segments where ROSATOM has capabilities and technological know-how. This approach helps it to mitigate market and technological risks. New business areas have been formed taking into account the maximum number of overlaps with existing technical, technological and research competences, including the research and production capabilities of the Corporation’s enterprises.

The Corporation has developed an effective system for managing new businesses; it includes integrators and enterprises in the relevant business areas. The responsibility for business development at all levels is reflected in overarching key performance indicators:

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

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

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

5.2.1. RESULTS IN 2019

In the reporting year, revenue from new products totalled RUB 227.9 billion, which is 1.7% above the target (RUB 224 billion) and 15.9% more than in 2018. The 10-year order portfolio reached RUB 1,169.1 billion, which is 8% above the target (RUB 1,082.5 billion) and 8% more than in 2018.

See also the section ‘Developing the Regions of Operation’.

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<th>Indicator</th>
<th>2017</th>
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<tr>
<td>REVENUE FROM NEW PRODUCTS AND 10-YEAR PORTFOLIO OF ORDERS FOR NEW PRODUCTS, RUB BILLION</td>
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<td></td>
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<tr>
<td>Revenue from new products</td>
<td>170.9</td>
<td>196.7</td>
<td>227.9</td>
</tr>
<tr>
<td>10-year portfolio of orders for new products</td>
<td>814.1</td>
<td>1,082.6</td>
<td>1,169.1</td>
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<table>
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<th>2018</th>
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<tr>
<td>STRUCTURE OF REVENUE FROM NEW PRODUCTS IN 2019</td>
<td></td>
<td></td>
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<tr>
<td>JSC Rusatom Automated Control Systems</td>
<td>1.08%</td>
<td></td>
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<tr>
<td>JSC Khimpromengineering</td>
<td>1.38%</td>
<td></td>
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<tr>
<td>JSC Rusatom Overseas</td>
<td>1.6%</td>
<td></td>
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<tr>
<td>JSC TENEX</td>
<td>3.39%</td>
<td></td>
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<tr>
<td>Innovation Management Unit</td>
<td>3.84%</td>
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<tr>
<td>Northern Sea Route Directorate</td>
<td>4.09%</td>
<td></td>
<td></td>
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<tr>
<td>JSC TENEX</td>
<td>4.13%</td>
<td></td>
<td></td>
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<tr>
<td>JSC Rusatom Healthcare</td>
<td>4.37%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel Division</td>
<td>5.6%</td>
<td></td>
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<tr>
<td>Mining Division</td>
<td>0.83%</td>
<td></td>
<td></td>
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<tr>
<td>JSC NovaWind</td>
<td>0.49%</td>
<td></td>
<td></td>
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<tr>
<td>JSC Rusatom Greenway</td>
<td>0.43%</td>
<td></td>
<td></td>
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<tr>
<td>Life Cycle Back-End Division</td>
<td>0.24%</td>
<td></td>
<td></td>
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<tr>
<td>Power Engineering Division</td>
<td>33.25%</td>
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<tr>
<td>Nuclear Weapons Division</td>
<td>18.14%</td>
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<tr>
<td>Mechanical Engineering Division</td>
<td>17.14%</td>
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<td>0.43%</td>
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</table>
ROSATOM is actively developing the Russian wind power market. In March 2020, the Adygea Wind Power Plant (WPP) started to supply electricity to the Russian wholesale market. This is the Corporation’s first wind farm, which comprises 60 wind turbines with a total installed capacity of 150 MW.

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

In 2019, ROSATOM played an active role in establishing the Composite Without Borders Inter-Regional Industry Cluster, which includes the Republic of Tatarstan and the Saratov and Moscow Regions. It is intended that the Tula and Ulyanovsk Regions will be included in the Cluster in 2020. The Cluster will facilitate cooperation between the regions in order to launch full-cycle production of composite materials in Russia, including the production of carbon fibre, glass fibre, basalt fibre, fabrics and pre-pregs based on them, and finished composite products for end users, and to create the relevant process chain.

In 2019, ROSATOM is implementing a WPP construction programme on four more sites in the Stavropol Territory and the Rostov Region. The next major wind farm will be built in the Kochubeyevsky District of the Stavropol Territory. Its installed capacity will total 210 MW.

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

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

In 2019, targets set under the Infrastructure for the Management of Hazard Class 1 and 2 Waste Federal Project were achieved. The development of a national information system for the management of hazard class 1 and 2 waste was initiated. The system will make it possible to accumulate all information about the waste management system, monitor waste flows from waste generation sources to waste processing sites, keep records, detect violations, optimize logistics and select the best infrastructure location. Targets for environmental remediation as part of municipal landfill reclamation in Chelyabinsk were exceeded.

**NEW MATERIALS**

In 2019, the Corporation signed an agreement with PJSC RusHydro on cooperation in the field of composite materials. The cooperation includes such areas as composite solutions for main and auxiliary equipment and structural components of small-scale hydro power plants, wind power plants and external reinforcement systems.

In 2019, bench tests of a KLT-6 linear particle accelerator and an upgraded AGAT-VT brachytherapy facility were completed. Upgraded facilities for the production of molybdenum-99, lutetium-177 and rutherium-182 for use in nuclear medicine started commercial operation.

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In 2019, the Corporation signed a memorandum of cooperation with the Federal State Budgetary Institution National Medical Research Radiological Centre of the Ministry of Health of Russia. The memorandum sets out plans for expanding cooperation on clinical trials of radionuclide products and medical equipment developed and produced for nuclear medicine and medical radiology.

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

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

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

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

The Corporation signed an agreement with PJSC ROSSETI on cooperation in energy markets, digitization of the electricity industry and producing substitutes for imported electrical equipment.

HYDROGEN ENERGY

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

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

5.2.2. PLANS FOR 2020

In 2020, the Corporation plans to approve programmes for additive manufacturing and the development of the lithium business. In the future, international logistics and hydrogen energy may also be given the status of strategically important business areas.

In addition, in 2020, the Corporation plans to approve a product strategy in the sphere of nuclear instrumentation engineering.

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

As part of its composite materials business, in 2020, the Corporation plans to commission a PAN precursor plant. The Corporation will initiate the establishment of the Polymer Composite Materials Competence Centre as part of implementation of the road map for developing a high-technology area, Technology for New Materials and Substances, in Russia.

As part of its environmental initiatives in the sphere of class 1 and 2 industrial waste management, ROSATOM intends to build an ash and slag processing facility.
Key results in 2019

Digital products: a trading firm, Rusatom Digital Solutions, was established; industry revenue from the sales of ROSATOM's digital products was consolidated. A number of products were unveiled: Logos Aero-Hydro, a solution solving decision-making on the management of gas pipeline systems; and The Technical Documentation E-Shop. Enterprises in the industry started to adopt the Logos product; migration of ROSATOM's information systems to the core data centre, Kalininsky, was initiated.

Digital economy of Russia: as a competence centre, ROSATOM initiated the preparation and approval of seven road maps for developing end-to-end digital technologies as part of the Digital Economy National Programme. A large-scale project to create a Russian-designed quantum computer was launched, with ROSATOM as the responsible contractor.

Internal digitization: a design concept of architecture of an integrated digital platform for the nuclear industry was developed. A digital import substitution programme was launched, and four key areas of its implementation were singled out.

Digital technologies: enterprises in the industry were audited in order to identify their needs for end-to-end digital technologies. The Digital Seasons Production Technology Club was started.

The organizational structure for digital transformation management in ROSATOM was established. Executives responsible for digital transformation were appointed in the Divisions, functions and enterprises directly subordinate to ROSATOM.

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

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

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

The road map also includes creating a science and technology ecosystem for developing quantum computing. It will cover a number of initiatives: the creation of the National Quantum Laboratory (a major element of this ecosystem; it will serve as a platform for cooperation between key participants of initiatives to develop quantum computing).

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

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

In 2019, we launched our first major projects aimed at producing substitutes for imported products across several main classes of IT solutions.

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

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

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

At year-end 2019, ROSATOM's potential digital product portfolio comprised 19 product and 20 services. All solutions developed by 33 enterprises in the industry, 20 of which were at the stage of active develop-ment and launch on the market.

In 2019, we created the organizational structure for digitization management. ROSATOM's Digital Transformation Department, which is responsible for the uniform digital strategy, Rusatom Digital Solutions, a trading firm, and Private Institution Ci-frum, a digital technology laboratory, were established within the Business Unit and started to operate as planned. Personnel respon-sibilities responsible for digital transformation were appointed in the Divisions, functions and enterprises directly subordinate to ROSATOM.
In 2019, ROSATOM as one of the key participants of the digitalization process in the Russian Federation initiated the development of seven road maps under the Digital Technology Federal Project, which forms part of the Digital Economy National Programme. We achieved all the targets that had been set for us.

We received recognition for our contribution to the digitization of the Russian economy at the Global Technology Leadership Forum. As part of this event, awards were given:
- To ROSATOM as a whole for initiating the preparation of road maps for developing end-to-end digital technologies;
- To JSC Rosenergoatom for implementing the Kalininsky Data Centre project, which leverages the company’s key capabilities in designing and building failure-free operation systems;
- To NIKIRET (an organization managed by ROSATOM) for developing the Pilot Access Control System designed for use at public events, which proved a great success during the 2014 Winter Olympics and the 2018 FIFA World Cup. The system continues to be used at stadiums across the country to ensure the safety of spectators and sports fans.

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

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

Digitization of the economy and everyday life is a key modern trend. ROSATOM leverages its extensive experience in responding to major technological challenges to develop efficient innovative solutions for operating in the digital world of the future.

6.1. UNIFORM DIGITAL STRATEGY

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

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

The Uniform Digital Strategy relies on the following major pillars:
- Strategic partnerships and M&A;
- Organizational change;
- Digital competences and culture.

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

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

In order to implement the UDS, the Digitization Unit has been formed within the Corporation; it includes the following divisions and companies:
- The Digital Transformation Department (established in 2019);
- The Information Technology Department;
- The IT Department of JSC Greenatom (including the CRTESIIT);
- The Digital Economy of Russia Project Office;
- LLC IV Kvant, an operator under the road map for the development of a quantum computer (established in 2019);
- Private Institution Cifrum, ROSATOM’s digital technology laboratory (established in 2019);
- LLC Rusatom Digital Solutions, a trading firm selling digital products and solutions (established in 2019);
- The Process Architecture Centre at JSC RPS.
In 2019, an agreement was signed with the Russian Government on developing a high-technology area: quantum computing. Under the agreement, a large-scale project was launched to develop a Russian-designed quantum computer. The use of quantum computers will enable a major breakthrough in solving a wide range of problems, such as modelling the behaviour of molecules to develop new drugs and tailored materials, complex logistical problems, big data management, ensuring information security, etc.

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

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

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

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

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6.3. DIGITAL PRODUCTS

In 2019, the development of ROSATOM’s digital product portfolio was focused on six prioritized areas:
- Science-based modelling and R&D;
- Enterprise and production management;
- Digital infrastructure;
- Design and construction/digital twins;
- Information security and digital physical security;
- Digitization of municipal services and processes.

Flagships have already been developed in each of these areas. They were created by various Divisions and enterprises of the Corporation, and the first customers for these products include major industrial, energy, and oil and gas companies, which are leaders in strategically important sectors of the Russian economy. At year-end 2019, the Corporation’s digital product portfolio included about 150 products.

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

SCIENCE-BASED MODELLING AND R&D

Logos
Logos is a software package designed following several years of development efforts initiated in 2009 by FSUE RFNC VNIIEF. The Logos product family comprises three modules:
- Logos Aero-Hydro (launched on the market in 2018 and designed for the modelling of aero- and hydrodynamic processes);
- Logos Thermo, which was launched in 2019; it is designed for assessing thermal performance and behaviour of components and assemblies;
- Logos Strength (scheduled to be launched on the market in 2020). It is designed primarily for solving static and dynamic strength problems.

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

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

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

Digital Enterprise FLCS

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

Prizma 2.0

Prizma (‘Prism’) 2.0 is a Russian-designed automated system for discrete production management. It has been designed specifically for ROSATOM’s instrumentation engineering enterprises and similar enterprises in other industries. The key advantages of this system include compliance with information security requirements, independence from foreign vendors, and a high level of availability for fast deployment.

Technical Documentation E-Shop

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

DIGITAL INFRASTRUCTURE

Data centres

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

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

INFORMATION SECURITY AND DIGITAL PHYSICAL SECURITY

Pilot Access Control System

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

The system was successfully used during the 2014 Winter Olympics in Sochi and the 2017 FIFA Confederations Cup. The Pilot Access Control System was also in full use during the 2018 FIFA World Cup and the 2019 Winter World University Games in Krasnoyarsk; by the end of the reporting year, it had been installed at stadiums across Russia.

In December 2019, the Pilot Access Control System won an award at the Global Technology Leadership Forum.

Performance of State Atomic Energy Corporation Rosatom in 2019

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

Multi-D digital platform

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

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

Its modular design enables phased implementation of individual elements of the platform at different stages of the NPP construction cycle and makes it possible to combine the modules in a way that is tailored to a specific project. This approach is necessitated by rapid development of digital technologies globally; it helps to meet the following key requirements:
- Compliance with the requirements for digital products set out in EPC contracts;
- Independence from vendors and imported solutions; adaptability to individual needs of business customers;
- Improved accuracy of monitoring, forecasting and modelling of key milestones of the projects that are being implemented;
- Management decision-making based on accurate data.
6.4. INTERNAL DIGITIZATION

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

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

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

Import substitution in the sphere of IT is one of the key priorities of ROSATOM’s internal digitization initiatives. The CRTESIIT was established and is now in operation. Key import substitution targets for 2022 were approved for Russian nuclear organizations.

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

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

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

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

6.5. TECHNOLOGICAL DEVELOPMENT

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

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

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

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

7.1. Escorting Vessels and Handling Cargo Traffic along the Northern Sea Route 127
7.2. Construction of New Icebreakers 128
7.3. New Products 128
7.4. Digitization of Operations 128
7.5. Activities of FSUE Hydrographic Enterprise 129
7.6. Plans for 2020 and for the Medium Term 130
Key results in 2019
- The targets set for the Northern Sea Route Federal Project were met. Cargo traffic totalled 31.5 million tonnes (against a target of 26 million tonnes).
- The Ural icebreaker was launched, and sea trials of the Arktika icebreaker began.
- The construction of the fleet of port vessels for the Yamal LNG project was completed.

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

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

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

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

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

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

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

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

2019 saw the 60th anniversary of the Russian nuclear-powered icebreaker fleet.
Under the Northern Sea Route Federal Project, cargo traffic along the NSR is projected to reach 80 million tonnes per year by 2024. Between 2030 and 2035, cargo traffic may increase to 100-120 million tonnes per year.

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

As at December 31, 2019, the nuclear-powered icebreaker fleet included:
- Two nuclear icebreakers with 75,000 h.p. two-reactor nuclear power units: Yamal and 50 Let Pobedy;
- Two nuclear icebreakers with a 50,000 h.p. one-reactor nuclear power unit: Taymyr and Vaygach;
- Sevmorput, a nuclear-powered LASH carrier with a 40,000 h.p. one-reactor nuclear power unit;
- Imandra and Lotta floating maintenance bases;
- Serebryanka, a motor vessel intended for liquid RAW management and SNF transportation;
- Rossita, a motor vessel used for SNF and RAW transportation; and
- Rosta-1, a radiation monitoring vessel.

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

In 2019, ROSATOM met the targets set for the Northern Sea Route Federal Project ahead of schedule. Cargo traffic totalled 31.5 million tonnes (against a target of 26 million tonnes). Both the number of escorted vessels and their gross tonnage increased significantly, mainly due to the ramp-up of the LNG plant in the seaport of Sabetta to rated capacity and the commissioning of large-capacity LNG carriers exporting liquefied natural gas as part of the Yamal LNG project.

In 2019, long-term cooperation agreements were signed with major operators of oil, gas and mineral deposits in the Russian Arctic. The new long-term contract format enables companies to secure logistic support provided by icebreakers with a planning horizon of 2025-2027 and the possibility of extending the terms of services provided under options amid growing cargo traffic along the Northern Sea Route.
To handle the growing cargo traffic along the Northern Sea Route, ROSATOM is upgrading its icebreaker fleet on a large scale. By the end of 2019, the construction of three Project 22220 multipurpose nuclear icebreakers was underway. In the reporting year, the Ural icebreaker was launched (the Sibir and Arktika icebreakers were launched in 2017 and 2016 respectively). In 2019, sea trials of the Arktika flagship icebreaker began. In the reporting year, ROSATOM concluded a contract for the construction of two more follow-on icebreakers of this type.

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

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

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

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

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

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

In 2019, a digitization programme was developed for FSUE Atomflot. With its engine power totalling 12 MW, the vessel can successfully maintain a speed of 2 knots through ice that is 1.5 metres thick and reach a speed of 4 knots in broken ice. Previously, the Pur, Tambey, Nadym and Yuribey tugboats had been built as part of the project. The vessels used in the project operate together with nuclear icebreakers and gas tankers, enabling FSUE Atomflot to provide a full range of services in the port of Sabetta.

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

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

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

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7.6. PLANS FOR 2020 AND FOR THE MEDIUM TERM

- To meet the target for cargo traffic under the Northern Sea Route Federal Project;
- To continue the construction of Project 22220 multipurpose nuclear icebreakers, commission the Arktika flagship icebreaker and carry out sea trials of the Sibir icebreaker;
- To extend the service life of reactor units of the Taymyr and Vaygach nuclear icebreakers;
- To lay the keel of the Lider icebreaker;
- To put the automated control system of the Marine Operations Headquarters into commercial operation;
- To organize a voyage of the Sevmorput nuclear-powered LASH carrier to the Antarctic to deliver cargo for the construction of an Antarctic station;
- To organize seafloor topography surveys along the NSR, in the Yenisei Gulf and the Yenisei and Kolyma Rivers;
- To organize maintenance, operation and infrastructure development of GLONASS/GPS monitoring and correction stations in the Arctic;
- To organize the construction of facilities forming part of the Global Maritime Distress and Safety System;
- To continue the construction of two hydrographic survey vessels and two buoy tenders;
- To develop the NSR port infrastructure, including the construction of the Utrenny liquefied natural gas and gas condensate terminal in the seaport of Sabetta.
EFFECTIVE MANAGEMENT OF RESOURCES
In accordance with Article 23 of Federal Law No. 317-FZ of December 1, 2007 on State Atomic Energy Corporation Rosatom, the Supervisory Board is ROSATOM’s supreme governing body. The powers of the Supervisory Board are stipulated by Federal Law No. 317-FZ of December 1, 2007.

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

The Supervisory Board members and chairman are appointed by the President of the Russian Federation. The Supervisory Board members, except for ROSATOM’s Director General, are not executives of ROSATOM.

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

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

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

**VALUE CREATION ACTIVITIES**

(See the section ‘Value Creation and Business Model’)

**SUPERVISORY BOARD**

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

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

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

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

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The functions and powers of the Director General are stipulated in the Federal Law on State Atomic Energy Corporation ROSATOM. In the reporting year, the Supervisory Board held 12 meetings, including three face-to-face meetings, and considered 34 issues.

The Supervisory Board approved the following:

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

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AUDITING COMMISSION

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

COMPOSITION OF THE AUDITING COMMISSION

Roman Art'yukhin
Head of the Federal Treasury, Chairman of the Auditing Commission

Olga Al'blueva
Administrative Aide in the Presidential Domestic Policy Directorate of the Presidential Executive Office

Alexey Lipaev
Deputy Department Director, Head of the Office for Budgetary Policy in the Sphere of the State Defence Order and Material Reserves of the Department for Budgetary Policy in the Sphere of State Military and Law Enforcement Services and the State Defence Order of the Ministry of Finance of the Russian Federation

Andrey Pogodin
Chief Engineer of the 12th Main Department of the Ministry of Defence of the Russian Federation

Vasily Utkin
Office Head of the Department for the Defence Industry of the Government of the Russian Federation

COMMISSIONS, BOARDS AND COMMITTEES UNDER THE GOVERNING BODIES

In 2019, ROSATOM had about 30 permanent committees, boards and commissions under the governing bodies.

Committee/Board/Commission Chairman

KEY COLLECTIVE AND ADVISORY BODIES AS AT DECEMBER 31, 2019

Strategic Council
Alexey Likhachev, Director General

Operations Committee
Staff and Incentives Committee
Ivan Kamenskikh, First Deputy Director General for Nuclear Weapons

Steering Board of the Proryv (Breakthrough) Project

Alexander Lokshin, First Deputy Director General for Operations Management

Investment Committee
Central Procurement Commission

Ethics Board
Committee on the Standardization of Technical Specifications

Committee on the Restructuring of Non-Core Assets, Real Property and Equity

Committee on Cost within International Sales

Committee on Strategic Partnerships, Mergers and Acquisitions

Committee on Venture Capital Financing

Committee for Corporate Development and International Business

Charity Committee

Risk Committee

Science Committee
Technical Committee of the Proryv Project

Central Procurement Commission
Committee on Procurement Strategies

Central Arbitration Committee (in procurement)
Committee on Pricing in the Construction of Nuclear Facilities

8.1.2. IMPROVEMENT OF THE CORPORATE GOVERNANCE SYSTEM

In the reporting year, the Corporation continued to adopt new regulations governing the cooperation between ROSATOM and the holding companies of its Divisions, business incubators and industry complexes.

An industry-wide mechanism for the conclusion of corporate integration and cooperation deals by ROSATOM and its organizations was improved.

The Litigation industry-wide centre for claims administration and litigation management started pilot operation. The Centre will:

- Provide a shared industry-wide information space for claims administration;
- Help to centralize the system for the monitoring of enforcement of cases and compliance with deadlines as part of claims administration and the relevant reporting.
8.1.3. KEY CHANGES IN THE CORPORATE STRUCTURE IN 2019

To promote its digital product portfolio on the market and to manage internal digitalization programmes and projects, ROSATOM established LLC Rusatom Digital Solutions and Private Institution for Digitization of the Nuclear Industry Cifrum.

To improve development processes in the electric power industry, JSC Rosenergoatom together with JSC Inter RAO – Electric Power Plants, JSC SD UPS and JSC UPS EC Real Estate established the Association of Digital Industry Development Organizations Digital Energy.

To create an industry integrator of logistical services and develop a new international business, JSC Atomenergoprogon established a wholly owned subsidiary, LLC Rusatom Cargo.

To develop the logistics business in the industry, JSC Atomenergoprogon acquired a 30% shareholding in Delo Group, a major Russian intermodal container terminal operator.

To ensure effective implementation of the Akkuyu NPP construction project in Turkey, JSC CONCERN TITAN-2 and a Turkish company IRC MBIR Consortium Leader.

To implement the project to build the Multipurpose Fast Neutron Research Reactor (MBIR) in cooperation with its foreign partners, JSC Atomenergoprogon established a wholly owned subsidiary, LLC IRC MBIR Consortium Leader.

 Shares of six joint-stock companies under federal ownership were transferred to ROSATOM pursuant to Decree No. 1241 of the Russian Government dated October 12, 2017 as an asset contribution of the Russian Federation.

 Shares of seven joint-stock companies under federal ownership were transferred to ROSATOM pursuant to Order No. 1066-r of the Russian Government dated May 25, 2019 as an asset contribution of the Russian Federation.

In 2019, ROSATOM's trademark was registered in Bangladesh and Indonesia. The Corporation submitted applications for trademark registration in another 15 countries where it has strategic interests.

To promote services provided by the data centre in Udomlya, JSC Rosenergoatom and LLC LinKey, an international data centre operator, established a joint venture, JSC ATOMDATA, on a parity basis.

To implement the project to build the Multipurpose Fast Neutron Research Reactor (MBIR) in cooperation with its foreign partners, JSC Atomenergoprogon established a wholly owned subsidiary, LLC IRC MBIR Consortium Leader.

Shams of six joint-stock companies under federal ownership were transferred to ROSATOM pursuant to Decree No. 1241 of the Russian Government dated October 12, 2017 as an asset contribution of the Russian Federation (as part of the completion of privatization of FSUEs).

Shares of seven joint-stock companies under federal ownership were transferred to ROSATOM pursuant to Order No. 1066-r of the Russian Government dated May 25, 2019 as an asset contribution of the Russian Federation.

8.1.4. NON-ARM’S LENGTH TRANSACTIONS

In accordance with Federal Law No. 317-FZ of December 1, 2007, the Supervisory Board approves non-arm’s length transactions. In 2019, five non-arm’s length transactions were approved with the following organizations:

- The Government of the Nizhny Novgorod Region and the National Research Centre Kurchatov Institute;
- The Foundation for Advanced Research Projects.

8.2. RISK MANAGEMENT

8.2.1. RISK MANAGEMENT SYSTEM

The industry-wide risk management system (RMS) is integrated into ROSATOM's planning and management processes. The RMS is based on a continuous cyclical process of identifying, assessing and managing the risks that can affect the Corporation’s short- and long-term performance and the implementation of its strategy.

The RMS is being developed in accordance with the approved Risk Management Development Programme for the period from 2019 through 2024.

In 2019:

- Approaches to risk monitoring and the prevention of risk recurrence were developed: a database of the relevant indicative external and internal case studies and NPP construction benchmarks (systemic risks) was created; an expert assessment of the impact of systemic risks on project cost, time frame and likelihood of abandonment was carried out;
- A quantitative risk assessment was carried out for ROSATOM's NPP construction projects.

8.2.2. RISK MANAGEMENT PRACTICES

A list of key risks of ROSATOM and its organizations and a matrix of responsibility for the management of key risks were approved;

An approach to early response to risks was developed and approved: a list of key risk indicators was compiled, including a description, sources of information, the calculation algorithm and frequency, thresholds (warning and response thresholds); an expert assessment of key risk indicators was carried out, and data on changes in their levels was collected;

Risk management practices forming part of maintenance processes in NPP construction projects in Russia and abroad were gathered;

Risk management measures were implemented in accordance with recommendations based on the findings of a comprehensive thematic audit of efficiency of cross-divisional cooperation on the Akkuyu and Hanhikivi NPP construction projects.

An assessment using the Monte Carlo method was carried out for Hanhikivi NPP (Finland), Akkuyu NPP (Turkey) and Rooppur NPP (Bangladesh). A parametric assessment was carried out for Hanhikivi NPP (India, power units Nos. 3-6), D’Ivetea NPP (Egypt), Akkuyu NPP (Turkey), Rooppur NPP (Bangladesh), Paks NPP (Hungary), Karak NPP-2 and the Sibnov NPP (Uzbekistan).

8.2.3. RISK MONITORING AND REPORTING

Approaches to risk monitoring and the prevention of risk recurrence were developed: a database of the relevant indicative external and internal case studies and NPP construction benchmarks (systemic risks) was created; an expert assessment of the impact of systemic risks on project cost, time frame and likelihood of abandonment was carried out;

An expert assessment of key risk indicators was carried out, and data on changes in their levels was collected;

Risk management practices forming part of maintenance processes in NPP construction projects in Russia and abroad were gathered;

Risk management measures were implemented in accordance with recommendations based on the findings of a comprehensive thematic audit of efficiency of cross-divisional cooperation on the Akkuyu and Hanhikivi NPP construction projects.
RISK MANAGEMENT PROCESS AT ROSATOM

RMS processes

1. RISK IDENTIFICATION
   - Proactive risk identification at all management levels, appointment of risk owners

2. RISK ASSESSMENT
   - Qualitative and quantitative assessment of the impact on the Corporation’s objectives within different time frames

3. RISK MANAGEMENT
   - Planning of risk management measures, assessment of their effectiveness

4. RISK MONITORING
   - Monitoring compliance with the risk appetite level

RMS METHODOLOGY MANAGEMENT
   Methodological support of RMS processes and individual risk management

RMS PROCESS EFFECTIVENESS MONITORING
   Internal and external monitoring of RMS effectiveness

ORGANIZATIONAL MODEL OF THE RISK MANAGEMENT SYSTEM AT ROSATOM

Director General and Strategic Council

Risk Committee

Risk owners at the Corporation and Division levels

Risk Management Department/ Risk Officers in Divisions

Strategic level
   - Aligning risk management with the Corporation’s business strategy

Tactical level
   - Organization of effective RMS functioning in accordance with the Corporation’s strategy and established risk appetite

Operational level
   - Risk identification and assessment, development and implementation of risk management measures

Organizational and methodological support of RMS processes at the Corporation and Division levels

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

Comprehensive risk management measures largely offset the negative impact of external factors on the implementation of the Corporation’s strategy. The connection between critical risks and the Corporation’s strategic goals is shown in section 8.2.2.3.

8.2.2. KEY BUSINESS RISKS OF ROSATOM

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

RISK RADAR

Low level

High level

Critical level

High level

Low level

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 risks
13. Climate change risks

The annual report does not contain an exhaustive description of all risks that may affect the Corporation’s operations; it only provides information on key risks.
### 8.2.3. RISK MANAGEMENT OUTCOMES IN 2019

#### Change in estimated risk levels for 2020:

<table>
<thead>
<tr>
<th>Change in estimated risk levels</th>
<th>ROSATOM's strategic goals:</th>
<th>Connection with strategic goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>increase</td>
<td>To increase the international market share 1</td>
<td>1 To increase international market share</td>
</tr>
<tr>
<td>decrease</td>
<td>To reduce production costs and the lead time 2</td>
<td>2 To reduce production costs and the lead time</td>
</tr>
<tr>
<td>no significant changes</td>
<td>To develop new products for the Russian and international markets 3</td>
<td>3 To develop new products for the Russian and international markets</td>
</tr>
<tr>
<td></td>
<td>To achieve global leadership in state-of-the-art technology 4</td>
<td>4 To achieve global leadership in state-of-the-art technology</td>
</tr>
</tbody>
</table>

#### FINANCIAL RISKS

1. **Currency risk**
   - Adverse changes in exchange rates
   - (Executives of ROSATOM’s Divisions)
   - Management approaches:
     - Setting the highest possible conversion rates when negotiating the terms of expense contracts;
     - Monitoring the terms of foreign currency payments under revenue contracts and expense contracts concluded as part of performance of revenue contracts;
     - Maintaining a balance of claims and liabilities denominated in foreign currencies (natural hedging);
     - Use of financial hedging instruments.
   - Results:
     - Foreign currency liabilities were met without raising additional funds to compensate for exchange rate fluctuations.
     - Divergent trends in the exchange rates of currencies in which project financing, key items of capital expenditure and operating cash flows are denominated were taken into account.
     - An optimal ratio of assets and liabilities denominated in the same currency was maintained.
   - Changes:
     - Due to high exchange rate volatility as at the beginning of 2020, the risk tends to increase.

2. **Interest rate risk**
   - (ROSATOM’s Treasury Department)
   - Adverse changes in interest rates, different timing of interest income and interest expenses
   - Management approaches:
     - Maintaining a balance of interest income and interest expenses in terms of timing and amounts;
     - Reasonable selection of interest rates (fixed or floating) for the expected maturity period. All things being equal, the Corporation prefers long-term fixed-rate loans with the option of penalty-free early repayment. It has not raised any loans with interest rates linked to the refinancing rate/key rate of the Bank of Russia;
     - Floating-rate loans on which interest rates may be increased are refinanced using the intra-group liquidity pool.
   - Results:
     - ROSATOM maintains a stable long-term credit portfolio. The average interest rate on the total debt portfolio of ROSATOM and its organizations was reduced to below 5% per annum, partly due to the refinancing of both the rouble-denominated and foreign-currency-denominated portions of the credit portfolio. The reduction in the risk level in 2019 was due to the effective use of the risk management approaches described above, as well as a decrease in the key rate of the Bank of Russia and lower volatility on the Russian credit market.
   - Changes:
     - The likelihood of an increase in the risk level due to an interest rate hike is assessed as low.

3. **Credit risk**
   - (ROSATOM’s Treasury Department for banks; executives of the Corporation’s organizations for other counterparties)
   - Failure by counterparties to fulfil their obligations in full and on time
   - Management approaches:
     - Setting and monitoring limits for counterparty banks;
     - Using suretyships, guarantees, restrictions on advance payments in favour of external counterparties;
     - Improving the legal framework for the wholesale electricity and capacity market (including increasing fines and improving the system of financial guarantees);
     - Monitoring the status of accounts receivable and the financial position of counterparties;
     - An internal counterparty solvency rating system.
### COMMERCIAL RISKS

#### 5. Nuclear fuel cycle (NFC) product and service market risk

**Risk description**
Adverse change in the pricing environment and demand on markets for natural uranium and uranium conversion and enrichment services

**Management approaches:**
- Maintaining an optimal balance between market-focused and escalation pricing mechanisms (based on benchmark price inflation) in contracts;
- Aligning pricing mechanisms used for procurement and those used in contracts with a high level of commodity risk;
- Discussing the volume of future orders with customers in advance;
- Embedding quantitative flexibility and options in contracts with suppliers to align purchase and sales volumes;
- Providing supply guarantee mechanisms;
- Improving the technical and economic characteristics of nuclear fuel; developing new types of fuel;
- Promoting products in new market segments.

**Results:**
In 2019 (like in previous periods), key drivers included electricity consumption in the first pricing zone, indexation of gas prices (with gas being the main type of fuel used by thermal power plants in the first pricing zone) and competition between power generation companies. There were no significant changes in the impact of these factors on electricity and capacity prices in 2019 compared to 2018.

**Connection with strategic goals**
- Risk management practices

---

#### 4. Liquidity risk

**Risk description**
Lack of funds for the fulfilment of obligations by ROSATOM and its organizations

**Management approaches:**
- Centralized cash management (cash pooling);
- Rolling liquidity forecasts and cash flow budget;
- Maintaining required amounts of open lines of credit with banks;
- Reducing the period of keeping spare cash on bank deposits when this is advisable from an economic perspective;
- Discussing matters related to state support with Russian federal executive authorities;
- Active use of project financing instruments as part of implementation of projects and programmes by the Corporation and its organizations;
- Maintaining credit ratings assigned to JSC Atomenergoprom by the ‘Big Three’ international rating agencies (S&P, Moody’s and Fitch), by JSC Expert RA and other rating agencies at the level of Russia’s sovereign credit rating.

**In 2019, the Analytical Credit Rating Agency (ACRA) assigned ROSATOM a credit rating at the highest possible sovereign credit rating level, AAA (RU), with a stable outlook.**

**Results:**
The Corporation maintained sufficient liquidity to repay liabilities on time, preventing unacceptable losses and reputational risk.

**Connection with strategic goals**
- Risk management practices

---

#### 6. Electricity and capacity market risks

**Risk description**
Adverse changes in electricity and capacity prices

**Management approaches:**
- The risk depends exclusively on external factors. The risk cannot be hedged using financial instruments due to the low liquidity of the market. To reduce the risk, power supply divisions of JSC Rosenergoatom are negotiating with PJSC FGC UES and JSC SO UEC in order to align the schedule of power grid equipment maintenance.

**Results:**
In 2019 (like in previous periods), key drivers included electricity consumption in the first pricing zone, indexation of gas prices (with gas being the main type of fuel used by thermal power plants in the first pricing zone) and competition between power generation companies. There were no significant changes in the impact of these factors on electricity and capacity prices in 2019 compared to 2018.

**Connection with strategic goals**
- Risk management practices

---

#### 7. Risk of a decrease in power generation

**Risk description**
Decrease in power generation due to equipment shutdowns and unavailability

**Management approaches:**
- Scheduled preventive maintenance and repairs at NPPs;
- Implementation of the NPP life extension programme and equipment upgrades to increase installed capacity and power generation at operating power units (including the possibility of power units operating at above nameplate capacity).

**Results:**
In 2019 (like in previous periods), key drivers included electricity consumption in the first pricing zone, indexation of gas prices (with gas being the main type of fuel used by thermal power plants in the first pricing zone) and competition between power generation companies. There were no significant changes in the impact of these factors on electricity and capacity prices in 2019 compared to 2018.

**Connection with strategic goals**
- Risk management practices
Risks and changes in risk levels (risk owners)

8. Industrial and environmental safety risk

Major accidents/incidents in nuclear enterprises

<table>
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<tr>
<th>Risk description</th>
<th>Risk management practices</th>
<th>Connection with strategic goals</th>
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Results:
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.

Changes:
The risk level has decreased. Implementation of a set of risk management measures and the use of tools forming part of the ROSATOM Production System has made it possible to offset the impact of negative factors.


9. Political risk

(Executive of the International Cooperation Department of ROSATOM)

Changes in the regulatory and political climate in foreign countries imposing restrictions on the operations of ROSATOM and its organizations

Management approaches:
- Coordination with the Russian Ministry of Foreign Affairs and other authorities; using the relevant intergovernmental mechanisms;
- Providing political support for global operations of nuclear organizations;
- Using the platform of specialized international organizations for communication and awareness campaigns;
- Establishing partnerships with local and foreign regional companies and searching for alternative partners;
- Examining alternative options for the supply of equipment that has been produced by the Corporation or is in production;
- Obtaining general export licences;
- Taking into account political interests of governments in the Corporation’s end markets.

Results:
The Corporation concluded 7 intergovernmental agreements and 23 major interdepartmental agreements, which is a positive trend.

Changes:
The risk tends to increase, as persisting sanctions pressure on Russian individuals and legal entities generally increases uncertainty over the possibility of implementation of specific economic projects.

For details, see the sections ‘International Cooperation’ and ‘International Business’.

10. Risk of loss of and damage to assets

(Candidate of the Asset Protection Department of ROSATOM)

Corruption and other offences leading to a damage to/loss of assets

Management approaches:
- ROSATOM has an integrated industry-wide system for the prevention of corruption and other offences;
- ROSATOM has issued local regulations specified in the recommended list of anti-corruption documents for ROSATOM’s organizations. Employees have been familiarized with the local regulations;
- Candidates nominated to various positions are screened, including in order to prevent conflicts of interest;
- Terms of reference are reviewed, and counterparties undergo due diligence checks in order to minimize the risk of corruption in the course of procurement procedures;
- ROSATOM operates a hotline.

Results: Safe operation of nuclear facilities and hazardous industrial facilities.
For details, see the section ‘Nuclear and Radiation Safety; Occupational Safety and Health’.
11. Reputational risk

(Communications Department of ROSATOM and executives of Divisions)

Changes in stakeholder perception of the trustworthiness and appeal of the Corporation and its organizations

Management approaches:

- Measures are taken to shape a positive public opinion on the development of ROSATOM's technologies (both nuclear and non-nuclear) through improved information transparency and open stakeholder engagement (including the functioning of an industry-wide public reporting system);
- The Corporation works continuously to improve the recognition and appeal of its HR brand (both in the industry and among prospective employees and within the expert community);
- ROSATOM continuously monitors public opinion on NPP construction and information on the decisions of government and regulatory bodies on curtailment of the nuclear industry in the countries where the Corporation is implementing projects. It continuously monitors and analyses news reports in the national and international media and information obtained during business meetings, industry conferences and workshops. Industry executives are promptly informed about key developments in the media space in Russia and abroad;
- If it is reasonable to make changes to the schedule of NPP construction projects in Russia and abroad, the relevant decisions are agreed with all parties involved in the projects and are reflected transparently in communications with partners and other stakeholders (including the general public and local communities);
- Technical tours and media tours of Russian nuclear facilities are arranged for foreign media representatives;
- The Corporation maintains a presence on social media;
- ROSATOM's representatives participate in international industry exhibitions (including ATOMEXPO) as speakers/delegates;
- The Corporation publishes printed materials (brochures, leaflets) to raise public awareness about the nuclear power industry.

Results:

Overseas projects are supported by government bodies. The main Russian nuclear industry exhibition, ATOMEXPO 2019, titled 'Nuclear for Better Life' was attended by over 4,000 specialists and experts from 74 countries worldwide. The findings of an opinion poll conducted in local communities near the construction site of Hanhikivi 1 NPP in Finland show that the level of public acceptance of the project increased from 73% to 75% in 2019 (the opinion poll was commissioned by Fennovoima and conducted by a Finnish company Norstat in November and December 2019). Between September and December, more than 10 scheduled public events were held in Turkey and received widespread positive coverage in the Turkish media (in Turkey, the Corporation is building Akkuyu NPP). According to an opinion poll by Levada-Centre, in 2019, 73.7% of the Russian population supported the use of nuclear power. Over the past few years, this figure remains persistently high. According to data in the Medialogia automated media monitoring and analysis system, in 2019, 95.4% of publications about the Corporation were positive or neutral. The Corporation received a number of prizes and awards in the sphere of personnel management. In March 2019, ROSATOM topped the Ranking of the Best Russian Employers compiled by HeadHunter.
Risks and changes in risk levels (risk owners)

A high level of transparency in ROSATOM is confirmed by the fact that it was included in the top groups in the sustainable development, corporate responsibility and reporting indices compiled by the Russian Union of Industrialists and Entrepreneurs (RSPP) for 2019 and that the quality of ROSATOM’s public annual report was assessed as high (the report for 2018 was awarded 5 stars (the highest rating) in the annual competition held by the RAEX-Analytics agency).

Systematic work initiated by ROSATOM to incorporate international sustainability principles and approaches into its operations and establish the relevant communication with stakeholders (via the corporate website, public reports, messages from senior executives, participation in specialized conferences, etc.) made an important contribution to strengthening ROSATOM’s reputation.

Changes:
An increase in the risk level was due to its strong correlation with political risk.

For details, see the sections ‘Stakeholder Engagement’, ‘Implementation of the HR Policy’ and ‘Public Reporting System’.

12. Project risk

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

Management approaches:
- Improving project management practices;
- Developing action plans for the interaction with foreign customers;
- Concluding long-term contracts stipulating fixed electricity prices;
- Developing standardized design solutions;
- Implementing a programme to reduce the cost and duration of NPP construction;
- Implementing measures forming part of the industry-wide approach to managing risks associated with NPP construction projects;
- Reallocating available credit resources between projects, when possible;
- Developing additive manufacturing, including a system of printing services and infrastructure for new digital production facilities, integrating the capabilities of ROSATOM’s enterprises in the sphere of development and operation of digital production facilities (including based on the Virtual Printer digital platform), supply of 3D printers and the relevant materials, and construction and operation of additive manufacturing centres in Russia and abroad.

Results:
ROSATOM continuously improves the system for managing all stages of NPP construction, from front-end engineering design to the commissioning of power units. The Corporation carries out quantitative risk assessment for NPP construction projects (using the Monte Carlo method). A pilot facility assembling 3D printers and producing components was put into operation.

13. Climate risk

Adverse climate change/impacts of natural disasters on the operations of the Corporation and its organizations

Management approaches:
- At the stage of NPP design, ROSATOM carries out a comprehensive assessment of risks associated with the climatic characteristics of the region where the proposed NPP construction site is situated;
- Calculations performed as part of an assessment of external impacts take into account the climatic characteristics of the customer country and form part of a probabilistic safety assessment;
- Industrial environmental control is performed to ensure that the operations of enterprises that make an impact on the environment comply with statutory limits and applicable environmental laws and regulations.

Results:
Following the completion of engineering surveys, appropriate design solutions are adopted for each NPP construction project taking into account the climatic characteristics of the region where the NPP will be built. ROSATOM makes sure that all its operations are environmentally safe; nuclear power generation facilities produce virtually no CO or CO2 emissions, helping to maintain the natural ecological balance and reduce the likelihood of adverse climate changes or natural disasters.
8.2.4. RISK INSURANCE

Risk insurance is one of the main risk management approaches used by ROSATOM. To improve the reliability of insurance coverage, in 2019, the Corporation continued to cooperate with the insurance community on the reinsurance of Russian operators against property risks. A significant share of liability of Russian NPPs for potential nuclear damage was transferred for reinsurance to the international pooling system. This proves that the international nuclear insurance community acknowledges the safety and reliability of Russian NPPs to be adequate. In-house insurance audits were conducted with assistance from experts of the Russian Nuclear Insurance Pool.

Key enterprises in the industry will continue to be audited for insurance purposes in 2020.

8.2.5. OBJECTIVES FOR 2020 AND FOR THE MEDIUM TERM

The Corporation has developed an action plan for 2020 covering the key areas of the Risk Management Development Programme for the period from 2019 through 2024. This plan takes into account both external factors related to the requirements of foreign customers (NPP construction on time and on budget) and Russian government bodies and internal factors (the need to build an efficient risk management system at ROSATOM that is aligned with global best practices).

The plan sets three key objectives for the development of risk management in the Corporation:

- To develop an automated risk assessment and management system, which will, among other things, enable the Corporation to maintain and update a knowledge base of typical risks and risk management measures;
- To develop the risk management expert community in the industry;
- To adopt procedures (including initial assessment) for managing risks associated with projects and programmes in the sphere of new business development.

8.3. PERFORMANCE OF GOVERNMENT FUNCTIONS

Key results in 2019

- The state defence order was 100% fulfilled.
- ROSATOM participated in the consideration of more than 400 bills.
- The government programme of the Russian Federation ‘Development of the Nuclear Power and Industry Complex’ was updated for the period until 2027.
- Overall performance against the targets set in the government programme of the Russian Federation ‘Development of the Nuclear Power and Industry Complex’ in 2019 was assessed at 99.73%.

8.3.1. PERFORMANCE OF THE NUCLEAR WEAPONS DIVISION (NWD)

In 2019, all targets set as part of the state defence order were achieved. ROSATOM’s enterprises conducted research and development.

A digitization strategy was developed for the NWD; it is aligned with ROSATOM’s Uniform Digital Strategy.
8.3.2. LAW DRAFTING

A landmark event in 2019 was the adoption of Federal Law No. 225-FZ of July 26, 2019 on Amendments to the Federal Law on Industrial and Consumer Waste and the Federal Law on State Atomic Energy Corporation Rosatom. The new law expanded the scope of Rosatom's jurisdiction and assigned it additional powers and functions in the sphere of hazard class 1 and 2 waste management.

Another important milestone in the reporting year was the adoption of Federal Law No. 81-FZ of May 1, 2019 on Amendments to Article 7 of the Federal Law on State Atomic Energy Corporation Rosatom Regarding Its Authority to Inspect Design Documentation of Nuclear Facilities under Construction Outside the Russian Federation and the Outcomes of Engineering Surveys Conducted for the Preparation of Such Design Documentation. This federal law granted Rosatom additional powers, thus closing a gap in the sphere of regulation of construction of nuclear facilities abroad and enhancing control over construction closing a gap in the sphere of regulation of construction of nuclear facilities abroad and enhancing control over construction.

As in previous years, the Corporation took an active part in the drafting and legal support of federal bills affecting its operations and the operations of its organizations in various areas (the use of nuclear energy, industrial safety, standardization, metrology, government support for business operations in the Russian Arctic, government regulation of prices (tariffs) and transformation of the legal framework regulating natural monopolies, addressing issues related to the location of wind turbines, etc.).

Overall, in 2019, the Corporation reviewed over 400 bills. Rosatom took an active part in the reform in the sphere of natural monopolies, government regulation of prices (tariffs) and transformation of the legal framework regulating natural monopolies, addressing issues related to the location of wind turbines, etc.).

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8.3.3. GOVERNMENT PROGRAMME ‘DEVELOPMENT OF THE NUCLEAR POWER AND INDUSTRY COMPLEX’

In 2019, the government programme of the Russian Federation ‘Development of the Nuclear Power and Industry Complex’ was being implemented. In the reporting year, the government programme was updated for the period until 202760. Amendments to the programme include the parameters of a comprehensive programme titled ‘Development of Technical Capabilities, Technology and Scientific Research in the Use of Nuclear Energy in the Russian Federation until 2024’, which is being developed by Rosatom. The measures and deliverables of this programme are aligned with the national goals and strategic development objectives of Russia stipulated in Decree No. 204 of the President of the Russian Federation dated May 7, 2018.

In 2019, the Russian Federation registered its title to 50 items of non-core assets and restructured 99 non-core items of real property owned by joint-stock companies in which Rosatom has a shareholding exceeding 25% were restructured (sold or liquidated). The relevant economic benefits totalled RUB 1.4 billion.

Overall performance under the government programme ‘Development of the Nuclear Power and Industry Complex’ was assessed at 99.73%. This assessment takes into account progress on measures scheduled for 2019 and the amount of budgetary and extra-budgetary financing used for implementing the measures stipulated in the government programme.

8.3.4. IMPLEMENTATION OF FEDERAL TARGET PROGRAMMES

In 2019, Rosatom's enterprises and organizations implemented measures forming part of three federal target programmes (FTP's).

To implement the FTP's (included in the part of the federal budget on which information is publicly available), Rosatom raised financing totalling RUB 34,414.2 million, including RUB 16,567.6 million from the federal budget and RUB 17,846.6 million from extra-budgetary sources.

8.3.5. STATE PROPERTY MANAGEMENT AND RESTRUCTURING OF NON-CORE ASSETS

In 2019, the Russian Federation registered its title to 50 items of non-core assets. Of these 275 non-core assets owned by joint-stock companies in which Rosatom has a shareholding exceeding 25% were restructured (sold or liquidated). The relevant economic benefits totalled RUB 4 billion.

Preclinical trials of a 40 W medical thulium laser were successfully completed. A mock-up of a 100 W laser for fragmenting kidney stones was designed and successfully tested.

In 2019, consolidated revenue from other products of the NWD totalled RUB 81.9 billion.

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8.4. FINANCIAL AND INVESTMENT MANAGEMENT

Key results in 2019
- The investment programme was 75% completed.
- Return on the investment portfolio stood at 11.3%.
- A total of RUB 37.1 billion was saved through intra-group financing between 2010 and 2019.

8.4.1. FINANCIAL MANAGEMENT

IMPLEMENTATION OF ROSATOMIC’S FINANCIAL STRATEGY

Given the scale of ROSATOM’s business in Russia and abroad, the Corporation’s management attaches special importance to the financial sustainability of nuclear organizations in a changing environment. The financial strategy is an integral part of ROSATOM’s overall business strategy. Its main goal is to ensure the financial sustainability of ROSATOM and its organizations and to maximize the efficiency of financing and financial risk management.

ROSATOM’s key financial transactions have been centralized. Cash flow management is centralized through:
- A single industry-wide legal framework regulating financial transactions (including the Uniform Industry-Wide Financial Policy);
- Vertical integration of treasury departments in subsidiaries and affiliates, which function is accountable to the Treasury Department of ROSATOM. The established treasury structure enables 100% control of funds in the industry;
- Centralized treasury transactions (complying with the financial policy);
- Using project financing instruments as part of project implementation by the Corporation and its organizations.

Targets for 2019 in the sphere of cooperation with banks, development of the cash pool and debt management set out in the financial strategy have been achieved.

In order to improve the performance of the treasury functions, in 2019, the Corporation continued to work on:
- Accumulating spare cash in the accounts of pool leaders;64
- Improving the accuracy of payment scheduling (a rolling liquidity forecast);
- Maintaining a competitive cost of servicing of the consolidated debt portfolio;
- Centralizing treasury transactions (complying with the financial policy);
- Using project financing instruments as part of project implementation by the Corporation and its organizations.

In 2019, ROSATOM continued to work towards further centralization of principal treasury functions of nuclear organizations in the Treasury Department of ROSATOM. The established treasury structure enables 100% control of funds in the industry.

In 2019, ROSATOM continued to work towards further centralization of principal treasury functions of nuclear organizations in the Treasury Department of ROSATOM, which communicates with nuclear organizations in a shared information space and is essentially a liquidity management centre.

An industry-wide automated system for recording treasury transactions (the Corporate Settlement Centre Information System), which enables the recording of all treasury transactions across the Corporation on a daily basis.

In the reporting year, JSC Atomenergoprom continued to take measures to maintain credit ratings assigned by the ‘Big Three’ international rating agencies (S&P, Moody’s Investors Service and Fitch Ratings) and the national rating agency, JSC Expert RA.

As at December 31, 2019, JSC Atomenergoprom was rated at the level of Russia’s sovereign credit ratings:
- BBB+/A-3 with a stable outlook by S&P;
- BBB with a stable outlook by Fitch Ratings;
- Baa3 with a stable outlook by the Moody’s Investors Service international rating agency;
- ruAAA with a stable outlook by the national rating agency, JSC Expert RA.

In addition, in the reporting year, the Analytical Credit Rating Agency (ACRA) assigned the Corporation the highest credit rating, AAA (RU), with a stable outlook.

RAISING FINANCING FOR DAY-TO-DAY OPERATIONS AND FOR PROJECTS

In 2019, the average interest rate on ROSATOM’s total debt portfolio denominated in Russian roubles was maintained below 8.4%. Throughout 2019, the Corporation maintained sufficient liquidity or sources of liquidity (credit facilities, etc.) to repay liabilities on time, preventing unacceptable losses and reputational risk.

The Corporation continued to use suretyship to secure obligations of organizations in the industry to their counterparties. This measure helps to reduce both the cost of bank guarantees and the cost of financing raised by ROSATOM (including interest expenses).

JSC AtomCapital (a wholly owned subsidiary of the Corporation acting as a pool leader in intra-group financing of FSUEs) enabled an optimal debt burden distribution between JSC Atomenergoprom and organizations and enterprises outside its scope.

In the reporting year, the Corporation continued to search for sources of financing for projects in traditional and new business areas.

Wind power

The limit under a credit facility agreement with JSC Gazprombank was increased by RUB 5.5 billion to RUB 69.7 billion as part of a project finance arrangement for the construction of a wind farm with installed capacity totalling 660 MW.

BOO projects

Independent advisors were engaged to conduct comprehensive due diligence for the Hanhikivi 1 NPP construction project.

Loan and collateral documents worth a total of USD 400 million were signed with PJSC Sberbank as part of the Akkuyu NPP construction project. The Corporation continued to take steps to obtain guarantee support for the project: agreement with Bpifrance on export credit support was formalized in the outcome document of the 25th session of the Franco-Russian Economic, Financial, Industrial and Trade Council (CEFIC) held in December 2019.

Concession projects in the utilities sector

A project finance arrangement was implemented as part of a project to renovate water supply and sewerage systems in the town of Lesnoy (Sverdlovsk Region). The acquisition of a shareholding in LLC WR-Lesnoy by PJSC Sovcombank was closed; the bank also acts as the lender under the deal.

Multipurpose fast neutron reactor

A target scenario for sources of financing was prepared using the tools of the VEB.RF Project Finance Factory. A syndicate comprising VEB.RF and JSC Gazprombank was selected as the financial partner of the project; their participation was approved by the VEB.RF Supervisory Board.

As at December 31, 2019, the Corporation continued to work towards further centralization of principal treasury functions of nuclear organizations in the Treasury Department of ROSATOM. The established treasury structure enables 100% control of funds in the industry;
MAKING THE RUSSIAN NUCLEAR INDUSTRY MORE ATTRACTIVE TO INVESTORS

In 2019, ROSATOM continued to take steps towards making the Russian nuclear industry more attractive to investors, engaging strategic investors in NPP construction projects in Russia and abroad, maintaining relationships with existing investors and lenders, and establishing relationships with and setting limits on credit facilities in new banks. Cooperation agreements were signed with financial institutions on the sidelines of business forums (the 2019 Saint Petersburg International Economic Forum, the Sochi Investment Forum, etc.). The agreements covered projects and digitization initiatives being implemented by ROSATOM and its organizations. During the year, ROSATOM organized visits to Leningrad NPP-2, which is currently under construction, and the construction site of the Adygea Wind Power Plant for representatives of Russian and foreign banks.

A round-table session titled ‘Investment in Sustainable Development: Opportunities and Challenges’ was held as part of the ATOMEXPO 2019 International Forum. The Corporation continued to promote financial and non-financial support instruments offered by JSC Russian Export Centre in the industry (including holding regular working group meetings attended by representatives of JSC Russian Export Centre and ROSATOM’s organizations).

A provisional financing structure was developed jointly with VEB.RF for the construction of a nuclear medicine centre on Russky Island (Primorsky Territory) and a radiology department building including a positron emission tomography centre in Irkutsk.

In 2019, the Ministry of Industry and Trade of Russia approved corporate competitiveness improvement programmes (CCIPs) for a number of ROSATOM’s organizations (JSC AECP, PSC ZVO-Podolsk, JSC NovaWind). Organizations implementing CCIPs are granted access to preferential government loans.

The Corporation continued to promote financial and non-financial support instruments offered by JSC Russian Export Centre in the industry (including holding regular working group meetings attended by representatives of JSC Russian Export Centre and ROSATOM’s organizations).

To discuss project financing arrangements to reduce recourse on ROSATOM and minimize the use of the Corporation’s consolidated investment resources (including through the use of project financing instruments);

To expand the use of financing instruments in order to reduce the cost of debt service and ensure timely and full financing of the investment programme of organizations in the industry (provided it is economically feasible to do so);

To discuss potential areas of cooperation in the sphere of digitization with credit institutions.

8.4.2. INVESTMENT MANAGEMENT

APPROACHES TO INVESTMENT MANAGEMENT

A distributed system has been built for investment decision-making: a corporate investment strategy and the investment programmes of organizations in the industry.

A phase-gate approach is used in the course of project implementation:

To discuss potential areas of cooperation in the sphere of digitization with credit institutions.

To ensure a consistent payment discipline for intra-group financing;

To improve the accuracy of medium-term cash flow planning;

To prevent internal competition for credit resources between organizations;

To continue to centralize cash management;

To focus on maintaining relations with supporting banks as the most reliable partners providing accessible funds in terms of both volumes and cost;

To fulfil all obligations (including covenants) to lenders and rating agencies;

To continue to centralize cash management;

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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 ensure a consistent payment discipline for intra-group financing;
In 2019, ROSATOM’s investment programme was 75% completed. The investment programme was not implemented in full (including in ROSATOM’s Divisions) due to the deferral of financing for certain projects to subsequent reporting periods.

Return on ROSATOM’s investment portfolio as a whole stood at 11.3%, while return on the portfolio excluding unprofitable projects (projects that do not produce economic benefits) reached 29%.

ROSATOM operates a venture fund, Digital Evolution Ventures, founded by JSC Atomenergoprom and LLC Orbita Capital Partners. The fund focuses on developing new businesses in promising sectors of the Russian and global economy.

Since the establishment of the fund, ROSATOM’s Investment Committee has reviewed 18 high-technology projects, 5 of which (in such areas as Energy Storage Systems, the Smart City, Digital Medicine and Artificial Intelligence) have been provided with funding. A list of about 150 promising projects worth a total of more than RUB 4 billion has been compiled.

In the reporting year, the Corporation updated the Comprehensive Programme of Measures to Improve the Maturity of Project Management in ROSATOM and Its Organizations.

Employees in the industry continued to develop their competences at the Project Management School. 577 people underwent assessment and subsequent training in 2019.

Challenges Mitigation measures
Slow processes in the sphere of new business development
- Decentralization of the decision-making system through an expansion of the Divisions’ powers
- Reducing the number of approvals and decision-making bodies, which will make it possible to speed up the launch of new businesses and reduce the load on the management

Organizational environment that is not conducive to the implementation of digitization projects
- Simplifying project formats; gathering best practices for the preparation of materials for investment decision-making bodies and communicating these practices to project teams
- Adapting the decision-making system for digitization projects; establishing the Quick Start Committee for investing in ideas with a budget totalling less than RUB 10 million

Lack of R&D integration with business initiatives
- Adopting a ‘one-stop-shop’ approach to all investment decisions concerning the Corporation’s scientific research efforts (a Council for Investing in Scientific Projects has been formed; its powers were delineated from those of other collective bodies responsible for innovation management)
- Increasing the level of maturity of investment and project management in the industry
- Preparing methodological guidelines for expert assessment of technological maturity of projects See also the section ‘Research and Innovations’.

PLANS FOR 2020 AND FOR THE MEDIUM TERM
- To develop project methodology on a systematic basis;
- To implement the Comprehensive Long-Term Programme of Measures to Improve the Maturity of Project Management in ROSATOM and its Organizations;
- To form business partnerships in order to develop technologies, research and technological capabilities in ROSATOM and its organizations;
- To digitize projects and investment activities.
8.5. ROSATOM PRODUCTION SYSTEM

Key results in 2019

- The status of an RPS Leader was given to 33 enterprises in the industry.
- 45 RPS benchmarks were created across various types of manufacturing operations.
- ROSATOM developed a new product, Lean Smart City.
- The Lean Polyclinic project was included in the Development of the Primary Healthcare System Federal Project.
- The Governors’ Club and the Russian Production Systems Partnership were established.

The ROSATOM Production System (RPS) is a lean manufacturing culture and a system for continuous process improvement to provide ROSATOM with competitive advantages globally. The RPS principles are instrumental in achieving one of the Corporation’s strategic goals: to reduce the production cost and the lead time by identifying and eliminating all types of losses in manufacturing enterprises and in offices and by improving the performance of each employee.

8.5.1. RESULTS IN 2019

RPS ENTERPRISES

Since 2015, RPS has been rolled out systematically across enterprises in the industry: goals are decomposed to the level of area supervisors; the manufacture of an enterprise’s core products (production flow) is optimized; RPS projects are implemented; training is provided for employees, and incentive systems are being developed.

In 2019, 35 enterprises were included in the scope of RPS roll-out, with 33 enterprises given the status of an RPS Leader. In order to obtain or confirm the status of an RPS Leader, in 2019, enterprises needed to achieve business goals set by ROSATOM and successfully undergo a peer quality review aimed at promoting development, which involved assessing the RPS benchmark created by an enterprise, its supplier development project and progress in the introduction of RPS engineering.

According to the RPS development concept, all enterprises participating in the systematic roll-out of the system are divided into three levels: RPS Leaders, RPS Candidates and RPS Reserve. RPS Leaders are provided with a package of privileges: a business coach makes on-site visits; employees are offered an opportunity to take business trips to leading foreign and Russian enterprises to share their experience; holiday packages are offered to employees’ families; employees receive vouchers for training at ROSATOM’s Corporate Academy, participate in the Workspace Design project, etc.

In order to reduce the cost and duration of NPP construction, in 2019, 34 RPS enterprises were taking active steps to assist the development of their suppliers. In addition, ROSATOM is implementing a supplier development programme as part of participation in the National Project to Improve Labour Productivity and Support Employment.

RPS BENCHMARKS

An RPS benchmark is a processing stage or a process in the flow of a key product of ROSATOM’s organization that has achieved the level of global best practices in production engineering. The Corporation tasks its enterprises with creating RPS benchmarks that could be used as a basis for training in the ROSATOM Production System for both employees in the industry and the country as a whole.

In 2018 and 2019, 45 RPS benchmarks were created by ROSATOM’s RPS enterprises across 16 types of manufacturing operations. The creation of each benchmark was preceded by at least five to seven years of preparatory work. In 2019, the main focus was on improving the benchmarks to make sure that they reach a ‘perfect’ state. At the next stage, the main task will be to create a benchmark product flow.

RPS ENGINEERING

In 2019, RPS engineering standards were being introduced at construction sites of 22 enterprises in the industry. Highlights of the year included the creation of a benchmark titled ‘Operational Management of the Kursk NPP-2 Construction Schedule’.

CHANGES IN THE NUMBER OF RPS ENTERPRISES IN THE INDUSTRY

- RPS enterprises
- RPS Leaders

<table>
<thead>
<tr>
<th>Year</th>
<th>Enterprises</th>
<th>Leaders</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>2016</td>
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<tr>
<td>2018</td>
<td>27</td>
<td>22</td>
</tr>
<tr>
<td>2019</td>
<td>35</td>
<td>33</td>
</tr>
</tbody>
</table>
INTRODUCTION OF LEAN TECHNIQUES IN RUSSIA’S SOCIAL SECTOR AND INDUSTRY

In 2019, a project was implemented in the Nizhny Novgorod Region to optimize the process of providing proper nutrition for babies aged under three years through special facilities dispensing baby formula. The aim of the project was to promote effective cooperation between the Ministry of Health, the Ministry of Social Policy and the administration of Nizhny Novgorod. As a result of the project, the amount of time required to complete the paperwork necessary for receiving subsidies was reduced from 23 to 9 days, while the number of visits to the relevant institutions was reduced from nine to two.

Another project, which was implemented by the Ministry of Sports of the Nizhny Novgorod Region and was aimed at optimizing individual rehabilitation programmes, enabled a 20% increase in the number of people who completed the rehabilitation process, while the amount of time spent on paperwork was reduced from two months to two weeks.

See also the section ‘Developing the Regions of Operation’.

Lean Polyclinic

In 2019, the project was included in the scope of the Development of Municipal and Regional Administration Systems. Letters of intent with regard to the implementation of the Lean Production System and the Smart City platform to support the development of municipal and regional administration systems.

In 2020, 36 enterprises will be included in the scope of RPS benchmarks and share best practices through Shop Floor Clubs.

As part of the Efficient Region project, work will be continued to create benchmarks across all aspects of the economy and the social sphere in the regions. The level of development of the benchmarks will be assessed, and methodological guidelines will be developed for the roll-out of best practices. It is intended that horizontal ‘ministers’ clubs’ will be formed in the regions in various industries in order to consolidate resources and accumulated experience in the sphere of performance improvement.

Russian Production Systems

In 2019, the Russian Production Systems Partnership was formed. It was joined by ROSATOM, JSC Russian Railways, State Space Corporation ROSCOSMOS, PJSC Rostelecom and other leading Russian industrial and technology companies. The aim of the partnership is to promote cooperation and the development of production systems. In the reporting year, joint projects were launched, and peer audits were conducted, followed up with recommendations for development. A shared knowledge base on projects and techniques was put into operation, and members of the Partnership started to share experience in the development of suppliers and regions of operation.

8.5.2. PLANS FOR 2020

In 2020, 36 enterprises will be included in the scope of RPS benchmarks. The key task will be to replicate the experience of RPS benchmarks and share best practices through Shop Floor Clubs.

In addition, ROSATOM plans to assist the Ministry of Labour and Social Protection and the Pension Fund of the Russian Federation in the adoption of lean practices.
8.6. PROCUREMENT MANAGEMENT

Key results in 2019

- Overall savings from competitive procurement procedures (using ROSATOM’s own funds and federal budget funds) totalled RUB 36.45 billion.
- The share of electronic procurement (excluding procurement for foreign projects) totalled 99%.
- 40,196 contracts worth a total of RUB 128 billion were concluded with small and medium-sized enterprises, with the value of contracts concluded based on the results of procurement procedures held exclusively among small and medium-sized enterprises totalling RUB 56.1 billion.
- Pursuant to the order of the Prime Minister of Russia to disclose information on counterparties, ROSATOM disclosed information on 17,585 counterparties (100%).

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

Governing and supervisory bodies in the sphere of procurement:
- Central Procurement Commission;
- Permanent procurement commissions of the Divisions;
- Central Arbitration Committee of ROSATOM and arbitration committees of the Divisions;
- Chief Controller.


8.6.1. IMPLEMENTATION OF THE ANNUAL PROCUREMENT PROGRAMME

In 2019, the demand of nuclear organizations for products with the required price and quality was met in full.

ROSATOM and its organizations made 36,458 competitive purchases worth a total of RUB 701.9 billion using their own funds. The Corporation achieved savings totalling RUB 36.1 billion (7.6% of the value of completed purchases); overall, over the past ten years, savings totalled RUB 281 billion.

495 competitive purchases worth a total of RUB 121 billion were made by ROSATOM using federal budget funds. Savings on procurement activities totalled RUB 0.35 billion (0.29% of the value of completed purchases).47

8.6.2. EXPANSION OF ACCESS TO PROCUREMENT PROCEDURES FOR SMALL AND MEDIUM-SIZED ENTERPRISES (SMES)

In 2019, ROSATOM’s organizations concluded 40,196 contracts with SMEs worth a total of RUB 128 billion, with the value of contracts concluded following tendering exclusively among SMEs totalling RUB 56.1 billion. The target share of procurement from SMEs stipulated for state-owned corporations by law (no less than 18%) was achieved.

Pursuant to an order of the Russian Government, in the reporting year, three operators of electronic trading platforms were selected for procurement from SMEs: JSC United Electronic Trading Platform (Roseltorg), JSC ETS (NEP) and CJSC Sberbank ATS.

In 2019, 20 workshops were held for SMEs in 20 Russian cities in cooperation with JSC Russian Small and Medium Business Corporation. They were attended by representatives of 1,701 SMEs. Overall, between 2016 and 2019, 43 workshops were held and were attended by representatives of 4,048 SMEs.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALUE OF COMPETITIVE PURCHASES AND ACHIEVED SAVINGS*, RUB BILLION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total value of procurement orders placed under an open competitive procedure</td>
<td>544.51</td>
<td>683.48</td>
<td>822.9</td>
</tr>
<tr>
<td>Using ROSATOM’s own funds</td>
<td>523.50</td>
<td>663.16</td>
<td>701.9</td>
</tr>
<tr>
<td>Using federal budget funds</td>
<td>21.01</td>
<td>20.32</td>
<td>121</td>
</tr>
<tr>
<td>Total savings, including:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Savings from competitive procurement procedures using ROSATOM’s own funds</td>
<td>38.37 (7.1%)</td>
<td>28.86 (6.2%)</td>
<td>36.45 (6.1%)</td>
</tr>
<tr>
<td>Savings from competitive procurement procedures using federal budget funds</td>
<td>1.68 (9%)</td>
<td>0.36 (1.9%)</td>
<td>0.35 (0.29%)</td>
</tr>
</tbody>
</table>

47 Taking into account open competitive procurement procedures conducted and orders placed using the funds allocated through the Russian Ministry of Industry and Trade pursuant to Law No. 44-FZ.
48 Savings from competitive purchases are the difference between the set initial maximum purchase price and the purchase price obtained as a result of competitive tendering. Only completed procurement procedures were taken into account.


As a result of the implementation of the annual procurement programme, contracts were concluded with 20,992 counterparties. The share of electronic procurement (excluding procurement for foreign projects) totalled 98%.
In 2019, the ATOMEX Regional Forum of Nuclear Industry Suppliers was held in Volgodonsk (Rostov Region), Ulan-Ude (Republic of Buryatia), Izhevsk (Udmurt Republic) and Saint Petersburg.

In 2019, the first stage of development and introduction of ROSATOM’s Unified Industry-Wide Quality Management System, UIS-Quality, was completed. The system is designed for automating assessment and irregularity management processes in order to reduce the lead time and improve product quality. By the end of 2019, more than 9,000 users in 827 organizations of ROSATOM had been connected to the system.

The Procurement, Logistics and Quality School continued to function as part of ROSATOM’s Corporate Academy. In 2019, more than 2,000 applications for training and more than 5,000 applications for testing were received. The first wave of testing was completed, which involved 1,900 people taking tests. Based on the results of the tests, 40% of employees were issued with certificates of competence, while the rest were enrolled on refresher training courses in the relevant subject areas.

In 2019, ROSATOM reviewed global experience in contract management. Following this review, pilot projects were implemented to adopt global practices and adapt them to business processes in the industry.

In 2019, lists of additional requirements for products to be supplied and organizations to be engaged were compiled for the Tianwan NPP and Xudabao NPP construction projects in China. These materials were made publicly available on ROSATOM’s procurement website; they will enable potential suppliers to study examples of requirements for overseas NPP construction projects in advance.

ROSATOM actively participated in finalizing an interactive manual on supply chain management prepared by the IAEA, which incorporates quality assurance tools and procurement systems used in the industry.

In the reporting year, a methodology for developing contract strategies for overseas NPP construction projects was approved. The use of this methodology will help to reduce the number of lots to be purchased by consolidating them, which will stimulate interest from leading market players and will enable ROSATOM to monitor the fulfillment of obligations by subcontractors. In addition, it will be possible to develop a contracting approach and a construction schedule taking into account the needs of the customer country, external conditions and restrictions affecting the project (including local content requirements) as early as at the pre-contract stage.

In 2019, ROSATOM and its Divisions continued to develop the Qualified Buyer Service. The Service performs the full range of procurement activities, from the identification of needs to the conclusion of contracts. This has enabled a transformation of the entire procurement cycle and a reduction in procurement lead time: in 2019, the lead time was reduced by 30%.

To develop the Qualified Buyer Service, including establishing similar functions in organizations in the industry;
To create a single information space for communication between customers and suppliers covering the entire procurement cycle, from the identification of needs to the performance of contracts, including the integration of local modules, industry-wide and national systems, globalization of data, wider use of electronic document management in procurement, and the use of robots to reduce the amount of time and effort spent on routine operations;
To develop contract strategies for ROSATOM’s overseas projects based on the methodology developed in 2019;
To develop the Procurement, Logistics and Quality School (to develop new training programmes and improve the training system as a whole);
To contribute to developing Russian legislation on procurement activities.
8.7. INTERNAL CONTROL SYSTEM

Key results in 2019

- ROSATOM topped the ranking of chief federal budget administrators compiled by the Federal Treasury of Russia.
- Inspections conducted in the Corporation and its organizations included 6 inspections and 4 expert reviews by the Accounts Bodies (SICBs) conducted 704 inspections in the Corporation and its organizations.

The internal control system in ROSATOM and its organizations is based on:
- Russian laws and regulations;
- The IAEA requirements;
- The COSO model (The Committee of Sponsoring Organizations of the Treadway Commission);
- Guidelines for Internal Control Standards for the Public Sector by the Internal Control Standards Committee of the International Organization of Supreme Audit Institutions (INTOSAI).

Key characteristics of the internal control system include the following:
- Preventive control and development of timely, comprehensive and practicable corrective measures;
- Efficient communication and cooperation with operating divisions at all stages of operations;
- Proactive change management;
- Growing demand from executives of organizations in the industry for advisory services provided by the Internal Control and Audit Function (ICAF).

8.7.1. RESULTS IN 2019

INSPECTIONS CONDUCTED IN ROSATOM AND ITS ORGANIZATIONS

In the reporting year, ROSATOM’s specialized internal control bodies (SICBs) conducted 704 inspections in the Corporation and its organizations.

External supervisory bodies conducted 15 inspections, including assessment of compliance with the budget legislation; these included 6 inspections and 4 expert reviews by the Accounts Chamber of the Russian Federation. No instances of misuse or illegal use of budget funds or assets were detected in ROSATOM or its organizations.

Following the inspections, the ICAF developed 622 corrective measures and approved them for implementation, with more than 97% of these measures implemented in the reporting year.

Based on the findings of inspections conducted in 2019, disciplinary sanctions were imposed on 586 employees of ROSATOM and its organizations, including the dismissal of 11 senior managers.

8.7.2. PLANS FOR 2020

- To implement an action plan for achieving the SICB 2020 target state;
- To improve control activities of the SICBs at the level of organizations and enterprises;
- To continue to take steps to shift the focus of the SICBs to control and analysis;
- To develop IT systems for the SICBs (SKB Partner and the ICAF 1C system).

PROFESSIONAL DEVELOPMENT OF AUDITORS

To support professional development of auditors, in 2019:
- A ‘mentoring’ practice was adopted: auditors from nuclear organizations participate in inspections conducted by the Corporation’s ICAF in order to share experience; for each thematic audit, a training session is held, which is attended by SICB employees;
- Training was organized for SICB employees in the following areas: business process audit, project activities, performance evaluation of the internal control function and the risk management system, and IT audit;

STAKEHOLDER CONTROL

In 2019, the Central Arbitration Committee of ROSATOM and the arbitration committees of the Power Engineering, Fuel and Engineering Divisions received 902 reports (complaints) from stakeholders regarding violations of procurement rules established by Russian legislation, ROSATOM’s Uniform Industrial Procurement Standard and other regulations of ROSATOM and its organizations.

606 complaints were investigated; 157 complaints (26% of the total number of investigated complaints) were deemed to be valid. Other complaints were withdrawn by complainants before being investigated by an arbitration committee or were dismissed on the following grounds:
- Because the deadline for filing the complaint had expired;
- Because a similar complaint had been accepted for investigation or investigated by the Federal Antimonopoly Service;
- Because the complainant was not entitled to file a complaint (after the deadline for submitting bids has expired, complaints may only be filed by bidders that have submitted a bid).

Systematic work of arbitration committees helps to minimize the number of violations in the procurement process: in 2019, the number of valid complaints as a percentage of the total number of purchases totalled 0.21% (0.23% in 2018).

See also the section ‘Procurement Management’.

Large-scale certification in accordance with the Internal Control Specialist (Internal Control) professional standard was conducted for the first time in Russia;
Standard internal audit programmes were included in the best practice library forming part of the 1C IT system supporting the ICAF activities.
8.8. PREVENTION OF CORRUPTION AND OTHER OFFENCES

Key results in 2019

- All measures forming part of ROSATOM’s Anti-Corruption Plan were implemented.
- Employees provided information on their income, expenses, property and liabilities, and the information was posted on ROSATOM’s official website (http://www.rosatom.ru/about/protivodeystvie-korruptsii/svedeniya-o-doxodax-robotnicov).
- Financial losses exceeding RUB 13 billion were prevented.

ROSATOM is committed to preventing corruption and works systematically to ensure that all its employees, including senior executives of ROSATOM and its organizations, comply with legislation. These efforts are based on anti-corruption regulations (including the Code of Ethics[49] and the Uniform Industry-Wide Anti-Corruption Policy of ROSATOM and Its Organizations[50]).

Measures to prevent corruption and other offences are implemented in accordance with ROSATOM’s Anti-Corruption Plan for the period from 2018 through 2020[51] (issued pursuant to Federal Law No. 273-FZ on Combating Corruption dated December 25, 2008, Decree No. 378 of the Russian President on the National Anti-Corruption Plan for the Period from 2018 through 2020 dated June 29, 2018 and other anti-corruption laws and regulations).

Inspections conducted in the reporting year enabled ROSATOM to prevent financial losses exceeding RUB 13 billion. Financial and disciplinary sanctions were imposed against 1,200 executives. About 320 files providing evidence of detected violations were submitted to law enforcement agencies for legal review; based on these materials, over 140 criminal proceedings were instituted.

8.8.1. KEY RESULTS IN 2019

DAMAGE PREVENTION

The Hotline is one of the key tools of ROSATOM’s anti-corruption system. Employees in the industry and other persons can use it to report suspected instances of corruption and other violations (https://rosatom.ru/en/about-us/anti-corruption-policy/).

The Corporation plans to continue to implement the Uniform Industry-Wide Anti-Corruption Policy of ROSATOM and Its Organizations with a focus on:

- Improving the efficiency of information support, analytics, organizational and methodological support for the activities of the relevant divisions;
- Developing the competences of executives of ROSATOM’s organizations who are responsible for preventing corruption and other offences.

In 2020, ROSATOM will continue to implement measures stipulated in the National Anti-Corruption Plan for the period from 2018 through 2020.

In the medium term, the Corporation plans to continue to implement the Uniform Industry-Wide Anti-Corruption Policy of ROSATOM and Its Organizations with a focus on:

- Preventing financial losses exceeding RUB 13 billion.
- Preventing or resolving conflicts of interest.
- Conducting inspections to verify compliance with requirements for preventing or resolving conflicts of interest.
- Developing the competences of executives of ROSATOM’s organizations who are responsible for preventing corruption and other offences.

In the reporting year, 654 employees completed face-to-face anti-corruption training and development courses, more than 2,400 employees completed online courses.

8.8.2. PLANS FOR 2020 AND FOR THE MEDIUM TERM
9.1. IMPLEMENTATION OF THE HR POLICY

Key results in 2019

- ROSATOM was declared to be the best Russian employer by HeadHunter, Russia’s largest online recruitment platform;
- ROSATOM’s team won the WorldSkills Hi-Tech national competition for workers and engineers for the fifth time;
- ROSATOM ranked first in the Industrial Engineering and Manufacturing category in the international youth ranking compiled by Universum;
- ROSATOM was included in the top three in terms of social programmes for women in the first ranking of the best employers compiled by Forbes Woman;
- ROSATOM’s Corporate Academy received the Global Council of Corporate Universities international award in the Best Corporate University category;
- The employee engagement rate stood at 82%, on a par with the best employers in Russia;
- 84% of employees appointed to the positions of Chief Executive Officers in the Corporation’s organizations and enterprises were members of the executive succession pool;
- Over 500 employees of ROSATOM and its organizations received government awards, certificates of appreciation and acknowledgements from the President of the Russian Federation;
- Over 7,700 employees and veterans received industry awards;
- Over 500 employees of ROSATOM and its organizations received government awards, certificates of appreciation and acknowledgements from the President of the Russian Federation;
- 84% of employees appointed to the positions of Chief Executive Officers in the Corporation’s organizations and enterprises were members of the executive succession pool;
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- 84% of employees appointed to the positions of Chief Executive Officers in the Corporation’s organizations and enterprises were members of the executive succession pool;
- Over 500 employees of ROSATOM and its organizations received government awards, certificates of appreciation and acknowledgements from the President of the Russian Federation;
- The average monthly salary totalled RUB 84,100 per month (up by 6.4% against 2018).

- One of the key priorities of ROSATOM’s current HR policy is to unlock the potential of its employees. How does the Corporation assess the potential of an employee and progress in unlocking it? What are ROSATOM’s requirements for its employees, and how will these requirements evolve in the future?

- To assess progress in unlocking the potential of our employees, we use a matrix developed by The Boston Consulting Group. It includes three dimensions: skills, opportunities and motivation.

As a high-technology corporation whose operations cover the entire production cycle, and therefore, we employ well-educated people with extensive professional experience and a wide range of skills, which we seek to identify and support. This approach attracts the best talent available on the market. Best students are eager to join our company: the grade point average of university graduates hired by the Corporation totals 4.7 points, i.e. one in every three young employees has graduated with honours.

As a global company, we are trying to create as many opportunities as possible for our employees, from a transparent career system to training available 24/7 from anywhere in the world on our web portal, in the RECORD Mobile app, at ROSATOM’s Academy, the Technical Academy or in specialized universities led by NRNU MEPhI. We regularly launch new industries-wide programmes to create a favourable environment conducive to unlocking our employees’ potential. For instance, 2019 was declared the Year of Health in ROSATOM; accordingly, we launched a well-being programme covering five areas: physical, emotional, financial, professional and social. At the same time, we are improving our digital and IT services and working on online accounts and a shared communication space for employees.

In terms of motivation for our talent, we are trying to find activities matching the needs and interests of different employees. Some people are motivated by career growth; others seek to develop their competences and gain experience, tackle large-scale problems, take part in national projects or engage in social activities. That is why we support and develop industry-wide communities consisting of 8,000 mentors and 3,500 experts in engineering and blue-collar jobs, 2,500 members of change support teams, 944 members of the Women in Nuclear clear organization, 100 representatives of the Youth Council and 210 members of the Runners’ Club.

As for requirements for our employees, it is obvious that requirements for specialists have fundamentally changed in recent years, which is particularly true with regard to engineering and blue-collar jobs. Today, an engineer is a multidisciplinary job requiring a wide range of competences. In addition to engineering and technical disciplines, engineers need to know the basics of economics, speak English, be able to take part in international negotiations, work in a cross-cultural environment and in remote teams. Blue-collar jobs in ROSATOM require higher education and continuous development of skills in accordance with international WorldSkills standards. IT skills have also become an integral part of today’s basic training.

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In 2019, ROSATOM took an active part in the signing of the Kazan Declaration after the conclusion of the WorldSkills competition. Could you give more detail about the main outcomes and long-term objectives in this area?

The Kazan Declaration has been adopted in response to a major problem in the education system, which ensures that skills obtained in the course of training are relevant as early as at the current stage of the career path. We also attach considerable importance to fundamental training provided by third-party institutions as part of our partner- ships with universities, schools and even kindergartens. Last year, alone, about 200,000 employees underwent training at ROSATOM’s Academy. We are actively developing a digital educational environment and successfully transitioned all our training programmes to the online format during the coronavirus pandemic. In April and May 2020, over 14,000 people took part in 500 training events, which is 3.5 times more than during the same period in 2019.

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- ROSATOM is actively developing corporate volunteering. Could you give more detail about the main outcomes and long-term objectives in this area?

- The shared misfortune that has befallen the entire world has driven a considerable increase in the number of our volunteers. During the coronavirus pandemic, even those who had not been volunteers before started to take part in municipal initiatives, for instance, by helping to deliver food to people in need. In April and May 2020, more than 30,000 people took part in 1,000 events. They fulfilled a total of over 10,000 requests for help as part of the WeAreTogether nationwide campaign. In addition, the volunteers congratulated 3,500 veterans ahead of May 9 at 8,000 events. This year, we have launched a new initiative: collection of donations. For instance, 300 top managers of ROSATOM and its organizations committed to raising a total of 100.5 million RUB for the Medical Voluntary Movement as part of the WeAreTogether campaign. Corporate volunteering is becoming part of the cultural code of nuclear industry workers. And now, after the pandemic, it is very important to make sure that this trend continues.
In 2019, ROSATOM and its organizations employed 266,400 people (including 1,780 people in foreign organizations), with men and women accounting for 67% and 33% of the total headcount respectively.

Number of employees by employee category:
- Executives: 32,500 people;
- Specialists: 107,600 people;
- White-collar workers: 10,100 people;

153,200 employees (57.5% of the total headcount) have a university degree. 3,787 employees (1.4% of the total headcount) are Candidates and Doctors of Sciences.

The age of employees averaged 43.4 years (46.5 years for executives). 30.7% of employees were aged under 35.

In 2019, the personnel turnover rate stood at 13.2%.

For ROSATOM to achieve its strategic goals, it is necessary for its employees to be able to fully unlock their potential. This is why people are ROSATOM’s most important capital. The Corporation’s HR policy prioritizes rapid competence development, the ability to work in a new, changing environment and the training of leaders at all levels.

9.1.1. KEY PERSONNEL CHARACTERISTICS

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Prominent people play a fundamental role in the history of the nuclear industry and its development. A group of brilliant scientists led by Igor Kurchatov have achieved an unprecedented technological breakthrough, while talented administrators, the legendary ‘nuclear’ minister Efim Slavsky being the foremost among them, have created a new industry, which has become a driver of development for the entire economy.

9.1.2. PERSONNEL COSTS AND REMUNERATION SYSTEM

In 2019, personnel costs totalled RUB 360.55 billion, up by 11.1% year on year. The costs per employee per year increased by 6.6%, from RUB 1,264,700 in 2018 to RUB 1,347,800 in 2019.
9.1.3. EXECUTIVE SUCCESSION POOL

In order to ensure succession and train employees to be appointed to managerial positions, an executive succession pool (ESP) is being formed and developed in ROSATOM.

ESP members are included in the executive succession pool through the career and succession planning process. The ESP is divided into four levels in order to select development programmes that are best suited to the target positions of ESP members. The ESP level is determined by their target position: ROSATOM’s Assets and ROSATOM’s Assets. Basic Level (top executives); ROSATOM’s Capital (middle-level executives); ROSATOM’s Talents (promising specialists and junior executives).

Since the establishment of the executive succession pool, the number of its members has exceeded 4,300 people. ESP members account for 84% of appointments to the position of Chief Executive Officer in ROSATOM’s organizations and enterprises.

A special feature of succession pool development programmes is their practical focus. Future executives not only complete training modules, but also work on their own projects contributing to the achievement of strategic goals of the Corporation. In 2019, ESP members completed a module-based training programme aimed at developing managerial knowledge and skills.

### Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>2017</th>
<th>Share</th>
<th>2018</th>
<th>Share</th>
<th>2019</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>men</td>
<td>2,148</td>
<td>80%</td>
<td>2,884</td>
<td>79%</td>
<td>3,407</td>
<td>79%</td>
</tr>
<tr>
<td>women</td>
<td>540</td>
<td>20%</td>
<td>765</td>
<td>21%</td>
<td>923</td>
<td>21%</td>
</tr>
</tbody>
</table>

### APPOINTMENT OF ESP MEMBERS TO NEW POSITIONS, %

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of ESP members appointed to vacant top and senior executive positions (top 30 and top 1,000 executives in the industry)</td>
<td>57.7</td>
<td>63.6</td>
<td>67.5</td>
</tr>
<tr>
<td>Share of ESP members appointed to the vacant position of Chief Executive Officer in ROSATOM’s organizations and enterprises</td>
<td>63.6</td>
<td>72.2</td>
<td>84</td>
</tr>
<tr>
<td>Share of ESP members appointed to vacant positions of Deputy Chief Executive Officer for core business</td>
<td>68</td>
<td>71.7</td>
<td>73.8</td>
</tr>
<tr>
<td>Share of ESP members among senior, middle-level and junior executives appointed to a new (managerial) position</td>
<td>45</td>
<td>72</td>
<td>74</td>
</tr>
</tbody>
</table>

### TRAINING AS PART OF ESP DEVELOPMENT PROGRAMMES

<table>
<thead>
<tr>
<th>ESP level</th>
<th>Development programme</th>
<th>Key training areas</th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior executives</td>
<td>ROSATOM’s Assets</td>
<td>Strategy, strategic leadership, horizontal cooperation, change management, finance, marketing for high-technology companies</td>
<td>295</td>
</tr>
<tr>
<td></td>
<td>ROSATOM’s Assets</td>
<td>Basic Level</td>
<td>114</td>
</tr>
<tr>
<td>Middle-level executives</td>
<td>ROSATOM’s Capital</td>
<td>Leadership and project management, advanced managerial skills, data management</td>
<td>1,102</td>
</tr>
<tr>
<td>Junior executives</td>
<td>ROSATOM’s Talents</td>
<td></td>
<td>1,177</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>2,888</td>
</tr>
</tbody>
</table>

18 In 2019, promotion of succession pool members was assessed based on the number of ESP members appointed to new positions during the last three reporting years.

19 The number of members included in the ESP is shown as a cumulative total for the period from 2017 through 2019.
9.1.4. SUCCESSOR ASSESSMENT

To facilitate rapid development of competences, which is one of the priorities of ROSATOM's HR policy, an innovative approach to assessing high-potential employees has been adopted in the Corporation. As part of this approach, executives are involved in talent pool assessment and have a greater personal responsibility for developing succession plans and reducing the duration and cost of assessments.

This approach is based on best practices adopted in major international companies; it was piloted in 2018. In 2019, the approach was rolled out in five Divisions in the industry; the assessment covered 1,700 executives in 51 of ROSATOM's organizations. About 30% of successors covered by the assessment have been appointed to new managerial positions.

9.1.5. PERSONNEL TRAINING

The Corporation's HR policy prioritizes the development of competences and employee training.

ROSATOM's Corporate Academy is the central training platform for specialists and executives in the industry. The Academy implements projects aimed at developing the corporate culture and unlocking the leadership potential of ROSATOM's employees. It also trains a new generation of workers and engineers in accordance with WorldSkills Standards.

In 2019, over 146,000 employees (54.8% of the average headcount) underwent training and retraining and completed professional development programmes. The number of training hours per employee averaged 28.4 hours.

To develop negotiation skills of employees taking part in negotiations with foreign partners, ROSATOM is implementing a module-based training programme, International Negotiations in the Nuclear Industry. In 2019, 321 employees completed this training programme.

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9.1.6. EMPLOYEES' PARTICIPATION IN EXTERNAL AND INDUSTRY-WIDE PROFESSIONAL COMPETITIONS

LEADERS OF RUSSIA

Employees of ROSATOM and its organizations actively participate in the Leaders of Russia national management competition. More than 1,500 nuclear industry employees took part in the second competition (in 2018/2019). 84 people reached the semi-finals, with 4 people progressing to the final; winners included one of ROSATOM's employees.

WORLDSKILLS

In the 45th WorldSkills International Competition, WorldSkills Kazan 2019, ROSATOM's employees won two gold medals and two Medallions for Excellence, while representatives of ROSATOM participating in the Future Skills competition, which is focused on professions of the future, won another 11 medals. In addition, ROSATOM was a strategic partner of the competition.

In the WorldSkills Hi-Tech 2019 Competition (Ekaterinburg), which became the fifth national competition of cross-industry skilled professions for workers in high-technology industries held in accordance with the WorldSkills methodology, ROSATOM's team once again achieved impressive results. 133 contestants and 145 experts represented 27 skills across all sections of the competition (the national competition, WorldSkills Juniors and Skills of the Wise) and won 58 medals: 42 golds, 10 silvers and 6 bronzes.

More than 600 participants and over 600 experts representing more than 80 organizations and core universities of ROSATOM took part in the competition. A career guidance programme for school and university students titled "Conquering the Arctic" was held as part of the competition; it was attended by more than 1,200 people.
After the conclusion of the WorldSkills Kazan 2019 competition, the Kazan Declaration was signed by 82 countries on the initiative of Russia, with active support from ROSATOM. The aim of the Declaration is to standardize international approaches to training quality assessment and professional development. It is underpinned by a human-centric approach. This document provides a foundation for the labour market of the future.

Principles of the Kazan Declaration:
1. Skills of the future for everyone. Every person should receive a basic set of competences needed for employment in the context of uncertainty and rapid changes in the labour market. These should include basic and cognitive skills, as well as social, cultural, green, and digital competences.
2. Self-conscious development. Every person’s professional development should follow a unique and individual path throughout their life.
3. Transparent and fair opportunities. Information on employment and educational opportunities in and outside the employee’s region should be easily accessible. Employees should be hired on the basis of their skills and actual experience, regardless of their formal education, life situation, gender, physical health, or social status.
4. Skills mobility. Labour mobility within existing legal frameworks, flexible employment (training) formats, and/or remote (virtual) employment should be available to all regardless of their current place of residence.
5. Appreciation of values and Respect for the individual. Workplace and working conditions should enable self-fulfilment and professional development for all regardless of their values or beliefs with due respect to sustainable development.

9.1.7. ROSATOM’S PERSON OF THE YEAR

ROSATOM’s Person of the Year is an industry-wide recognition programme whereby executives express their appreciation for the achievements of the best employees. Key selection criteria include major work achievements, the ability to think out of the box, commitment to corporate values, and professional competences of the candidates. The programme includes more than 50 leaders of volunteer groups who represented about 20 organizations and enterprises in the nuclear industry.

In 2019, ROSATOM held the first volunteers’ forum. It was attended by more than 70 representatives of nuclear enterprises and more than 30 representatives of administrations of nuclear towns and cities.

About 400 employees took part in a tree-planting campaign conducted in Nizhny Novgorod as part of an industry-wide Youth Congress.

ROSATOM launched a campaign titled ‘School Bag for a Friend’ for children affected by a flood in the Irkutsk Region. As part of this initiative, more than 1,600 school bags filled with school supplies were donated to school students.

In 2019, employees collected (and later transferred for processing and recycling):
- 38 kilograms of batteries;
- 54 kilograms of appliances;
- 1.1 tonnes of unwanted items.

ROSATOM’s Divisions organized blood donation campaigns.

In the reporting year, ROSATOM participated for the first time in the International Volunteer Forum in Sochi, which was attended by the Russian President. ROSATOM’s delegation comprised more than 50 leaders of volunteer groups who represented about 20 organizations and enterprises in the nuclear industry.

9.1.8. CORPORATE VOLUNTEERING

Nuclear organizations continue to develop a large number of volunteering initiatives.

Key objectives of corporate volunteering include:
- Forming a pool of social leaders comprising employees of organizations in the industry;
- Developing horizontal cooperation;
- Enhancing the image of ROSATOM as a socially responsible company.

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Work of Change Support Teams (CSTs)

ROSATOM has a tradition of supporting ‘bottom-up’ initiatives and thus enabling talented employees to fulfill themselves. The CSTs comprise proactive employees who implement projects in order to promote changes. Participation in the CSTs not only enables them to put their ideas into practice, but also provides an informal channel for communicating directly with industry executives. In turn, this provides employees with new career opportunities and serves as an efficient tool for training new leaders at the local level. By the end of 2019, more than 100 such teams had been formed; they comprise about 2,500 employees from different organizations and enterprises of ROSATOM.

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9.1.9. EMPLOYEE ENGAGEMENT

According to the findings of a survey among 50,402 employees in 70 of ROSATOM’s organizations, in 2019, the employee engagement rate stood at 82%, on a par with the best employers in Russia.

The target for the next three to five years is to maintain the average employee engagement rate on a par with global leaders in high-technology industries (at least 77%) and to achieve this rate in most organizations that participate in the survey.

9.1.10. SOCIAL POLICY

ROSATOM’s social policy is designed to:
- Make ROSATOM more attractive as an employer;
- Engage and integrate young professionals and highly skilled specialists;
- Improve employee loyalty;
- Improve the efficiency of social expenditure.

Employment benefits provided to employees and retirees comply with the Uniform Industry-Wide Social Policy, which is based on standardized corporate social programmes.

The structure of corporate social programmes and the relevant expenses are determined on the basis of ROSATOM’s priorities in personnel management:
- Importance of maintaining health and a long working life;
- Protecting the health of people working in conditions that deviate from the standard conditions (which is why the bulk of funding is allocated for additional personal insurance and health resort treatment for employees).

ROSATOM’S VALUES

Traditions established at ROSATOM: companies in the Russian nuclear industry always pay great attention to retired employees who had worked in the industry for a long time; veterans receive social assistance and are involved in various events, including working with young people;

Government policy focused on promoting the development of mass sports, providing additional pensions, and supporting families with children, young professionals and people in need.

In 2019, programmes to support soon-to-retire employees in ROSATOM and its organizations were developed. As part of these programmes:
- 2,553 soon-to-retire employees underwent health screenings;
- 2,682 employees were given vouchers for health resort treatment;
- 3,268 employees underwent training and retraining, with 320 employees switching over to flexible working hours.

An industry-wide futsal competition was held for the first time to mark the 120th anniversary of Efim Slavsky, with the teams of 12 divisions playing in the final.

Employees of ten of ROSATOM’s divisions took part in the 10th Winter Spartakiad for Employees in Nuclear Power, Industry and Science ‘Atomiada 2019’. 280 top athletes competed in the final stages of the event for 35 sets of medals and 12 cups in four disciplines.

2019 was declared the Year of Occupational Health and Safety and Healthy Lifestyle in the nuclear industry. The practice of organizing health days, health screenings and detailed medical examinations for employees has been introduced in ROSATOM’s organizations.

The biggest sporting event of 2019 was the Running Race of Nuclear Towns and Cities; its participants included 16,500 employees, members of their families and residents of 20 towns and cities where nuclear organizations operate.

Corporate social programmes

<table>
<thead>
<tr>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voluntary health insurance and personal insurance against accidents and diseases</td>
<td>1.9</td>
<td>2</td>
</tr>
<tr>
<td>Health resort treatment and recreation for employees and their children, including:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>health resort and rehabilitation treatment for employees</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>health resort treatment and recreation for children</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Providing better living conditions for employees</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>Private pension plans</td>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td>Support for retirees</td>
<td>1.2</td>
<td>1.3</td>
</tr>
<tr>
<td>Sporting and cultural events</td>
<td>1.3</td>
<td>1.5</td>
</tr>
<tr>
<td>Assistance to employees</td>
<td>1.1</td>
<td>1.2</td>
</tr>
<tr>
<td>Other</td>
<td>0.7</td>
<td>0.3</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>9.2</td>
</tr>
</tbody>
</table>

61 Engagement is an emotional and intellectual state encouraging employees to do their job to the best of their abilities. Employee engagement surveys have been conducted in the Russian nuclear industry since 2011 under the international methodology with assistance from an independent expert organization. The engagement rate is defined as the share of engaged employees as a percentage of the total number of respondents.

62 Compensations and benefits forming part of ROSATOM’s corporate social programmes are provided to full-time employees.

PERFORMANCE OF STATE ATOMIC ENERGY CORPORATION ROSATOM IN 2019

188
At the Ready for Labour and Defence National Festival held among employee teams with support from the Russian Ministry of Sport, ROSATOM’s team ranked first in the team standings. At the 18th International Issyk Kul Games in Cholpon-Ata (Kyrgyzstan), ROSATOM’s team of 25 athletes won 94 medals (58 golds, 28 silvers and 8 bronzes) and a trophy for the 3rd place in the team standings at the 16th International Workers’ Sports Festival in Al- bena (Bulgaria).

SUPPORT FOR INDUSTRY VETERANS

The Interregional Social Movement of Veterans of Nuclear Power and Industry (ISMV NPI)63 comprises 130 veteran organizations in Russia with a total of 312,200 members. In reporting year, at the request of ISMV NPI:
■ 128 veterans were presented with the Veteran of Nuclear Power and Industry badge, a departmental award for outstanding work;
■ 106 veterans were awarded ROSATOM’s badges;

SOCIAL PARTNERSHIP IN THE NUCLEAR INDUSTRY

ROSATOM adheres to the Industry-Wide Agreement on Nuclear Power, Industry and Science for 2018–2020. The Agreement is based on the established practice of social partnership in the nuclear industry and is aimed at implementing the Integrat ed Standardized Remuneration System, the Uniform Indus try-Wide Social Policy and the Occupational Safety Manage ment System. The agreement has been developed and is being implemented jointly with the Russian Trade Union of Nuclear Power and Indus try Workers (RTUNPWI). As at December 31, 2019, the Union had 134,771 members, i.e. 56.4% of the average headcount at ROSATOM. In the reporting year, the Union focused on ensuring compliance with the current Industry-Wide Agreement on Nuclear Power, Industry and Science, safeguarding employees’ legal rights, assisting trade unions in drafting and signing collective labour agreements, and actively participating in the work of the Russian Tri lateral Commission on the Regulation of Social and Labour Rel ations.

In March 2020, an official ceremony was held at NRNU MEPhI to mark the unveiling of a monument ‘To the Creators of the Russian Nuclear Project’ commemorating the 75th anniversary of the Russian nuclear industry. The sculpture became one of the key and most distinctive ensembles of the Avenue of Nobel Prize Winners, a complex of monuments at the university campus. The composition is centred around an atom, which serves as a conceptual and symbolic focus of a group comprising the figures of three great scientists (Igor Kurchatov, Yakov Zeldovich and Yuliy Khariton).

Specialized educational organizations training specialists for the nuclear industry form part of the Consortium of Core Universities of ROSATOM (18 universities specializing in disciplines relevant to the nuclear industry). The National Research Nuclear University MEPhI (NRNU MEPhI) is the central university for the nuclear in dustry. Its alumni include six Nobel Prize winners.

In 2019, a total of 1,834 students attended universities under arrangements with nuclear enterprises. Over 660 people were subsequently hired by the organizations.

Overall, more than 1,500 university graduates were hired, with about 70% of them graduating from core universities (including branches of NRNU MEPhI). ROSATOM attracts the best students. In 2019, the grade point average of university graduates hired by the Corporation totalled 4.7 points, i.e. one in every three young people hired by ROSATOM had graduated with honours.

Career events involving representatives of nuclear enterprises are a traditional tool for promoting ROSATOM’s employer brand at core universities. In 2019, ROSATOM’s Career Days were held in Ekaterinburg, Nizhny Novgorod, Tomsk and Moscow; in addition,

NBRU MEPhI is included in leading global and national educa tional rankings:
■ Top 25 of the QS Emerging Europe and Central Asia Rankings; and
■ Top 25 of the U-Multirank ranking in the student mobility cat egory; etc.

In 2019, over 35,000 school students and over 2,000 university students took part in competitions held by NRNU MEPhI, includ ing over 2,000 school students and over 500 university students from foreign countries. The average score achieved in the Unified State Examination by students whose results were enrolled based on the examination results totalled 93.5 (top 5 of the best Russian universities).
career fairs were held in Saint Petersburg and Ivanovo. The total number of participants exceeded 6,500. More than 45 enterprises were presented at these events and offered over 300 vacancies and 475 internships to students and graduates.

TEMP TOURNAMENT

ROSATOM attaches special importance to attracting and selecting promising graduates and offering them employment in nuclear enterprises. The TeMP Tournament for Young Professionals is the main competition in the nuclear industry. In 2019, over 2,000 graduates and students from 200 specialized and core universities participated in the Tournament. The competition participants presented 85 ideas and 20 projects, with 142 participants advancing to the finals. Five projects that reached the finals are being considered by nuclear enterprises for further implementation.

ROSATOM successfully exports Russian nuclear education to potentially attractive markets. Foreign students study at NRNU MEPhI, as well as at ROSATOM’s core universities and partner universities.

In 2019, more than 1,600 foreign students from Vietnam, Rwanda, Bolivia, Uzbekistan, Turkey, Bangladesh, Jordan, Egypt, Algeria, Nigeria, South Africa, Ghana and other countries studied at Russian universities. Another 275 students from 58 countries are due to enrol on courses in nuclear and related disciplines in 2020.

To enable rapid development of key business competences;
To create a digital environment and promote employees’ digital literacy;
To train leaders at all levels;
To develop a safety culture aligned with the Vision Zero paradigm (for details, see the section ‘Occupational Safety and Health’);
9.2. DEVELOPING THE REGIONS OF OPERATION

Key results in 2019

- Taxes paid to Russian budgets of all levels totalled RUB 207.4 billion.
- NPPs accounted for 19.0% of the total electricity output in Russia.

### SCALE OF ROSATOM’S INVOLVEMENT IN THE SOCIAL AND ECONOMIC DEVELOPMENT OF REGIONS

**THE POPULATION OF REGIONS WHERE NUCLEAR ENTERPRISES ARE LOCATED TOTALS 2 MILLION PEOPLE**

This includes employees of the enterprises (300,000 people) + their families (700,000 people) + residents of single-industry towns associated with the nuclear industry (1 million people).

#### REGIONS OF OPERATION

- 10 CATFs + 10 towns and cities where NPPs are located
- 6 single-industry towns
- A total of over 70 municipalities in 36 regions of the Russian Federation

### TAXES PAID BY ROSATOM AND ITS ORGANIZATIONS, RUB BILLION

**Taxes paid to budgets of all levels totalled RUB 207.4 billion.**

<table>
<thead>
<tr>
<th>Taxes paid to</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total, including:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>to the federal budget</td>
<td>95.1</td>
<td>116.8</td>
<td>135.4</td>
</tr>
<tr>
<td>to the budgets of federal subjects of Russia</td>
<td>52.7</td>
<td>70.8</td>
<td>71.5</td>
</tr>
<tr>
<td>to local budgets</td>
<td>0.7</td>
<td>0.6</td>
<td>0.5</td>
</tr>
</tbody>
</table>

### NUCLEAR POWER GENERATION CONTRIBUTES SIGNIFICANTLY TO POWER SYSTEMS ACROSS RUSSIA

- NPPs accounted for 19% of the total electricity output (18.7% in 2018), while in European Russia the share of nuclear power generation exceeded 25%.

### ROSATOM’S ORGANIZATIONS AND ENTERPRISES HAVE A SIGNIFICANT IMPACT ON BUDGET REVENUE

- ROSATOM is one of the largest taxpayers in Russia. In 2019, payments to budgets of all levels totalled RUB 207.4 billion.

#### ENSURING THE ENERGY SECURITY OF RUSSIAN REGIONS

- Nuclear power generation at ROSATOM, billion kWh
- Share of nuclear power generation, %**

<table>
<thead>
<tr>
<th>Russia</th>
<th>European Russia</th>
<th>IPS of the Centre</th>
<th>IPS of the Middle Volga</th>
<th>IPS of the North-West</th>
<th>IPS of the South</th>
<th>IPS of the Urals</th>
<th>IPS of the East</th>
</tr>
</thead>
<tbody>
<tr>
<td>208.78</td>
<td>208.6</td>
<td>96.31</td>
<td>30</td>
<td>38.6</td>
<td>33.89</td>
<td>9.78</td>
<td>0.21</td>
</tr>
<tr>
<td>19</td>
<td>25.2</td>
<td>40.8</td>
<td>27.2</td>
<td>34.2</td>
<td>32.9</td>
<td>3.7</td>
<td>0.41</td>
</tr>
</tbody>
</table>

* Including isolated systems.
9.2.3. GENERATING EMPLOYMENT THROUGH NPP CONSTRUCTION

The construction and commissioning of nuclear facilities, including NPP power units, creates new jobs, as enterprises often recruit employees from local communities within a 100-kilometre radius of the construction site. For instance, as construction work progressed at the site of Rooppur NPP in Bangladesh in 2019, thousands of local residents gained employment. Importantly, these projects also create jobs in related sectors of the economy (the metals industry, mechanical engineering, etc.).

The construction of the Belarusian NPP has become a major infrastructure project providing employment to thousands of people, both at the NPP itself and in organizations that are servicing it. In 2019, more than 30 local contractors were involved in NPP construction.

In 2019, the Corporation continued its work focused on the implementation of national projects in all nuclear towns and cities. ROSATOM took part in developing a methodology for improving the efficiency of participation of its regions of operation in national projects to enable them to focus their efforts on projects of key importance for a town, a city or the entire region. The methodology was tested in three towns in the Chelyabinsk Region: ROSATOM’s specialists analysed social and economic indicators, identified development areas and the most significant projects and then compiled road maps for the development of these towns. In the future, this practice may be rolled out in other regions.

9.2.4. SUPPORTING THE IMPLEMENTATION OF NATIONAL PROJECTS IN ROSATOM’S REGIONS OF OPERATION

In 2019, the Corporation continued its work focused on the implementation of national projects in all nuclear towns and cities. ROSATOM took part in developing a methodology for improving the efficiency of participation of its regions of operation in national projects to enable them to focus their efforts on projects of key importance for a town, a city or the entire region. The methodology was tested in three towns in the Chelyabinsk Region: ROSATOM’s specialists analysed social and economic indicators, identified development areas and the most significant projects and then compiled road maps for the development of these towns. In the future, this practice may be rolled out in other regions.

<table>
<thead>
<tr>
<th>NPP</th>
<th>Actual headcount, including contractors</th>
<th>Including employees recruited from local communities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leningrad NPP-2 (Russia)</td>
<td>3,416</td>
<td>3,249</td>
</tr>
<tr>
<td>Kursk NPP-2 (Russia)</td>
<td>4,566</td>
<td>4,566</td>
</tr>
<tr>
<td>Belarusian NPP</td>
<td>7,873</td>
<td>1,849</td>
</tr>
<tr>
<td>Rooppur NPP (Bangladesh)</td>
<td>8,850</td>
<td>7,454</td>
</tr>
<tr>
<td>Akkuyu NPP (Turkey)</td>
<td>5,643</td>
<td>4,435</td>
</tr>
</tbody>
</table>

9.2.4. SUPPORTING THE IMPLEMENTATION OF NATIONAL PROJECTS IN ROSATOM’S REGIONS OF OPERATION

In 2019, the Corporation continued its work focused on the implementation of national projects in all nuclear towns and cities. ROSATOM took part in developing a methodology for improving the efficiency of participation of its regions of operation in national projects to enable them to focus their efforts on projects of key importance for a town, a city or the entire region. The methodology was tested in three towns in the Chelyabinsk Region: ROSATOM’s specialists analysed social and economic indicators, identified development areas and the most significant projects and then compiled road maps for the development of these towns. In the future, this practice may be rolled out in other regions.

9.2.4. SUPPORTING THE IMPLEMENTATION OF NATIONAL PROJECTS IN ROSATOM’S REGIONS OF OPERATION

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9.2.5. PRIORITY DEVELOPMENT AREAS IN NUCLEAR TOWNS AND CITIES

In 2019, 18 companies became residents of priority social and economic development areas (PSEDAs) in the CATFs of Sarov, Zarechny, Seversk, Novouralsk, Zheleznogorsk, Snezhinsk and Ozersk. According to the residents’ business plans, the total amount of investments that they intend to attract will exceed RUB 3 billion, including capital investment. Overall, 870 new jobs will be created. It is intended that 19 more companies will become residents in 2020.

STATUS OF PROJECT IMPLEMENTATION IN PSEDAS

- Tomsk Region
  - PSEDA IN ZARECHNY
    - 3 third-party projects, RUB 379 million in investment, 207 jobs
    - Products: spare parts for locomotives, building materials and plastic products.
  - PSEDA IN SEVERSK
    - 1 third-party project, RUB 1,259 million in investment, 154 jobs
    - Products: titanium dioxide pigment produced using fluoride technology; mechanical engineering.
  - Chelyabinsk Region
    - PSEDA IN OZERSK
      - 4 third-party projects, RUB 366 million in investment, 135 jobs
      - Products: polymers and polymer materials, non-ferrous metals and alloys, adaptive suspension modules for vehicles; modernization of drilling equipment.
    - Chelyabinsk Region
      - PSEDA IN SNEZHINSK
        - 2 third-party projects, RUB 576 million in investment, 60 jobs
        - Products: rope-making machines, disks for harrows, burners.
  - Krasnoyarsk Territory
    - PSEDA IN ZHELEZNOGORSK
      - 2 third-party projects, RUB 54 million in investment, 40 jobs
      - Products: rope-making machines; design and manufacture of custom modular equipment packages.

- Sverdlovsk Region
  - PSEDA IN NOVOURALSK
    - 4 third-party projects, RUB 324 million in investment, 235 jobs
    - Products: steel short-radius elbows, pipe assemblies; repairs of machine tools and industrial equipment; development of technology and manufacture of corundum-based ceramic substrate.
  - Nizhny Novgorod Region
    - PSEDA IN SAROV
      - 3 third-party projects, RUB 29 million in investment, 119 jobs
      - Products: concrete and reinforced concrete products; specialized construction and installation technology and manufacture of Cecilie-based ceramic substrate.
  - Tomsk Region
    - PSEDA IN ZARECHNY
      - 1 third-party project, RUB 1,259 million in investment, 154 jobs
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9.2.6. IMPROVING THE QUALITY OF HEALTHCARE SERVICES IN THE TOWNS AND CITIES OF OPERATION

In 2019, the first stage of the Right to Health social project initiated by Rosatom's Public Council and the Russian Patients’ Association was implemented in six towns where ROSATOM operates. Residents of Novouralsk, Lesnoy, Ozersk, Snehinsk, Tryokhgorny and Zarechny (Sverdlovsk Region) can now consult legal advisors using a free hotline. Over 40 training sessions on legal matters for patients were held in these towns; as a result, over 1,200 people improved their knowledge in this field. 12 healthcare professionals were retrained as consulting experts in conflict-free communication with patients and now provide training in these techniques to employees of healthcare centres. The project has helped to make communication between doctors and patients more efficient. In 2020, further steps will be taken to organize special dialogue platforms.

The Corporation signed an agreement with the Federal Biomedical Agency of Russia on cooperation in four areas:
- Healthcare quality control and implementation of the Lean Polyclinic project;
- Upgrading the capabilities of healthcare organizations of the FMBA;
- Creating nuclear medicine centres and providing them with equipment;
- Production of radiopharmaceuticals.

In addition, underlying principles were formulated for a new model of provision of healthcare services by FMBA organizations to people living in CATFs and other regions of Rosatom’s operation. The model includes public-private partnerships, digital technology and telemedicine mechanisms.

See also the section ‘Rosatom Production System’. 
9.2.7. URBAN INFRASTRUCTURE DEVELOPMENT

ROSATOM is implementing the Smart City project in its regions of operation. This project forms part of the Housing and Urban Environment National Project and the Digital Economy National Programme; its aim is to make Russian towns and cities more competitive, develop an efficient system for the management of municipal services and create a safe and comfortable environment for local residents. The project has been implemented in Sarov (Nizhny Novgorod Region). Over the year and a half since the launch of the Smart City system, the amount of time required to process enquiries and complaints received from residents has been reduced four-fold; the amount of time required for public transport dispatch operations has been reduced from two and a half days to an hour and a half, while the time of response to accidents or utility service failures has been reduced from 30 to 3 minutes.

In 2019, ROSATOM signed a number of cooperation agreements with Russian regions covering the following areas:
- Digitalization of municipal services in order to improve transport and social infrastructure;
- Making the regions more attractive to investors; upgrading utility infrastructure using modern approaches based on digital technology.

Under an agreement with Udmurtia, ROSATOM will implement an investment project which will help to increase the reliability of water supply in Glazov. The Corporation will upgrade the entire municipal water supply and sewerage infrastructure system, including the construction of new facilities, renovation and overhaul of existing ones. RUB 1.2 billion will be allocated for these purposes over the next five years. A pilot project in the sphere of water supply and sewerage management is also being implemented by the Corporation in Lesnoy (Sverdlovsk Region).

Agreements with the Nizhny Novgorod Region and the city of Sarov provide for upgrading the housing and utility infrastructure using modern digital approaches, including such elements of the Smart City as Smart Utilities and the Smart Water Supply and Sewerage System.

The Smart City is underpinned by the sustainable use of resources and the use of state-of-the-art digital technologies. Information obtained as a result of a thorough process analysis at the local level is digitized and provides a basis for a continuous improvement system.

The Smart City includes the Digital Water Supply and Sewerage System as one of its elements. This is a system for the automation and digitization of production and distribution processes which enables effective management of water supply and sewerage systems.

JSC Smart City Digital Platforms and Solutions, an organization of ROSATOM, acts as the integrator of solutions in the following areas: Centralization of Municipal Utility Systems, Clean Water and the Smart City.

Implementation of agreements with the Republic of Dagestan, the Tomsk, Kursk and Murmansk Regions will also be based on ROSATOM’s experience and developments in the field of the smart city. For instance, the Corporation is cooperating with the administration of the Tomsk Region to create a regional digital platform for supporting the implementation of the Region’s social and economic development strategy. The Our North portal, a digital solution with a range of functions similar to the Active Citizen platform, was promptly developed and adopted for the Murmansk Region. Citizens can use the portal to report problems in the sphere of housing, utilities and municipal administration and submit proposals concerning municipal services or the development of the Region as a whole.

See also the section ‘ROSATOM Production System’.

9.2.8. GRAZHDANIN STRANY ROSATOM APP

In 2019, ROSATOM launched a mobile app, Grazhdanin Strany ROSATOM. It is a communication platform designed to engage people living in ROSATOM’s regions of operation in the discussion of relevant topics related to urban and social life. The service involves targeting users based on their gender, age and preferences according to the data entered during registration, including via social media.

Key services available through the app include:
- Surveys and feedback collection, with users being able to propose subjects for discussion with the help from moderators;
- A discussion platform;
- A system of bonuses for active survey respondents, who can then use bonus points when ordering paid services via the mobile app (a partner programme run in cooperation with municipal organizations and businesses);
- Prompt provision of information to residents (municipal and federal-level news, information about ROSATOM’s projects);
- Access to background information about local enterprises and organizations;
- Online booking of tickets to cultural events, tables in cafes, etc.

In the reporting year, the app provided coverage of events in Russia, ROSATOM’s projects and life in 27 towns and cities where nuclear enterprises are located. By the end of 2019, the app had over 70,000 registered users.
In 2019, the Accelerator of Social Initiatives competition was held for the second time. The competition was held in Lesnoy, Zarechny (Penza Region), Zelenogorsk and Zheleznogorsk (Krasnoyarsk Territory), Novovoronezh (Voronezh Region) and Zarechny (Chelyabinsk Region), Udomlya (Tver Region), Zelenogorsk (Krasnoyarsk Territory). The competition was held for the second time. The competition was held in Lesnoy, Zarechny (Penza Region), Zelenogorsk and Zheleznogorsk (Krasnoyarsk Territory), Novovoronezh (Voronezh Region) and Zarechny (Chelyabinsk Region), Udomlya (Tver Region), Zelenogorsk (Krasnoyarsk Territory), Novovoronezh (Voronezh Region) and Zarechny (Sverdlovsk Region). More than 500,000 people from 20 nuclear towns and cities participated in the competition. The town of Zarechny (Penza Region) declared the winner. The town received a money prize (RUB 10 million); these funds will be used to support social projects in the field of education, culture, sports and the veteran movement.

CHARITY WORK
Continuing the traditions established in the nuclear industry, ROSATOM and its organizations adhere to the principles of responsible business conduct. The Corporation is guided by the priorities of social and economic development of Russia, its regions and its cities, including the CATFs in the nuclear industry, and consistently implements industry-wide social and charity programmes.

As part of its charity initiatives, ROSATOM gives priority to the following areas:
- Social and environmental initiatives, including assistance to victims of natural disasters, industrial accidents and environmental disasters related to the nuclear legacy;
- Initiatives aimed at protecting people’s life and health (support for the disabled, elderly people, orphans or disadvantaged children, emergency medical care);
- Support for educational projects, assistance to socially important cultural and educational initiatives;
- Preservation of cultural heritage sites and historic monuments;
- Promoting a healthy lifestyle, physical education, popular and amateur sports;
- Fostering moral and spiritual values and strengthening the civil identity;
- Supporting the youth education system based on spiritual, moral and patriotic values traditional for the Russian culture.

TERRITORY OF CULTURE
ROSATOM’s Territory of Culture is a programme aimed at finding and supporting creative talents in the cities and towns where ROSATOM operates, improving the performance of cultural institutions and introducing residents of Russian nuclear cities and towns to the highlights of performing, figurative and dramatic arts.

In 2019, the following events were held as part of the programme:
- The second Music Academy of Nuclear Towns and Cities under the auspices of the People’s Artist of Russia Yury Bashmet;
- Meet-the-artist sessions and master classes with famous Russian performers (including People’s Artists of Russia Alexey Gusakov and Yulia Rutberg, Honoured Artists of Russia Anna Bolshova, Daniil Spivakovsky, etc.);
- Creative laboratories as part of a project titled ‘Theatre of Nations to Theatres of Nuclear Towns and Cities’;
- A choir festival featuring singers from the Turetsky Choir and the Soprano art project.

In addition, as part of the Programme, special emphasis was placed in 2019 on professional development of people involved in the organization of cultural events, which contributed to an increase in the number of such events and facilitated their promotion. Events aimed at developing the competences of heads of cultural institutions included onsite workshops, specialized webinars and professional development programmes for regional civil servants. Special online communities were created to enable prompt exchange of information between experts in the relevant areas and representatives of local governments.

ACCELERATOR OF SOCIAL INITIATIVES
In 2019, the Accelerator of Social Initiatives competition was held for the second time. The competition was held in Lesnoy, Zarechny and Novovoronezh (Sverdlovsk Region), Zarechny (Penza Region), Zelenogorsk and Zheleznogorsk (Krasnoyarsk Territory). 855 people participated in the competition, with about 50 projects submitted for critical review. Authors of the most exciting and well-thought-out concepts presented them to municipalities, representatives of ROSATOM and regional funds supporting entrepreneurship. The projects that reached the finals included aerial gymnastics, fitness and dance studios, family dental clinics, leisure centres for children, shops selling goods for diabetic patients, cleaning companies, chess clubs and other organizations whose services are in demand.

9.2.9. IMPLEMENTATION OF SOCIAL AND CHARITY PROGRAMMES IN ROSATOM’S REGIONS OF OPERATION

ROSATOMVMESTE
In 2019, a large-scale competition of social projects titled #ROSATOMVMESTE (‘ROSATOM Together’) was held for the second time. The goal of this competition is to create ‘change teams’ in towns and cities, to form an efficient environment for communication between employees in the nuclear industry and residents of ROSATOM’s host towns and cities, and to raise their awareness.

In 2019, the competition was held in 20 of ROSATOM’s host towns and cities and included five stages:
- The Town/City Brand;
- ROSATOM’s Million;
- A competition for social project coordinators;
- ROSATOM’s Best Month;
- ROSATOM’s Day of Towns and Cities.

More than 500,000 people from 20 nuclear towns and cities participated in the competition. The town of Zarechny (Penza Region) declared the winner. The town received a money prize (RUB 10 million); these funds will be used to support social projects in the field of education, culture, sports and the veteran movement.

ROSATOM’S SCHOOL
The long-term project titled ROSATOM’s School is aimed at providing children with first-class education regardless of where they live, while preserving and developing the unique character of municipal educational systems. The project is implemented in 21 towns and cities in which ROSATOM operates. It covers almost 250 schools and over 400 nursery schools with a total of over 200,000 children and school students.

In 2019, the Corporation began to develop efficient technologies for providing additional education to children. Five ‘Atom – Class!’ Interschool Network Competence Centres were provided with the necessary equipment and started to function in Tryokhotorgomny (Chelyabinsk Region), Udomylya (Tver Region), Zelenogorsk (Krasnoyarsk Territory), Novovoronezh (Voronezh Region) and Zarechny (Sverdlovsk Region).

In the reporting year, a network competence centre for teachers forming part of ROSATOM’s School held a 10-week remote methodological marathon, with over 9,500 people from 53 federal subjects of Russia participating in this event. 97 remote workshops were held, and an electronic platform was created which contains over 100 hours of video materials prepared for these workshops.

The Corporation held the sixth Meta-Disciplinary Academic Competition. Participants of the competition included more than 1,000 teams, more than 4,000 students and more than 1,000 teachers from all schools in the towns and cities participating in the initiative.

The Corporation held the ARTatomCITY visual arts festival, with artwork submitted by 1,500 young artists from 18 towns and cities participating in the project.

In 2019, the #ROSATOMVMESTE project won the Silver Archer National PR Award in the Corporate Social Responsibility category.
9.2.10. WORK OF THE PUBLIC COUNCIL

ROSATOM’s Public Council13 established in 2006 is tasked with providing support for cooperation between ROSATOM’s organizations and individuals, non-profit organizations, regional and local governments in Russia and abroad.

In 2019, the Public Council, together with the Northern Sea Route Directorate and FSUE Atomflot, prepared and published a book titled ‘Captains’ to mark the anniversary of the nuclear-powered icebreaker fleet. The book contains information on the history of the Russian nuclear-powered icebreaker fleet, biographies and stories told by captains of nuclear icebreakers; it also outlines plans for the development of the Northern Sea Route.

PUBLIC DIALOGUE FORUM

In November 2019, the Public Council took part in the organization of the International Public Dialogue Forum and the Atomics 2019 Exhibition in Hungary. The event was aimed at opening a dialogue between specialists in the nuclear industry, government agencies, experts, ecologists and the general public. It was attended by more than 570 people from 16 countries. Participants of the forum included representatives of international organizations (the IAEA, the OECD NEA, Nuclear Transparency Watch) and Russian and Hungarian non-governmental organizations (Bellona, Energiapoliti ka 2000).

The findings of pre-operational radiation and environmental assessment of the environment in the vicinity of the Belarusian NPP and the landscape in the vicinity of the Belarusian NPP. As a result of this survey, the group publicly recorded a zero background radiation level, confirming the findings of state environmental monitoring. The survey methodology and the findings are available for use as part of public control and further verification of the safety of operation of the Belarusian NPP.

The Corporation fosters systematic and constructive stakeholder engagement as follows:

- Respect and accommodation of the interests of all participants;
- Open efficient cooperation;
- Timely and exhaustive information on ROSATOM’s activities;
- Strengthening self-regulation and transparency;
- Fulfilment of obligations;
- Timely and exhaustive information on ROSATOM’s activities;
- Fulfilment of obligations.

One of the focus areas of the work of the Public Council in 2019 was cooperation with the regional expert community. More than 70 experts from research institutions and universities, including the Ural Federal University named after Boris Yeltsin, Tomsk State University and Siberian Federal University, discussed matters related to the safety of nuclear technologies and nuclear power and demand for them in today’s world. Experts from Lomonosov Moscow State University were engaged in the discussion of matters related to public control and public participation in decision-making with regard to the development of the Russian nuclear industry. Overall, in the reporting year, the Council published 1,483 items of information material on regional, industry-wide and corporate sites.

CONTEST OF SOCIALLY IMPORTANT PROJECTS14

As part of ongoing cooperation between ROSATOM and non-governmental and non-profit organizations in its regions of operation, in 2019, the Corporation once again held the annual contest of socially beneficial initiatives implemented by non-profit organizations and associations.

To be eligible to participate in the contest, an applicant organization must invest its own funds totalling at least 25% of the total project cost.

Key results in 2019

- 73.7% of the population in Russia supports the use of nuclear energy.
- 335,000 people visited Nuclear Energy Information Centres.
- Viewership of channels broadcasting the Strana ROSATOM TV programme in various regions of Russia totals 7.3 million people.

9.3. STAKEHOLDER ENGAGEMENT

Due to its scale and special characteristics of its business (simultaneous performance of state and business tasks, operation across a large number of markets), ROSATOM has a wide range of stakeholders both in Russia and worldwide. Targeted stakeholder engagement is aimed at achieving strategic goals and getting the public on board for developing nuclear energy.

The Corporation fosters systematic and constructive stakeholder engagement in each area of its business and communicates with society as a whole.

Following two stages of the competition, 73 socially important projects in various areas were declared winners. They included the Active Longevity School, a dance marathon titled ‘Zarechny: the Dance Territory’, an adventure game and competition titled ‘Ecology of the Future’, Motor Sports at ROSATOM, the Summer Students’ Camp, the Navigator National Online Intellectual Competition, etc.

9.3.1. APPROACHES TO STAKEHOLDER ENGAGEMENT

Fundamental principles of stakeholder engagement are as follows:

- Respect and accommodation of the interests of all participants;
- Open efficient cooperation;
- Timely and exhaustive information on ROSATOM’s activities;
- Strengthening self-regulation and transparency;
- Fulfilment of obligations.

https://osatom.ru/en/

https://oskonkurs.ru/
STAKEHOLDER MAP

- Government bodies of the Russian Federation
  1–16, B, C, E, F, G, P, Q
- Government regulators (supervisory bodies)
  1, 2, 4, 6, 7, 10, B, C, N, P, Q
- Regional governments
  2, 6, 10, 15, B, C, E, F, G, P, Q
- Local governments in the regions of operation
  2, 11, 15, C, E, F, G, K, P, Q
- Government bodies of foreign countries
  1, 2, 6, 7, 10–13, 16, A, D, J, K, P, Q
- International organizations, including those in the nuclear sector
  1, 2, 6, 7, 10–13, 16, A, D, J, K, P, Q
- Organizations forming part of ROSATOM
  3, 5, 6, 13, 16, D, K, P, Q
- Manufacturers and suppliers of equipment and services
  5, 7, 10, K, I, P, Q
- Consumers of technologies, products and services
  3, 5, 6, 7, 8, 9, 12, K, H, P, Q
- Business partners
  5, 6, 7, 8, 9, 12, K, M, P, Q
- Professional associations
  6, 14, 16, F, D, K, O, P, Q
- Non-governmental organizations, including environmental NGOs
  2, 10, 11, 15, C, E, G, K, O, P, Q
- Employees of the Corporation and its organizations, as well as organizations representing their interests
  6, 10, 14, 16, F, D, I, E, O, P, Q
- Local communities in the regions of operation
  11, 15, C, E, F, G, H, K, O, P, Q
- Educational institutions
  3, 14, 16, D, J, P, Q
- Financial institutions
  3, 5, 8, 10, K, P, Q
- Rating agencies, market analysts, experts
  5, 10, 13, K, P, Q
- Citizens of the Russian Federation
  1, 2, 4, 6, 10, 11, 12, 15, H, O, P, Q
- Research institutes
  3, 11, K, O, P, Q
9.3.2. NUCLEAR ENERGY INFORMATION CENTRES (NEICS)

The objective of NEICs is to raise awareness among local communities in the regions about the nuclear industry and the development prospects of nuclear power and radiation technologies, make professions in the industry more prestigious, promote science, innovative technologies and technical education, and cooperate with the professional scientific community in promoting science.

In 2019, almost every NEIC held a city-wide event. Vladimir and Zheleznogorsk (Krasnoyarsk Territory) hosted a mini science festival, Scientific Encounters; an adventure game titled Stork Is Alive! was designed in Ulyanovsk and successfully replicated in Voronezh, Novovoronezh and Rostov-on-Don; residents of Minsk and Smolenisk took part in a science and sporting event, AtomDvizh (AtomMove). Centres in Ekaterinburg, Kaliningrad and Novosibirsk held the KSTATI (‘By the Way’) Festival of Science, which has become an annual event in these cities. Employees of the NEIC in Nizhny Novgorod organized a Science Tour in six districts in the northern part of the Nizhny Novgorod Region, while the NEIC in Saratov held a Science Lawn festival, which consisted of a 3D-day non-stop series of workshops for children, popular science talk shows, musical performances and outdoor games. The NEIC in Belarus launched a special project, Construction DNA, as part of a town festival in Minsk and a programme titled Sounds of a Construction Site in Minsk.

As at December 31, 2019, the NEIC network comprised 17 centres in Russia, as well as centres in Minsk (Belarus) and Nur-Sultan (Kazakhstan). In 2019, 335,000 people visited the centres.

Nuclear Kids (NucKids) (http://nuckids.ru/en) is an annual international art project for the children of employees of Russian nuclear organizations and ROSATOM’s foreign partners. The project is being implemented in 15 countries. Many NucKids alumni study at well-known universities, such as the Russian Institute of Theatre Arts (GITIS), the Moscow Art Theatre School, the Russian State University of Cinematography (VGIK) and the Oleg Tabakov Studio. They perform in films and work in show business.

In 2019, 57 children took part in the project. Under the supervision of professional choreographers, directors, voice coaches and singing teachers, they staged a play titled In the Beginning Was the Word, based on Chuchelo (The Scarecrow), a novella by Vladimir Zheleznykh. This frank and profound piece focused on the problem of teenage bullying and ‘living online’. It was premiered in Debrecen (Hungary), followed by performances in Russian ‘nuclear’ towns of Sosnovy Bor (Leningrad Region) and Udomlya (Tver Region), as well as in Saint Petersburg and Moscow.
9.3.4. PARTICIPATION IN THE WORK OF INTERNATIONAL CORPORATE ORGANIZATIONS

ROSATOM and its organizations are members of the World Nuclear Association (WNA) and actively participate in all WNA events, including country workshops and the annual Symposium. In 2019, the Corporation was one of the key participants of World Nuclear Spotlight Brazil.

ROSATOM has been a Patron of the World Energy Council (WEC) since 2017 and a member of the Russian National Committee of the World Energy Council since 2012. In 2019, as part of its cooperation with the WEC, the Corporation actively participated in panel discussions and the exhibition during the 24th World Energy Congress held in Abu Dhabi (UAE) on September 9-12. In addition, the WEC and the WNA published a joint report on the nuclear industry for the first time with assistance from the Corporation.

Throughout 2019, ROSATOM and its organizations also actively participated in the work of other international nuclear organizations: the World Association of Nuclear Operators, the World Nuclear University, the Japanese Nuclear Society, the Japan Atomic Industrial Forum, the Brazilian Association for the Development of Nuclear Activities (ABDAN), the Nuclear Industry Association of South Africa, etc. Overall, in the reporting year, ROSATOM took part in more than 40 forums and conferences abroad and organized 16 displays at overseas exhibitions.

For details on cooperation with international non-governmental organizations, see the section ‘International Cooperation’.

9.3.5. PROJECTS IN THE SPHERE OF COMMUNICATION AND THE HUMANITIES IMPLEMENTED IN COOPERATION WITH FOREIGN PARTNERS

In 2019, ROSATOM organized 25 events in the field of the humanities in Russia and seven partner countries. As part of these events, foreigners learnt about Russia, the Russian culture and way of life. The events were attended by more than 2,000 people from 43 countries.

Four international shifts were organized as part of the International Smart Holidays project, with 94 children from the Corporation’s partner countries participating in the project.

The Corporation provided support for community relations projects in the countries in which it operates (the Benois de la Danse World Ballet Festival, the Geographical Dictation, the FIDE World Chess Championship, etc.).

About 25 technical tours of nuclear facilities in Russia and construction sites of Russian-design NPPs abroad were organized for Russian and foreign journalists and experts (more than 200 people).

9.3.6. INDUSTRY MEDIA

To inform employees and other stakeholders of the news and key events in ROSATOM and its organizations, a range of corporate media outlets under the common brand name Strana ROSATOM (“The Country of ROSATOM”) is used in the industry:

- A newspaper (published weekly in all enterprises in the Russian nuclear industry, with a circulation of 59,000 copies and a readership of over 250,000 people);
- A radio programme (it is broadcast two or three times a week in 30 of ROSATOM’s organizations and has an audience of 50,000 people);
- A television programme (it is aired weekly in 20 towns and cities where nuclear organizations operate; the viewership of the channels that broadcast the programme totals 7.3 million people).

Throughout 2019, ROSATOM and the TASS news agency were cooperating on joint multimedia projects. They won a number of awards in the sphere of journalism and design. Andrey Reznichenko, editor-in-chief of TASS Science, won a prize in the Energy of Words International Media Contest for journalists reporting on the energy industry for his special project, Secrets of Radiation Technologies, implemented jointly with ROSATOM’s Communications Department. A project titled ‘Northern Sea Route 2.0’ won the Digital Communication Awards, a prestigious award in the field of design, in the Long Read category. This project is an interactive presentation on the history of the Northern Sea Route, the modernization of the nuclear-powered icebreaker fleet and its development prospects.

9.3.7. ONLINE COMMUNICATIONS

ROSATOM is actively developing online communication with stakeholders. In 2019, the Corporation’s official website at www.rosatom.ru was visited by more than 700,000 people, or approximately 5,000 people on average every weekday.

The Corporation is also expanding its presence on social media in order to inform users of various developments in the Russian nuclear industry, answer questions and conduct awareness-raising events. In 2019, ROSATOM recorded the largest increase in the number of followers on social media platforms focused on visual content: Instagram (where the official community expanded by more than 70% year on year) and Youtube (an increase of more than 50%). At year-end 2019, ROSATOM’s communities on social media comprised a total of more than 158,000 people.
9.3.8. OPINION POLLS

ROSATOM analyses the public perception of the development of nuclear power in Russia on a yearly basis and adjusts its communication with stakeholders accordingly.

According to an independent opinion survey by Levada-Centre**, 73.7% of the Russian population supported the use of nuclear power (74.5% in 2018). Over the past few years, this figure remains persistently high.

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** The survey was conducted from February 14 through February 28, 2020 across a representative sample of Russian citizens consisting of 3,951 people aged 18 and above.

---

<table>
<thead>
<tr>
<th>Platform</th>
<th>Number of followers as at December 31, 2018*</th>
<th>Increase (+%)</th>
<th>Number of followers as at January 1, 2020*</th>
</tr>
</thead>
<tbody>
<tr>
<td>VKontakte</td>
<td>42,600</td>
<td>6,900 (+16.1%)</td>
<td>49,500</td>
</tr>
<tr>
<td>Facebook</td>
<td>31,500</td>
<td>8,300 (+26.3%)</td>
<td>39,800</td>
</tr>
<tr>
<td>Instagram</td>
<td>18,100</td>
<td>13,300 (+73.4%)</td>
<td>31,400</td>
</tr>
<tr>
<td>YouTube</td>
<td>16,400</td>
<td>9,500 (+57.9%)</td>
<td>25,900</td>
</tr>
<tr>
<td>Twitter</td>
<td>10,800</td>
<td>600 (+5.5%)</td>
<td>11,400</td>
</tr>
<tr>
<td>Odnoklassniki</td>
<td>–</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>119,400</td>
<td>38,700 (+32.4%)</td>
<td>158,100</td>
</tr>
</tbody>
</table>

* Follower numbers have been rounded to hundreds
10.1. Nuclear and Radiation Safety; Occupational Safety and Health 216
10.2. RAW and SNF Management and Decommissioning of Facilities Posing Nuclear and Radiation Hazards 228
10.3. Environmental Safety 234
10.1. NUCLEAR AND RADIATION SAFETY; OCCUPATIONAL SAFETY AND HEALTH

Key results in 2019
- No events rated at level 1 or higher on the INES scale were detected.
- The injury frequency rate and the lost time injury frequency rate (LTIFR) stood at 0.22 and 0.1 respectively.
- Individual radiation risk was calculated for 64,932 people using the IRAW system.

10.1.1. NUCLEAR AND RADIATION SAFETY MANAGEMENT

ROSATOM focuses on effective exercise of powers and performance of functions stipulated by the laws of the Russian Federation on the use of nuclear power, with safety and environmental protection as the top priority. This task is addressed by various divisions of ROSATOM and its organizations using all the main government and non-governmental regulation mechanisms.

Nuclear and radiation safety management functions are performed by the following divisions of ROSATOM:
- The General Inspectorate prepares proposals for shaping the state policy on nuclear and radiation safety, takes measures to ensure the safety of nuclear facilities and monitors safety in ROSATOM’s organizations;
- The Nuclear and Radiation Safety, Licensing and Permitting Department is tasked with ensuring that personnel and equipment are ready to respond to emergencies at nuclear facilities and monitoring the implementation of emergency prevention measures;
- The Directorate for Public Policy on Radioactive Waste, Spent Nuclear Fuel and Nuclear Decommissioning plays a leading role in the system for the management of government programmes aimed at addressing nuclear legacy issues;
- The Technical Regulation Department formulates technical safety requirements for the use of nuclear power.

The following bodies were established in 2019:
- An industry-wide Coordinating Council for Safety Culture;
- An industry-wide coordinating council for the development and implementation of an occupational risk management system in ROSATOM’s organizations;
- An industry-wide Council for Occupational and Industrial Safety.

In 2019, at the third Industry-Wide Dialogue Forum titled ‘Nuclear Power and Industry Safety Day’, the Safety Culture Policy Statement of ROSATOM and Its Organizations was reviewed and adopted. The document states the principles of the Safety Culture Policy, the main focus areas of its implementation, as well as the relevant obligations of ROSATOM’s management (http://www.nwatom.ru/images/Documents/Politika bezopasnosti_Rosatom.pdf).

In 2019, 876 employees of the Corporation received training as part of programmes aimed at developing a culture of safe behaviour.
The safety status of nuclear facilities is assessed based on the number and scale of recorded deviations in their operation that are benchmarked against the IAEA International Nuclear and Radiological Event Scale (INES). Events on the scale are rated at seven levels: the upper levels (4–7) are termed ‘accidents’, while the lower levels are ‘incidents’ (2–3) and ‘anomalies’ (1). Events that have no safety significance are called ‘deviations’ and are rated as below scale, at level 0. Events that have no safety relevance are classified as ‘out of scale’.

In 2019, 38 deviations were recorded at Russian nuclear power plants. Deviations (rated at level 0) do not pose a risk to employees operating the facilities, local residents or the environment. Failures of monitoring and control systems were caused by deficiencies in self-diagnostic and defect detection functions. Following investigations into the deviations, corrective measures have been developed and implemented to prevent such deviations in the future.

### CHANGES IN THE NUMBER OF ANOMALIES AND DEVIATIONS IN NPP OPERATION ON THE INES SCALE

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total, including:</td>
<td>33</td>
<td>42</td>
<td>38</td>
</tr>
<tr>
<td>Level 0 and out of scale</td>
<td>33</td>
<td>40</td>
<td>38</td>
</tr>
<tr>
<td>Level 1</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

The deviations were mainly associated with failures of thermal mechanical and electrical equipment; a small number of deviations was caused by failures of monitoring and control systems. Equipment failures were due to hidden defects that could not be detected during manufacturing, installation and adjustment.

### NUCLEAR POWER PLANTS

As in many recent years, in 2019, no events rated at level 2 or higher on the international INES scale were detected at Russian nuclear power plants. Moreover, in 2019, there were no events rated at level 1.

### RESEARCH NUCLEAR FACILITIES

In 2019, there were no nuclear, radiation or technical accidents at research nuclear facilities in ROSATOM’s organizations. No events rated higher than level 0 on the INES scale were detected.

### MARINE NUCLEAR PROPULSION UNITS

There were no violations of safe operating limits and conditions for propulsion units of nuclear-powered vessels in 2019. The deviation level remained within permitted limits. No events rated higher than level 0 on the INES scale were detected.

### PHYSICAL PROTECTION OF NUCLEAR FACILITIES

The security and physical protection of ROSATOM’s nuclear facilities poses nuclear and radiation hazards and of nuclear and radioactive materials used and stored by ROSATOM (including during their transportation) complies with Russian legislation and the provisions of the Convention on the Physical Protection of Nuclear Material and is consistent with the IAEA recommendations.

In 2019:

- Departmental inspections of the condition of physical protection systems were carried out in 12 organizations of the Corporation;
- ROSATOM upgraded and replaced security equipment along 27 kilometres of the perimeters of protected areas of facilities posing nuclear and radiation hazards, including checkpoints;
- Over 2,500 items of equipment were installed in protected areas as part of equipment systems for physical protection;
- Equipment for physical protection was upgraded in 34 buildings;
- More than 25 kilometres of cable routes for physical protection systems were laid.

In the reporting year, ROSATOM’s departmental security agency in cooperation with the federal executive government ensured the safety of Akademik Lomonosov floating power unit during its transportation from Murmansk to Pevek (Chukotka Autonomous District). This experience in safe transportation can be used in the future, including in international practice.

In 2019, there were no violations of access control and internal security requirements at ROSATOM’s facilities resulting in the theft of nuclear materials, terrorist acts or sabotage at nuclear facilities.
10.1.5. INDUSTRY-WIDE RADIATION MONITORING SYSTEM

The Industry-Wide Radiation Monitoring System (IRMS) is in operation in Russia as a functional subsystem of the Integrated State Automated Radiation Monitoring System in the Russian nuclear industry. The upper level of the IRMS is the departmental information and analysis centre for radiation monitoring, which integrates data from: • On-site automated radiation monitoring systems (ARMSs). On-site ARMSs are in operation in the locations of 31 of ROSATOM’s facilities posing radiation hazards; • The on-site subsoil condition monitoring (OSCM) system. The industry-wide OSCM system has been implemented in 55 organizations of the Corporation, including all environmentally relevant organizations. Information collected by the system is used to assess and predict changes in the condition of the subsoil, provide rationale for design solutions and evaluate the effectiveness of remediation measures.

In 2019, the IRMS included: • 435 fixed on-site ARMS stations; • 2,695 OSCM wells; • 206 air quality monitoring stations; • 176 atmospheric precipitation monitoring stations; • 455 stations monitoring surface water bodies; • 213 stations monitoring bottom sediments; • 561 soil monitoring stations; • 404 ground vegetation monitoring stations; • 92 stations monitoring algae and aquatic organisms; • 397 stations monitoring the snow cover; • 290 stations monitoring food products; • 432 absorbed dose monitoring stations. Real-time data from automated radiation monitoring stations operated by ROSATOM’s organizations is available on the website of the Corporation at http://www.russianatom.ru. An information and analysis system for radiation and environmental monitoring has been piloted at FSUE Mayak Production Association and JSC Siberian Chemical Plant. It is used to systematize the findings of routine monitoring of radionuclide content in discharges and emissions from enterprises and in the natural environment (water, soil, vegetation, the atmosphere, atmospheric precipitation, bottom sediments, etc.). In 2019, the system was launched at PJSC MSZ.

In 2019, transportation of nuclear materials fully complied with the relevant laws and regulations. There were no violations. In all instances, transportation was monitored using an automated system for the safe transportation of nuclear materials.

In 2019, 505 operational training exercises were held, including 5 command post exercises, 20 special tactical exercises, 2 table-top exercises, 38 emergency response exercises and 11 comprehensive training exercises.

In 2019, 2,202 atmospheric precipitation monitoring stations; 206 air quality monitoring stations; 2,695 OSCM wells; 435 fixed on-site ARMS stations; the on-site subsoil condition monitoring (OSCM) system. The on-site automated radiation monitoring systems (ARMSs). On-site ARMSs are in operation in the locations of 31 of ROSATOM’s facilities posing radiation hazards; The on-site subsoil condition monitoring (OSCM) system. The industry-wide OSCM system has been implemented in 55 organizations of the Corporation, including all environmentally relevant organizations. Information collected by the system is used to assess and predict changes in the condition of the subsoil, provide rationale for design solutions and evaluate the effectiveness of remediation measures.

10.1.6. INDUSTRIAL SAFETY

As at December 31, 2019, 98 of ROSATOM’s organizations operated 737 hazardous industrial facilities (739 facilities in 2018), including 6 hazardous class 1 facilities, 32 hazardous class 2 facilities, 282 hazardous class 3 facilities and 417 hazardous class 4 facilities. In 2019, there were no events classified as ‘accidents at a hazardous industrial facility’ at ROSATOM’s industrial facilities. One event classified as an incident occurred at JSC NIKIET: a lead leak happened at an experimental lead-cooled reactor, which was contained and repaired by the organization’s personnel (there were no injured persons).

All equipment used at the Corporation’s facilities undergoes timely technical inspection and industrial safety assessment. Personnel operating hazardous production facilities are provided with special clothing and personal protective equipment of appropriate quality.

10.1.7. FIRE SAFETY

The fire situation at the Corporation’s facilities is stable. Since 2015, there have been no fires at facilities under construction in the industry. In 2019, there was a fire at LLC Petrozavodskimzay Facility (Mechanical Engineering Division). This was a decommissioned baggage and mail car was being cut, insulated, caught fire due to sparks and scale falling under the casing. There were no injured persons or damage to property.

10.1.8. OCCUPATIONAL SAFETY AND HEALTH

The fundamental principle underlying ROSATOM’s operations is to protect the life and health of employees in the course of operation of equipment, buildings, structures and production processes, including those involving radioactive materials and hazardous substances. ROSATOM has adopted a Single Industry-Wide Policy of Occupational Safety and Health, which defines the goals, principles and obligations of the Corporation in this area. In 2019, ROSATOM joined the Vision Zero10 international campaign in order to achieve a zero injury rate in its organizations.

The industry-wide occupational safety and health management system is an important element of mutual obligations undertaken by ROSATOM, the Russian Union of Employers in the 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 (in the reporting year, those involving the period from 2018 through 2020 was in force). The Agreement incorporates the opportunities provided by legislation on the special inspection of working conditions (SIWC) and stipulates an additional mechanism for cooperating with the trade union in conducting an SIWC and analysing inspection findings. In 2019, 81,841 workplaces were inspected as part of the SIWC.

A KPI-based incentive system adopted in ROSATOM is one of the key mechanisms for improving safety performance.

220

https://rosatom.ru/sustainability/menedzhment-bezopasnosti-truda-i-okhrany-zdorovya/ 10 Vision Zero is based on the belief that all accidents, diseases and harm at work are preventable and on the commitment of Vision Zero Companies and Partners to promote the three core values of this campaign: Safety, Health and Well-Being (http://visionzero.global/).
In 2019, the injury frequency rate remained relatively low compared to major Russian companies (despite an increase in the average headcount in ROSATOM’s organizations by 11,000 people in the reporting year). The injury frequency rate (FR) stood at 0.22, which is more than five times lower than the national average (FR = 1.2).

62 persons were injured in 2019, including 41 men and 21 women. Out of the total number of the injured, 16 persons suffered serious injuries; there were 3 fatalities (all three victims were male). The main causes of injuries include falling on the premises, road accidents, the impact of moving mechanisms or rotating equipment parts, and the fall of an object on the victim.

A total of 9 people were injured in 2019 in contractor organizations, including 1 person who suffered serious injuries and 1 fatality. Falls from a height were the main cause of the accidents. Over the past five years, the number of injuries in contractor organizations has decreased threefold.

The risk of injuries remains high for employees involved in the operation and maintenance of equipment, and for those employees who do not follow safety precautions when moving around the premises of an organization.

In addition to the FR injury frequency rate, ROSATOM also uses the lost time injury frequency rate (LTIFR), which enables it to benchmark the injury rate across the Corporation against that of other companies and countries. The LTIFR has been included in the KPI maps of all Division executives.

The reference value of the LTIFR for ROSATOM’s Divisions, units, holding companies and the Corporation as a whole has been set at 0.5, which is a good result for any company in any country globally. The target for ROSATOM as a whole has been set at 0.4, which is better than the reference value. Individual values not exceeding the baseline values (a three-year average) have been accepted as target LTIFR values for the Divisions, units and holding companies within ROSATOM.

In 2019, the LTIFR across the Corporation and its organizations stood at 0.178.
At year-end 2019, the number of employees in jobs that are characterized by harmful and (or) hazardous working conditions in ROSATOM’s organizations totalled 120,061 people.

In 2019, the number of employees newly diagnosed with occupational diseases totalled 12 people (10 people in 2018, 37 people in 2017), including:
- 11 people in the Mining Division (PJSC PIMCU);
- 1 person in the Life Cycle Back-End Division (FSUE Mining and Chemical Plant).

The main occupational diseases of employees in the industry include diseases of the musculoskeletal system and the peripheral nervous system, as well as diseases caused by vibration (more than 80% of the total incidence). As a rule, people newly diagnosed with occupational diseases are employees aged 50 to 60 years who have been working in the industry for about 20 to 30 years on average.

A high risk of occupational diseases persists at PJSC PIMCU. To prevent them and to improve working conditions, mine equipment is being upgraded. In addition, strict disciplinary sanctions are imposed on employees who do not use respiratory protective equipment.

In addition, ROSATOM has organized the provision of medical treatment and preventive care to employees, which includes not only preliminary and periodic medical examinations, but also measures aimed at treating and preventing diseases and enabling the employees’ rehabilitation, if necessary (provision of health food and milk, health resort treatment).

As at December 31, 2019, 65,069 people (group A personnel) were under individual radiation exposure monitoring in ROSATOM’s organizations. The number decreased by 0.3% compared to 2018.

In 2019, the average annual effective radiation dose of ROSATOM’s personnel totalled 1.59 mSv. In the reporting year, employee radiation exposure did not exceed regulatory limits. The total effective dose for any employee did not exceed 100 mSv over five consecutive years. The annual dose limit of 50 mSv was not exceeded. Over the past ten years, average effective employee radiation exposure, its structure and the number of people exposed to radiation have been varying insignificantly and remain low.

Occupational Diseases

A further decrease in injury rates in the Corporation’s organizations will be achieved through process improvement, the introduction of a safety culture and the enhancement of controls.

### OCCUPATIONAL DISEASES

At year-end 2019, the number of employees in jobs that are characterized by harmful and (or) hazardous working conditions in ROSATOM’s organizations totalled 120,061 people.

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### DISTRIBUTION OF GROUP A PERSONNEL BY DOSE RANGES, %

<table>
<thead>
<tr>
<th>Division/complex/unit</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHANGES IN LTIFR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mining Division</td>
<td>0.28</td>
<td>0.22</td>
<td>0.22</td>
</tr>
<tr>
<td>Fuel Division</td>
<td>0.06</td>
<td>0.08</td>
<td>0.02</td>
</tr>
<tr>
<td>Mechanical Engineering Division</td>
<td>0.21</td>
<td>0.11</td>
<td>0.14</td>
</tr>
<tr>
<td>Engineering Division</td>
<td>0.06</td>
<td>0.05</td>
<td>0.06</td>
</tr>
<tr>
<td>Power Engineering Division</td>
<td>0.08</td>
<td>0.08</td>
<td>0.04</td>
</tr>
<tr>
<td>Life Cycle Back-End Division</td>
<td>0.05</td>
<td>0.20</td>
<td>0.13</td>
</tr>
<tr>
<td>Nuclear Weapons Division</td>
<td>0.14</td>
<td>0.16</td>
<td>0.13</td>
</tr>
<tr>
<td>Innovation Management Unit</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Total across the Corporation</td>
<td>0.13</td>
<td>0.12</td>
<td>0.10</td>
</tr>
</tbody>
</table>

A high risk of occupational diseases persists at PJSC PIMCU. To prevent them and to improve working conditions, mine equipment is being upgraded. In addition, strict disciplinary sanctions are imposed on employees who do not use respiratory protective equipment.

In addition, ROSATOM has organized the provision of medical treatment and preventive care to employees, which includes not only preliminary and periodic medical examinations, but also measures aimed at treating and preventing diseases and enabling the employees’ rehabilitation, if necessary (provision of health food and milk, health resort treatment).

### 10.1.9. RADIATION EXPOSURE OF EMPLOYEES

Ionizing radiation is an occupational hazard specific to ROSATOM’s enterprises. The criteria of employee radiation safety are laid down in the Radiation Safety Standards (NRB-99/2009), the Basic Sanitary Rules of Radiation Safety (GSPORB-98/2010) and other regulations. ROSATOM’s organizations provide workplace conditions that fully comply with the requirements set out in these documents.

**AVERAGE ANNUAL EFFECTIVE RADIATION DOSE AND COLLECTIVE RADIATION DOSE OF THE PERSONNEL**

As at December 31, 2019, 65,069 people (group A personnel) were under individual radiation exposure monitoring in ROSATOM’s organizations. The number decreased by 0.3% compared to 2018.

In 2019, the average annual effective radiation dose of ROSATOM’s personnel totalled 1.59 mSv. In the reporting year, employee radiation exposure did not exceed regulatory limits. The total effective dose for any employee did not exceed 100 mSv over five consecutive years. The annual dose limit of 50 mSv was not exceeded. Over the past ten years, average effective employee radiation exposure, its structure and the number of people exposed to radiation have been varying insignificantly and remain low.

DISTRIBUTION OF GROUP A PERSONNEL BY DOSE RANGES, %

- Less than 1 mSv: Average — 56%
- 1-2 mSv: Average — 21%
- 2-5 mSv: Average — 16%
- 5-20 mSv: Average — 7%
- 20-50 mSv: 0% — 0.03%
2019, ROSATOM continued to monitor radiation risks for group A personnel using the IRAW occupational radiation risk assessment system. Individual risk was calculated for 64,932 people, or 99.8% of the total number of group A employees. The absolute majority of group A employees work in the conditions of acceptable occupational risk. For 700 people (1.08% of the number of employees included in the IRAW system), individual risk exceeded the regulatory level of $10^{-3}$. The high-risk group comprises mainly veterans of the industry, whose average age exceeds 60 years.

Over the last three years, the average individual radiation risk across ROSATOM did not exceed 7% of the regulatory limit, while the maximum individual risk has been decreasing steadily.

In 2019, ROSATOM received 85 applications for the provision of government accreditation services in the use of nuclear energy (8 applications were subsequently withdrawn by the applicants) and issued 24 accreditation certificates (following initial accreditation and/or renewal). ROSATOM considered 28 applications from individuals regarding the certification of experts on accreditation in the use of nuclear energy, and issued 14 certificates of accreditation expert certification. Information on persons who underwent accreditation and certification is available on ROSATOM’s official website.¹⁰

Ensuring the Uniformity of Measurements in the Use of Nuclear Energy

Mandatory metrological evaluation of 9 draft national standards developed for the use of nuclear energy and more than 30 draft standards of the Corporation was carried out.

In the reporting year, a Calibration System for the use of nuclear energy was created. As part of this system, a core organization of the metrological calibration service was created. The competence of two organizations of ROSATOM was verified, and 43 calibration methods were developed.

In 2019, metrological supervision was carried out in 29 organizations of the Corporation; measurement capabilities were assessed in 59 laboratories of organizations in the industry.

10.1.11. Plans for 2020

- To ensure accident-free operation of nuclear facilities;
- To reduce the number of violations of safety requirements detected by supervisory government agencies;
- To reduce the number of industrial injuries;
- To improve the incident investigation system: to identify the root causes of incidents, thoroughly plan and implement preventive measures;
- To develop a safety culture among industry employees and contractors.

10.2. Raw and SNF Management and Decommissioning of Facilities Posing Nuclear and Radiation Hazards

Key results in 2019

- All targets of FTP NRS 2 were achieved or exceeded; progress in the achievement of the Programme’s main goal totalled 15.8% (as against a target of 15%).
- Six facilities posing nuclear and radiation hazards were decommissioned.
- Two nuclear submarines, one surface ship with a nuclear propulsion unit and two nuclear maintenance ships were dismantled.

In 109, active work continued as part of the implementation of FTP NRS 2, including:
- Maintaining the Techa Cascade of Reservoirs (Chelyabinsk Region) in a safe condition;
- Dismantling the Sibir nuclear icebreaker and decommissioning the Arktika nuclear icebreaker;
- Preparing the shut-down power units at Bilibino and Beloyarsk NPPs for decommissioning;
- Reprocessing of SNF from power and industrial reactors, propulsion units and research reactors at FSUE Mayak Production Association;
- Commissioning data terminals forming part of the analytical information system for an on-site subsod condition monitoring at two industrial sites of FSUE RosRAO.

In 1950, the Council of Ministers of the USSR adopted a resolution on the construction of Combine No. 815 of the First Main Directorate in the Krasnoyarsk Territory (now FSUE Mining and Chemical Plant). Within a short period of time, a unique underground industrial facility unparalleled in the world was built inside a mountain, under 200 metres of rock. Original technological solutions were developed for the construction of the plant. Builders removed a total of 15 million cubic metres of rock. The volume of those mine workings, which became the largest known underground structure in the world, is comparable to the total volume of the tunnels of the Moscow metro in the early 1960s. Reactor rooms built in rock are still the largest man-made excavations in the history of mankind and are listed in the Guinness Book of Records.

Today, FSUE Mining and Chemical Plant is a key enterprise in the Life Cycle Back-End Division of ROSATOM. The plant is developing a set of technological solutions for the recycling of energy materials in a two-component nuclear fuel cycle. Over the past decade, dozens of new facilities were built in the enterprise, including “wet” (renovation) and “dry” storage facilities for spent nuclear fuel, a plant producing MOX fuel for the BN-800 Fast Reactor, and the first start-up facility forming part of a pilot and demonstration centre for radiochemical SNF reprocessing.

For more information about the goals and objectives of FTP NRS 2, see the website: http://en---2030-lead@yandex.ru. The programme is implemented exclusively for Russia.

In 2030, the Federal Target Programme “Nuclear and Radiation Safety for the Period from 2016 through 2020 and for the Period until 2030 (FTP NRS 2)”

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- Preparing the shut-down power units at Bilibino and Beloyarsk NPPs for decommissioning;
- Reprocessing of SNF from power and industrial reactors, propulsion units and research reactors at FSUE Mayak Production Association;
- Commissioning data terminals forming part of the analytical information system for on-site subsod condition monitoring at two industrial sites of FSUE RosRAO.

In 2019, active work continued as part of the implementation of FTP NRS 2, including:
- Maintaining the Techa Cascade of Reservoirs (Chelyabinsk Region) in a safe condition;
- Dismantling the Sibir nuclear icebreaker and decommissioning the Arktika nuclear icebreaker;
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- Reprocessing of SNF from power and industrial reactors, propulsion units and research reactors at FSUE Mayak Production Association;
- Commissioning data terminals forming part of the analytical information system for on-site subsod condition monitoring at two industrial sites of FSUE RosRAO.
At year-end 2019, the volume of RAW totalled $5.66 \times 10^8$ m$^3$, of which $5.53 \times 10^8$ m$^3$ were classified as accumulated RAW ('nuclear legacy').

In 2019, work continued on the third stage of development of the Integrated National System for Radioactive Waste Management (INS RAW).

The construction of power supply facilities for an underground research laboratory in the Nizhnekamsky Rock Massif was continued as part of the construction of a deep repository for class 1 and 2 RAW in Zheleznogorsk (Krasnoyarsk Territory).

Disposal of class 3 and 4 RAW in the repository in Novouralsk (Sverdlovsk Region) continued; in the reporting year, 5,900 m$^3$ of RAW were accepted for disposal.

Construction and installation work was carried out on schedule as part of the renovation of the near-surface disposal site for solid radioactive waste in Novouralsk. Positive opinions were obtained on design documentation for disposal sites for class 3 and 4 RAW in the CATF of Ozersk (Chelyabinsk Region) and the CATF of Sever (Tomsk Region); construction and installation work forming part of the preparatory stage was carried out at the sites.

In the reporting year, three deep repositories for class 5 liquid RAW were in operation in the CATFs of Dimitrovgrad (Ulyanovsk Region), Seversk (Tomsk Region) and Zheleznogorsk (Krasnoyarsk Territory).

As at December 31, 2019, the volume of SNF accumulated in the Russian Federation totalled 24,669 tonnes (including 16,580 tonnes of SNF in federal ownership). In the reporting year, 774 tonnes were accumulated.

During the reporting year, 999.4 tonnes of SNF were removed from nuclear facilities in the Russian Federation, and 106.6 tonnes of various types of SNF were reprocessed (including 28.5 tonnes of SNF in federal ownership).

In 2019, the construction of the second start-up facility of the Pilot and Demonstration Centre (PDC) for SNF Reprocessing continued at FSUE Mining and Chemical Plant. The PDC is expected to become a leading-edge SNF reprocessing plant with a high level of environmental and economic performance.

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During the reporting year, 999.4 tonnes of SNF were removed from nuclear facilities in the Russian Federation, and 106.6 tonnes of various types of SNF were reprocessed (including 28.5 tonnes of SNF in federal ownership).

In 2019:
- 6,336 spent fuel assemblies from RBMK-1000 reactors were removed and placed in dry storage at FSUE Mining and Chemical Plant;
- 344 spent fuel assemblies from VVER-1000 reactors were removed and placed in temporary storage for subsequent reprocessing at FSUE Mining and Chemical Plant;
- 432 spent fuel assemblies from VVER-440 reactors, 175 spent fuel assemblies from BN-600 reactors and 98 spent fuel assemblies from VVER-1000 reactors were removed and transported to FSUE Mayak Production Association for processing.
- 1,584 spent fuel assemblies from the AMB reactor (70 bundles) were removed from Beloyarsk NPP and transported to FSUE Mayak Production Association. Taking into account the amount of previously removed SNF, this made it possible to completely empty one of the two storage pools at Beloyarsk NPP and enabled safe storage of the remaining spent fuel assemblies from the AMB reactor at Beloyarsk NPP until their complete removal;
- Removal of SNF from research institutes and industrial reactor facilities continued.

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- Removal of SNF from research institutes and industrial reactor facilities continued.
In 2019, six facilities posing nuclear and radiation hazards were decommissioned.

In 2019, a five-year Consolidated Programme of Measures to Ensure the Safety of ROSATOM’s Organizations Operating Facilities Presenting Particularly High Levels of Nuclear and Radiation Hazards came into force, the Programme covers all stages of the life cycle and development of such facilities and is financed from the special reserve funds of ROSATOM.

Radiation and environmental monitoring of the Yenisei River floodplain was continued; by the end of 2019, no areas requiring rehabilitation had been identified.

In 2019, two nuclear submarines, one surface ship with a nuclear propulsion unit and two nuclear maintenance ships were dismantled.

17 reactor compartments of dismantled nuclear submarines were prepared and put in long-term storage.

2,058 spent fuel assemblies were unloaded and transported for further processing.

2.96 tonnes of spent nuclear fuel and 300 m³ of liquid radioactive waste were processed; 700 m³ of solid radioactive waste were conditioned.

In 2019, using international technical assistance funds (a total of RUB 1.26 billion was received), ROSATOM cleaned up the pool of an emergency SNF storage facility and removed 6,125 spent fuel assemblies from the storage facility in Andreev Bay; SNF unloading from the storage facility of the disused Lepse floating maintenance base continued.

In 2020, ROSATOM will continue to implement FTP NRS 2, including:

- Completion of construction of the Pilot and Demonstration Centre (the second start-up facility) for SNF reprocessing based on innovative technologies at FSUE Mining and Chemical Plant;
- Completion of construction of a disposal facility for class 3 and 4 RAW in Novouralsk (Sverdlovsk Region);
- Transportation of accumulated spent nuclear fuel from NPP sites to long-term storage facilities at FSUE Mining and Chemical Plant and FSUE Mayak Production Association;
- Removal of RAW from storage sites, preparation for disposal, transportation to disposal sites and transfer for disposal;
- Decommissioning of a number of facilities in ROSATOM’s organizations;
- Completion of the mothballing of the B-1 and B-25 storage pools for radioactive waste at JSC SCP;
- Dismantling of one nuclear submarine and one nuclear maintenance ship.

10.2.4. DECOMMISSIONING OF FACILITIES POSING NUCLEAR AND RADIATION HAZARDS

<table>
<thead>
<tr>
<th>Year</th>
<th>Target</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>2018</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>2019</td>
<td>24</td>
<td>26</td>
</tr>
</tbody>
</table>

10.2.5. DISMANTLING OF NUCLEAR SUBMARINES

In 2019, two nuclear submarines, one surface ship with a nuclear propulsion unit and two nuclear maintenance ships were dismantled.

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- Decommissioning of a number of facilities in ROSATOM’s organizations;
- Completion of the mothballing of the B-1 and B-25 storage pools for radioactive waste at JSC SCP;
- Dismantling of one nuclear submarine and one nuclear maintenance ship.

10.2.6. PLANS FOR 2020

In 2020, ROSATOM will continue to implement FTP NRS 2, including:

- Completion of construction of the Pilot and Demonstration Centre (the second start-up facility) for SNF reprocessing based on innovative technologies at FSUE Mining and Chemical Plant;
- Completion of construction of a disposal facility for class 3 and 4 RAW in Novouralsk (Sverdlovsk Region);
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- Removal of RAW from storage sites, preparation for disposal, transportation to disposal sites and transfer for disposal;
- Decommissioning of a number of facilities in ROSATOM’s organizations;
- Completion of the mothballing of the B-1 and B-25 storage pools for radioactive waste at JSC SCP;
- Dismantling of one nuclear submarine and one nuclear maintenance ship.
10.3. ENVIRONMENTAL SAFETY

Key results in 2019
- Expenditure on environmental protection totalled RUB 23.55 billion.
- Energy costs were reduced by 9.7% compared to 2015 as the base year.
- Gross greenhouse gas emissions in the Corporation’s organizations decreased by 6.4% compared to 2018.

10.3.1. ENVIRONMENTAL SAFETY AND ENVIRONMENTAL PROTECTION MANAGEMENT

The environmental footprint of the nuclear power industry is substantially smaller than that of carbon-based power generation using fossil fuel. Emissions of hazardous chemicals, including those that destroy the ozone layer or contribute to the greenhouse effect, from nuclear power plants are close to zero.

ROSATOM and its enterprises operate responsibly in accordance with the following principles:
- Giving priority to preserving natural ecosystems;
- Making use of the latest scientific achievements and ensuring environmental safety as a mandatory requirement;
- Transparency and making information on environmental aspects of operations of enterprises in the industry publicly available.

The Corporation’s goals and initiatives in the sphere of environmental safety and environmental protection are stipulated in the Uniform Sectoral Environmental Policy of the Corporation and its organizations (including environmentally relevant organizations).

A list of environmentally relevant organizations of ROSATOM is compiled and updated on an annual basis (34 organizations\(^1\) in 2019). The Corporation’s management gives special focus to their operations. On an annual basis, environmentally relevant organizations issue public reports on environmental safety\(^2\).

An important tool for the implementation of the environmental policy is a three-year Comprehensive Implementation Plan. In 2019, the Corporation approved the Comprehensive Plan for 2019–2021, which stipulates organizational, operational and technical measures to be implemented by the Corporation and its organizations (including environmentally relevant organizations).

To assess progress in the implementation of the Environmental Policy, ROSATOM has developed the Uniform Industry-Wide Guidelines for the Use of Environmental Performance Indicators. The Guidelines are based on the requirements of environmental legislation of the Russian Federation and incorporate modern scientific and methodological approaches, as well as recommendations of international standards for corporate and non-financial reporting on environmental aspects.

The results of environmental performance assessment should be taken into account when making any management decisions which may have a negative impact on the environment (including during economic planning).

In the reporting year, the Corporation continued to develop its environmental, energy and quality management systems, as well as the occupational health and safety management system. Integrated management systems are in place in 13 environmentally relevant organizations. They comprise:
- Environmental management systems compliant with the ISO 14001 standard;
- Quality management systems compliant with the ISO 9001 standard;
- Occupational health and safety management systems compliant with the OHSAS 18001 standard;
- Energy management systems compliant with the ISO 50001 standard.

During 2019, 45 inspection audits were conducted in ROSATOM’s organizations to assess their compliance with the requirements of the ISO 14001 environmental management system standard, the ISO 9001 quality management system standard and the OHSAS 18001 occupational health and safety management system standard. In the reporting year, recertification audits of the quality management system and the environmental management system were carried out in three organizations of ROSATOM.

10.3.2. IMPROVED ENERGY EFFICIENCY

ENERGY EFFICIENCY MANAGEMENT SYSTEM

Energy conservation is an important prerequisite for the efficient use of energy resources in the nuclear industry, making it more competitive and reducing its negative environmental impact. ROSATOM is implementing an energy conservation and energy efficiency improvement programme for the period from 2018 through 2022.

ROSATOM’s organizations have implemented most elements of the energy management system compliant with the international standard ISO 50001 standard (JSC Rosenergoatom and JSC TVEL have been issued with an international certificate, while other organizations have implemented individual elements of this management system).

Since 2015, ROSATOM has been using an Automated Energy Efficiency Management System, through which 80 organizations of the Corporation submit quarterly reports on energy savings.

ROSATOM uses the following tools for managing energy efficiency:
- Developing an action plan or programme for energy conservation at the level of ROSATOM’s organizations;
- Monitoring the achievement of energy efficiency targets and reviewing progress in the implementation of the energy conservation programme;
- Assessing energy costs at the main stages of the production cycle;
- Formalized energy efficiency requirements for investment and procurement activities;
- Linking employee remuneration to energy conservation performance.

ROSATOM holds an annual competition titled Environmental-ly Exemplary Organization in the Nuclear Industry; its aim is to support initiatives launched by the Corporation’s environmentally relevant organizations to improve their environmental performance.

In 2019, 52 environmentally relevant organizations took part in the competition. The winners were chosen based on a benchmarking of all areas of work of their environmental functions: environmental footprint, efficiency of management and organization of environmental activities, and compliance with the principle of information transparency set out in the Uniform Sectoral Environmental Policy of ROSATOM and its Organizations.

The competition winners were Kola NPP (ranked first), JSC PA ECP (ranked second) and Balakovo NPP (ranked third).
In 2019, energy costs in the nuclear industry (under comparable conditions against 2015 as the base year) totalled RUB 26.4 billion (excluding VAT), including:

- RUB 6.1 billion for heat;
- RUB 2.1 billion for water;
- RUB 12 billion for electricity;
- RUB 6.2 billion for other types of energy resources.

**RESULTS IN 2019**

In accordance with the government programme of the Russian Federation ‘Development of the Nuclear Power and Industry Complex’, the energy conservation target for ROSATOM for 2019 had been set at 6%. The actual cumulative total energy savings against 2015 as the base year under comparable conditions amounted to 9.7%, including:

- 13.7% for heat;
- 12% for water;
- 8.9% for electricity.

Energy savings totalled RUB 2.9 billion in monetary terms and 7,077,615 GJ in physical terms.

The most significant reduction in energy consumption was achieved in the Fuel Division, the Nuclear Weapons Division and the Life Cycle Back-End Division.

### RESULTS IN 2019

#### Division/complex/organization

<table>
<thead>
<tr>
<th>Division/complex/organization</th>
<th>Heat</th>
<th>Water</th>
<th>Electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100 Gcal</td>
<td>%</td>
<td>100 m³</td>
</tr>
<tr>
<td>Power Engineering Division</td>
<td>369</td>
<td>6.3</td>
<td>1,270,685.66</td>
</tr>
<tr>
<td>Fuel Division</td>
<td>1,995.25</td>
<td>34</td>
<td>317,146.16</td>
</tr>
<tr>
<td>Nuclear Weapons Division</td>
<td>1,908.81</td>
<td>32.5</td>
<td>65,911.34</td>
</tr>
<tr>
<td>FSUE Atomflot</td>
<td>0</td>
<td>183.45</td>
<td>0</td>
</tr>
<tr>
<td>Life Cycle Back-End Division</td>
<td>586.01</td>
<td>10</td>
<td>27,142.73</td>
</tr>
<tr>
<td>Mining Division</td>
<td>635.56</td>
<td>10.8</td>
<td>3,721.34</td>
</tr>
<tr>
<td>Mechanical Engineering Division</td>
<td>54.53</td>
<td>0.9</td>
<td>3,893.67</td>
</tr>
<tr>
<td>JSC Rusatom Healthcare</td>
<td>6.35</td>
<td>0.1</td>
<td>56.54</td>
</tr>
<tr>
<td>JSC RPC Klimpromengineering</td>
<td>8.22</td>
<td>0.1</td>
<td>50.52</td>
</tr>
<tr>
<td>Engineering Division&lt;sup&gt;84&lt;/sup&gt;</td>
<td>23.83</td>
<td>0.4</td>
<td>108.77</td>
</tr>
<tr>
<td>Sales and Trading Division</td>
<td>1.99</td>
<td>0</td>
<td>12.46</td>
</tr>
<tr>
<td>Innovation Management Unit</td>
<td>241.62</td>
<td>41</td>
<td>6,244.78</td>
</tr>
<tr>
<td>JSC Rosatom Emergency Response Centre</td>
<td>3.13</td>
<td>0.1</td>
<td>4.75</td>
</tr>
<tr>
<td>Other</td>
<td>33.09</td>
<td>0.6</td>
<td>283,033.83</td>
</tr>
<tr>
<td>Total across ROSATOM</td>
<td>5,867.39</td>
<td>100</td>
<td>1,978,196</td>
</tr>
</tbody>
</table>

<sup>84</sup> Data on Russian projects and organizations managed by the Engineering Division, where annual consumption in monetary terms exceeds RUB 7 million.

### ENERGY CONSUMPTION IN 2019 IN PHYSICAL TERMS (UNDER COMPARABLE CONDITIONS AGAINST 2015)

<table>
<thead>
<tr>
<th>Division/complex/organization</th>
<th>Cumulative total compared to 2015, RUB million (excluding VAT)</th>
<th>Cumulative total compared to 2015, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Engineering Division</td>
<td>95.94</td>
<td>4.78</td>
</tr>
<tr>
<td>Fuel Division</td>
<td>1,241.9</td>
<td>13.45</td>
</tr>
<tr>
<td>Nuclear Weapons Division</td>
<td>613.82</td>
<td>12.31</td>
</tr>
<tr>
<td>FSUE Atomflot</td>
<td>8.67</td>
<td>6.04</td>
</tr>
<tr>
<td>Life Cycle Back-End Division</td>
<td>446.59</td>
<td>18.74</td>
</tr>
<tr>
<td>Mining Division</td>
<td>197.19</td>
<td>10.95</td>
</tr>
<tr>
<td>JSC Rusatom Healthcare</td>
<td>7.76</td>
<td>7.36</td>
</tr>
<tr>
<td>Innovation Management Unit</td>
<td>71.29</td>
<td>7.75</td>
</tr>
<tr>
<td>JSC Rosatom Emergency Response Centre</td>
<td>0.9</td>
<td>13.14</td>
</tr>
<tr>
<td>JSC ITPC</td>
<td>56.88</td>
<td>1.06</td>
</tr>
<tr>
<td>Other</td>
<td>173.37</td>
<td>up to 34.94</td>
</tr>
<tr>
<td>Total across ROSATOM</td>
<td>2,914.31</td>
<td>9.7</td>
</tr>
</tbody>
</table>

### PLANS FOR 2020

The energy conservation target for 2020 under the government programme ‘Development of the Nuclear Power and Industry Complex’ has been set at 7% (as a cumulative total against 2015 as the base year, under comparable conditions). ROSATOM sets individual differentiated targets for annual energy savings (expressed as a percentage) for its Divisions, complexes and organizations, provided that the overall target set under the programme is achieved.
In addition, ROSATOM plans to continue to monitor progress on energy audits in its organizations, assess the outcomes of energy conservation measures implemented over the past five years as part of the government programme ‘Development of the Nuclear Power and Industry Complex’ and prepare proposals for the next reporting period.

10.3.3. FINANCING OF ENVIRONMENTAL MEASURES

In 2019, expenditure on environmental protection in ROSATOM’s organizations totalled RUB 23.55 billion, including expenditure on environmental measures totalling RUB 17.30 billion and fixed asset investment totalling RUB 6.25 billion.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expenditure on environmental measures</td>
<td>14.37</td>
<td>15.44</td>
<td>17.3</td>
</tr>
<tr>
<td>Fixed asset investment</td>
<td>8.09</td>
<td>8.8</td>
<td>6.25</td>
</tr>
<tr>
<td>Total</td>
<td>22.46</td>
<td>24.24</td>
<td>23.55</td>
</tr>
</tbody>
</table>

The largest volume of expenditure on environmental measures was allocated for ensuring radiation safety (48.0%), collecting and treating wastewater (19.6%), managing industrial and consumer waste (14.9%), protecting the atmosphere and preventing climate change (7.7%). Environmental costs increased by RUB 1.86 billion year on year. This was due to an increase in current costs at JSC Chepetsk Mechanical Plant as tailings storage facility No. 3, which had been in federal ownership, was recorded on the balance sheet of the enterprise.

10.3.4. ENVIRONMENTAL CHARGES AND FINES

In 2019, charges for the negative environmental impact totalled RUB 55 million, including charges for allowable emissions and discharges of pollutants, disposal of industrial and consumer waste totalling RUB 34 million (61.8%), and charges for excess emissions and discharges totalling RUB 21 million (38.2%). A reduction in charges for the negative environmental impact compared to 2017 and 2018 was due to the timely receipt of permits by ROSATOM’s organizations in the reporting year.

<table>
<thead>
<tr>
<th>Payment amount, RUB million</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charges for allowable emissions (discharges) of pollutants (disposal of industrial and consumer waste), total, including:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>into water bodies</td>
<td>36.4</td>
<td>33.7</td>
<td>34</td>
</tr>
<tr>
<td>into the atmosphere</td>
<td>1.9</td>
<td>2.9</td>
<td>3.1</td>
</tr>
</tbody>
</table>
| Hereinafter in this section, the shares of ROSATOM and its organizations in the overall figures for Russia are calculated based on the data provided in the Government Report on the Status and Protection of the Environment in the Russian Federation in 2018.
In 2019, environmental regulators detected 36 violations, for which they imposed administrative penalties on ROSATOM’s organizations in the form of fines totalling RUB 1.8 million (in 2018 and 2017, 46 and 41 violations were detected and fines were imposed totalling RUB 2.2 million and RUB 3.1 million respectively). The violations did not pose a threat to the well-being of the population and did not necessitate restrictions on the operations of the organizations.

The nuclear industry is a major water user. In 2019, water withdrawal from natural sources by ROSATOM’s organizations made up 9.6% of the total water withdrawal in Russia. The main consumers of water among ROSATOM’s organizations and enterprises are Leningrad NPP and Kola NPP (82.4% of the total water withdrawal).

In the reporting year, water withdrawal by ROSATOM’s organizations totaled 6,531.3 million m³, which is 786.5 million m³ less than in 2018. The decrease was mainly due to a reduction in sea water withdrawal at Leningrad NPP due to the shutdown of power unit No. 1 for decommissioning.

In 2019, the volume of water used by ROSATOM’s organizations for their own needs totaled 6,450.4 million m³, which is 735.4 million m³ less than in 2018. This was mainly due to a decrease in water consumption at Leningrad NPP (by 696.2 million m³).

<table>
<thead>
<tr>
<th>Source</th>
<th>Volume, million m³</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL WATER WITHDRAWAL</strong></td>
<td></td>
</tr>
<tr>
<td>Sea water</td>
<td>5,061.1</td>
</tr>
<tr>
<td>Fresh surface water, including rivers, marshes and lakes</td>
<td>2,239.1</td>
</tr>
<tr>
<td>Groundwater</td>
<td>87.7</td>
</tr>
<tr>
<td>Runoff water</td>
<td>2</td>
</tr>
<tr>
<td>Water from third-party organizations</td>
<td>21.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>7,411</td>
</tr>
<tr>
<td></td>
<td>7,317.8</td>
</tr>
<tr>
<td></td>
<td>6,531.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>Volume, million m³</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VOLUME OF RECYCLED AND REUSED WATER</strong></td>
<td></td>
</tr>
<tr>
<td>Total volume of recycled and reused water, million m³</td>
<td>34,159.7</td>
</tr>
<tr>
<td>Water withdrawal, million m³ (% of the volume of recycled and reused water)</td>
<td>7,411</td>
</tr>
<tr>
<td><strong>Total, million m³</strong></td>
<td>41,578.6</td>
</tr>
<tr>
<td><strong>Share of recycled and reused water as a percentage of water withdrawal, %</strong></td>
<td>460.9</td>
</tr>
</tbody>
</table>

In 2019, the volume of water used by ROSATOM’s organizations for their own needs totaled 6,450.4 million m³, which is 735.4 million m³ less than in 2018. This was mainly due to a decrease in water consumption at Leningrad NPP (by 696.2 million m³).

<table>
<thead>
<tr>
<th>Type of consumption</th>
<th>Volume, million m³</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WATER CONSUMPTION BY ROSATOM’S ORGANIZATIONS FOR THEIR OWN NEEDS</strong></td>
<td></td>
</tr>
<tr>
<td>Drinking and sanitary purposes</td>
<td>41.9</td>
</tr>
<tr>
<td>Operational needs</td>
<td>7,126</td>
</tr>
<tr>
<td>Other types</td>
<td>18</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>7,185.9</td>
</tr>
<tr>
<td></td>
<td>7,185.8</td>
</tr>
<tr>
<td></td>
<td>6,450.4</td>
</tr>
</tbody>
</table>
In 2019, wastewater discharge by ROSATOM’s organizations totaled 5,864.5 million m³, with clean water compliant with regulatory requirements accounting for 96.1% of the total volume, while the share of treated wastewater compliant with regulatory requirements and contaminated wastewater stood at 0.8% and 3.1% respectively. Wastewater discharge decreased by 762.4 million m³ compared to 2018 due to a decrease in the discharge from Leningrad NPP into the Gulf of Finland in the Baltic Sea.

### WATER DISCHARGE

<table>
<thead>
<tr>
<th>Water category</th>
<th>Volume, million m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total wastewater discharge</td>
<td>6,716.4</td>
</tr>
<tr>
<td>Clean water compliant with regulatory requirements</td>
<td>6,600.1</td>
</tr>
<tr>
<td>Treated wastewater compliant with regulatory requirements</td>
<td>37.3</td>
</tr>
<tr>
<td>Contaminated wastewater</td>
<td>79</td>
</tr>
</tbody>
</table>

In the reporting year, discharge of treated wastewater compliant with regulatory requirements totaled 44.9 million m³, of which 25.1% was treated using the biological method, while wastewater treated using the physical and chemical method and the mechanical method accounted for 1.9% and 73.0% of the total volume respectively.

Contaminated wastewater discharge totaled 184.3 million m³ in 2019. In 2019, contaminated wastewater discharge by ROSATOM’s organizations accounted for 1.4% of the total volume of discharges in Russia.

In 2019, wastewater discharge by ROSATOM’s organizations to-taled 5,864.5 million m³, with clean water compliant with regulatory requirements accounting for 96.1% of the total volume, while the share of treated wastewater compliant with regulatory requirements and contaminated wastewater stood at 0.8% and 3.1% respectively. Wastewater discharge decreased by 762.4 million m³ compared to 2018 due to a decrease in the discharge from Leningrad NPP into the Gulf of Finland in the Baltic Sea.

<table>
<thead>
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In the reporting year, discharge of treated wastewater compliant with regulatory requirements totaled 44.9 million m³, of which 25.1% was treated using the biological method, while wastewater treated using the physical and chemical method and the mechanical method accounted for 1.9% and 73.0% of the total volume respectively.

Contaminated wastewater discharge totaled 184.3 million m³ in 2019. In 2019, contaminated wastewater discharge by ROSA-TOM’s organizations accounted for 1.4% of the total volume of discharges in Russia.

Implementation of initiatives to reduce the environmental impact on water sources in 2019:
- Beloyarsk NPP: modernization of chemical wastewater treatment facilities enabled a 27% reduction in the weight of pollutant discharges compared to 2017 as the base year;
- FSUE VNIITF: the introduction of a recycled water supply system and reuse of treated water in the production cycle resulted in a 99% reduction in the weight of pollutant discharges;
- PJSC MSZ: the creation of a system for collecting industrial wastewater and storm water runoff was completed; as a result, the discharge of industrial wastewater and storm water runoff from the production site totaling 1,285,500 m³ per year ceased, and withdrawal of river water was reduced.

### WASTEWATER DISCHARGE IN 2019 BY DESTINATION

- Seas 71%
- Lakes 20%
- Rivers 8%
- Other 1%

### POLLUTANT CONTENT IN WASTEWATER IN 2019, TONNES

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Tonnage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical oxygen demand</td>
<td>10,973.379</td>
</tr>
<tr>
<td>Suspended matter</td>
<td>3,087.757</td>
</tr>
<tr>
<td>Iron</td>
<td>60.327</td>
</tr>
<tr>
<td>Phosphates (phosphorus content)</td>
<td>44.118</td>
</tr>
<tr>
<td>Manganese</td>
<td>0.979</td>
</tr>
<tr>
<td>Zinc</td>
<td>0.673</td>
</tr>
<tr>
<td>Copper</td>
<td>0.56</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>0.467</td>
</tr>
<tr>
<td>Nickel</td>
<td>0.18</td>
</tr>
<tr>
<td>Trivalent chromium</td>
<td>0.095</td>
</tr>
<tr>
<td>Hexavalent chromium</td>
<td>0.081</td>
</tr>
<tr>
<td>Lead</td>
<td>0.033</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.001</td>
</tr>
<tr>
<td>Antimony</td>
<td>0</td>
</tr>
</tbody>
</table>

A significant change compared to 2017 and 2018 is related to a new approach to determining the degree of pollution of discharged wastewater (adopted in order to ensure compliance with Order No. 815 of the Federal State Statistics Service dated December 27, 2019 on Approval of a Federal Statistical Observation Form and Instructions for Filling It Out for the Organization of Federal Statistical Observation of Water Use by the Federal Agency for Water Resources). Accordingly, in 2019, wastewater discharged by Rosatom’s organizations was categorized as contaminated (previously, it had been classified as clean water compliant with regulatory requirements).

### POLLUTANT CONTENT IN WASTEWATER IN 2019, TONNES

<table>
<thead>
<tr>
<th>Pollutant</th>
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</tr>
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<tbody>
<tr>
<td>Chemical oxygen demand</td>
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<tr>
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<tr>
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<td>Lead</td>
<td>0.033</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.001</td>
</tr>
<tr>
<td>Antimony</td>
<td>0</td>
</tr>
</tbody>
</table>

### 10.3.6. POLLUTANT EMISSIONS INTO THE ATMOSPHERE

In 2019, pollutant emissions into the atmosphere totaled 38,600 tonnes; the pollutant capture rate reached 91.4%.

In 2019, the Corporation’s organizations accounted for 0.1% of the total emissions in the Russian Federation. Pollutant emissions into the atmosphere decreased by 1,300 tonnes compared to 2018 due to a decrease in fuel combustion at Rosatom’s thermal power plants (CHPPs).

Implementation of initiatives to reduce the environmental impact on the atmosphere in 2019:
- FSUE SRI SIA LUCH: modernization and renovation of the ventilation system, including the installation of dust collectors and gas-capturing equipment at production facilities, made it possible to reduce pollutant emissions into the atmosphere by 99.9%.

### POLLUTANT EMISSIONS INTO THE ATMOSPHERE, KT

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (excluding CO₂), including emissions of solid particles</td>
<td>36.4</td>
<td>39.9</td>
<td>38.6</td>
</tr>
<tr>
<td>NOₓ emissions</td>
<td>12.8</td>
<td>13.8</td>
<td>13.4</td>
</tr>
<tr>
<td>SO₂ emissions</td>
<td>9.2</td>
<td>10.6</td>
<td>10.2</td>
</tr>
<tr>
<td>CO emissions</td>
<td>8.6</td>
<td>9.4</td>
<td>9.7</td>
</tr>
<tr>
<td>CO₂ emissions</td>
<td>3.6</td>
<td>3.7</td>
<td>3.5</td>
</tr>
<tr>
<td>carbon emissions, including methane emissions</td>
<td>1.8</td>
<td>1.7</td>
<td>1.4</td>
</tr>
<tr>
<td>other gases and liquids</td>
<td>0.3</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>volatile organic compounds</td>
<td>1.2</td>
<td>1.2</td>
<td>1.1</td>
</tr>
<tr>
<td>other gases and liquids</td>
<td>0.4</td>
<td>0.7</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Pollutant emissions are reported by Rosatom’s organizations using chemical analysis methods or automatic gas analysers.
From fuel combustion for electricity and heat generation

From production and other processes

POLLUTANT EMISSIONS FROM INDIVIDUAL GROUPS OF POLLUTION SOURCES, KT

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid particles</td>
<td>12.3</td>
<td>11.1</td>
<td></td>
</tr>
<tr>
<td>NO&lt;sub&gt;x&lt;/sub&gt;</td>
<td>9.3</td>
<td>3.4</td>
<td>4.7</td>
</tr>
<tr>
<td>SO&lt;sub&gt;2&lt;/sub&gt;</td>
<td>8.9</td>
<td>8.0</td>
<td>7.9</td>
</tr>
<tr>
<td>CO</td>
<td>2.6</td>
<td>2.9</td>
<td>3.9</td>
</tr>
<tr>
<td>Hydrocarbons, including volatile organic compounds (excluding methane)</td>
<td>0.02</td>
<td>1.2</td>
<td></td>
</tr>
</tbody>
</table>

SPECIFIC POLLUTANT EMISSIONS FROM ROSATOM'S CHPPS, G/MWH

<table>
<thead>
<tr>
<th>CHPP Location</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novouralsk</td>
<td>3,142</td>
<td>2,696</td>
<td>1,821</td>
</tr>
<tr>
<td>Seversk</td>
<td>5,652</td>
<td>9,183</td>
<td>8,312</td>
</tr>
<tr>
<td>Glazov</td>
<td>2,939</td>
<td>3,057</td>
<td>2,959</td>
</tr>
<tr>
<td>Krasnokamensk</td>
<td>9,826</td>
<td>9,126</td>
<td>9,124</td>
</tr>
<tr>
<td>Dimitrovgrad</td>
<td>2,437</td>
<td>2,496</td>
<td>3,083</td>
</tr>
</tbody>
</table>

An increase in specific emissions from the CHPP in Seversk between 2017 and 2019 was due to a change in the fuel combustion structure (the coal/gas/fuel oil ratio). Changes in specific emissions from the CHPPs in Dimitrovgrad and Novouralsk were related to a change in the calculation methodology.

Emissions of ozone-depleting substances decreased in 2019 as a result of a reduction in dichlorodifluoromethane emissions at JSC Chepetsk Mechanical Plant.

<table>
<thead>
<tr>
<th>Substance</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide&lt;sup&gt;88&lt;/sup&gt;</td>
<td>5,653.369</td>
<td>5,802.284</td>
<td>5,451.82</td>
</tr>
<tr>
<td>Methane</td>
<td>281.175</td>
<td>239.72</td>
<td>193.734</td>
</tr>
<tr>
<td>Nitrous oxide</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Trifluoromethane</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Perfluoromethane</td>
<td>124.841</td>
<td>124.806</td>
<td>124.806</td>
</tr>
<tr>
<td>Perfluoroethane</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sulphur hexafluoride</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6,059.385</td>
<td>6,166.81</td>
<td>5,770.36</td>
</tr>
</tbody>
</table>

Greenhouse gas emissions from ROSATOM are generated mainly by CHPPs in the towns and cities where ROSATOM's enterprises are located: Glazov (Udmurt Republic), Dimitrovgrad (Ulyanovsk Region), Krasnokamensk (Zabaikalsky Territory), Novouralsk (Sverdlovsk Region) and Seversk (Tomsk Region). These CHPPs generate heat and electricity not only for ROSATOM's enterprises, but also for the population of the relevant towns and cities.

In 2019, the installed capacity of the CHPPs totalled 929.3 MW. No new capacities are scheduled to be put into operation in the next three years.

10.3.7. GREENHOUSE GAS EMISSIONS

Climate change is recognized as one of the biggest problems facing the international community, businesses and citizens. The Russian Government has ratified the Paris Agreement, whereby the participating countries take on a commitment to reduce greenhouse gas emissions.

A greenhouse gas emissions accounting system is being created in ROSATOM in order to fulfill international legal commitments of the Russian Federation on climate and mitigate risks associated with the operations of ROSATOM and its enterprises. In 2019, a framework high-level document in this area was developed and approved: the Regulation on a System for Accounting for Greenhouse Gas Emissions Generated by ROSATOM's Organizations. Plans for 2020 include developing uniform industry-wide methodological guidelines on greenhouse gas emissions accounting for ROSATOM's organizations.

In 2019, gross greenhouse gas emissions totalled 5,770.36 tonnes, down by 6.4% year on year due to a decrease in natural gas consumption for heat generation. ROSATOM's organizations accounted for 0.04% of the total volume of greenhouse gas emissions in Russia (in CO<sub>2</sub> equivalent).

Greenhouse gas emissions from ROSATOM are generated mainly by CHPPs in the towns and cities where ROSATOM's enterprises are located: Glazov (Udmurt Republic), Dimitrovgrad (Ulyanovsk Region), Krasnokamensk (Zabaikalsky Territory), Novouralsk (Sverdlovsk Region) and Seversk (Tomsk Region). These CHPPs generate heat and electricity not only for ROSATOM's enterprises, but also for the population of the relevant towns and cities.

In 2019, the installed capacity of the CHPPs totalled 929.3 MW. No new capacities are scheduled to be put into operation in the next three years.

88 Data are presented taking into account the ozone depletion potential of substances under the Montreal Protocol on Substances that Deplete the Ozone Layer.

89 Quantitative estimates of greenhouse gas emissions are based on data obtained from statistical observation forms 2-TP (air).

90 The data are presented using a coefficient of 1.57 calculated by converting CO to CO<sub>2</sub> based on molar mass.
An increase in CO₂ emissions from the CHPP in Seversk between 2017 and 2019 was due to a change in the fuel combustion structure (the coal/gas/fuel oil ratio).

The decrease in specific CO₂ emissions from the CHPPs (except for the one located in the city of Seversk) was related to improved performance of steam boilers and a decrease in the specific consumption of fuel equivalent for heat generation.

In 2019, ROSATOM’s organizations produced 24.8 million tonnes of industrial and consumer waste, which is 3.9 million tonnes (18.7%) more than in 2018. The increase in waste generation was caused by an increase in the volume of rock and loose overburden mined in the Mining Division (JSC Lunnoye and PJSC PIMCU).

Most of the waste was generated by PJSC PIMCU (17.3 million tonnes). 99.96% of all waste generated in the Corporation’s organizations is class 4 and 5 waste (low-hazard and practically non-hazardous waste). In 2019, industrial and consumer waste generated by ROSATOM’s organizations accounted for 0.3% of the total waste generation in Russia.

The weight of transferred waste totalled 2,138,700 tonnes, including 30,800 tonnes of solid municipal waste transferred to regional operators.

77.1% of the total amount of waste generated in ROSATOM’s organizations and received from other organizations was recycled; 0.02% was treated.

In 2019, ROSATOM did not transport, import, export or process waste that is classified as ‘hazardous’ in accordance with Annexes I, II, III, and VIII to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.

### Industrial and Consumer Waste Management

#### Specific CO₂ Emissions from CHPPs, kg of CO₂/MWh

<table>
<thead>
<tr>
<th>Location</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novouralsk</td>
<td>2,379</td>
<td>2,370</td>
<td>2,095</td>
</tr>
<tr>
<td>Seversk</td>
<td>1,343</td>
<td>1,712</td>
<td>1,840</td>
</tr>
<tr>
<td>Glazov</td>
<td>2,054</td>
<td>2,024</td>
<td>1,468</td>
</tr>
<tr>
<td>Krasnokamensk</td>
<td>1,391</td>
<td>1,406</td>
<td>1,390</td>
</tr>
<tr>
<td>Dimitrovgrad</td>
<td>1,716</td>
<td>1,793</td>
<td>1,727</td>
</tr>
</tbody>
</table>

#### CO₂ Emissions from CHPPs, Tonnes

<table>
<thead>
<tr>
<th>Location</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novouralsk</td>
<td>346,938</td>
<td>374,350</td>
<td>371,876</td>
</tr>
<tr>
<td>Seversk</td>
<td>1,376,368</td>
<td>1,738,801</td>
<td>2,065,818</td>
</tr>
<tr>
<td>Glazov</td>
<td>354,388</td>
<td>363,251</td>
<td>373,147</td>
</tr>
<tr>
<td>Krasnokamensk</td>
<td>2,045,860</td>
<td>2,062,501</td>
<td>2,077,436</td>
</tr>
<tr>
<td>Dimitrovgrad</td>
<td>169,857</td>
<td>177,147</td>
<td>154,147</td>
</tr>
<tr>
<td>Total across the Corporation</td>
<td>4,293,411</td>
<td>4,716,050</td>
<td>5,042,424</td>
</tr>
</tbody>
</table>

#### Recycling and Treatment of Generated and Received Waste

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount at the beginning of the reporting year</th>
<th>Waste generated and received during the year</th>
<th>Recycling and treatment of generated and received waste %</th>
<th>Transferred to third-party organizations</th>
<th>Amount in enterprises</th>
<th>Amount at the end of the reporting year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>399,497</td>
<td>27,963.4</td>
<td>83.1</td>
<td>153.9</td>
<td>58.7</td>
<td>404,019</td>
</tr>
<tr>
<td>2018</td>
<td>403,891.9</td>
<td>20,862.3</td>
<td>72.6</td>
<td>176.4</td>
<td>5,565.3</td>
<td>403,872.2</td>
</tr>
<tr>
<td>2019</td>
<td>408,668.7</td>
<td>24,782.2</td>
<td>77.2</td>
<td>2,138.7</td>
<td>2,332.7</td>
<td>412,391.5</td>
</tr>
</tbody>
</table>
As at December 31, 2019, the area of land disturbed by ROSATOM’s organizations totalled 6,400 ha (6,500 ha in 2018 and 5,100 ha in 2017).

This included land disturbed during the following operations:
- Mining: 3,400 ha;
- Construction: 2,300 ha;
- Disposal of industrial waste (including construction waste) and solid household waste: 600 ha;
- Survey work: 4.2 ha;
- Other operations: 96.9 ha.

In 2019, ROSATOM’s organizations implemented a set of measures to restore the productivity and economic value of disturbed land. In the reporting year, the area of restored land totalled 29.5 ha. The increase in the area of restored land compared to 2018 was due to the rehabilitation of forest areas by JSC Lunnoye (10.8 ha) and their subsequent inclusion in the forest estate as forest firebreaks.

<table>
<thead>
<tr>
<th>Hazard class</th>
<th>Waste amount as at January 1, 2019</th>
<th>Waste generated and received in the reporting year</th>
<th>Recycling of generated and received waste</th>
<th>Treatment of generated and received waste</th>
<th>Transfer to third-party organizations</th>
<th>Waste storage at the site operated by ROSATOM in the reporting year, kt</th>
<th>Amount in enterprises as at December 31, 2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazard class 1</td>
<td>0.049</td>
<td>0.028</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.000001</td>
<td>0.0005</td>
</tr>
<tr>
<td>Hazard class 2</td>
<td>0.034</td>
<td>1.509</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.000002</td>
<td>0.0001</td>
</tr>
<tr>
<td>Hazard class 3</td>
<td>4.449</td>
<td>7.231</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.000692</td>
<td>0.0096</td>
</tr>
<tr>
<td>Hazard class 4</td>
<td>21.871</td>
<td>82.107</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.003834</td>
<td>0.0098</td>
</tr>
<tr>
<td>Hazard class 5</td>
<td>408,842.3</td>
<td>24,691.54</td>
<td></td>
<td></td>
<td></td>
<td>19,116.187</td>
<td>77.4</td>
</tr>
</tbody>
</table>

Total | 408,868.7 | 24,762.21 | 19,116.196 | 77.1 | 4.461 | 0.02 | 2,138.726 | 2,332 | 701 | 2,147 | 352 | 412,391.534 |

10.3.9. REHABILITATION OF DISTURBED AREAS

In 2019, radiation burden on the environment was almost unchanged compared to 2018. The total activity of radionuclides released into the atmosphere by ROSATOM’s organizations amounted to 4.85·10^16 Bq, with beta-emitting nuclides accounting for 99.22% of the total activity (4.81·10^16 Bq).

In 2019, radionuclide emissions did not exceed permitted levels.

<table>
<thead>
<tr>
<th>Radionuclide type</th>
<th>Permitted emission, Bq</th>
<th>Actual emission, Bq</th>
<th>% of the permitted level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha-emitting</td>
<td>1.95·10^16</td>
<td>4.28·10^14</td>
<td>21.94</td>
</tr>
<tr>
<td>Beta-emitting</td>
<td>1.90·10^16</td>
<td>4.81·10^16</td>
<td>2.53</td>
</tr>
</tbody>
</table>
In 2019, ROSATOM’s organizations discharged 66.95 million m³ of wastewater into surface water bodies (down by 63% year on year) with a total activity of $4.17 \times 10^{13}$ Bq. A significant decrease in the volume of wastewater was mainly due to a decrease in the number of discharge outlets at Novovoronezh NPP.

Natural uranium accounted for 64.54% of alpha-emitting radio-nuclides discharged into the open drainage system. Tritium accounted for 99.76% of beta-emitting radionuclides discharged with wastewater into surface water bodies.

In 2019, discharges of radionuclides did not exceed permitted levels.

Gas and aerosol emissions from NPPs

In 2019, as in previous years, gas and aerosol emissions from NPPs were significantly lower than the allowable limits set by Rostekhnadzor for emissions of radioactive substances into the atmosphere. Actual emissions of radioactive substances calculated under a conservative accounting procedure did not exceed:

- 33% of the permitted amount for inert radioactive gases;
- 19% of the permitted amount for carbon-14;
- 10% of the permitted amount for tritium.

Changes in gas and aerosol emissions following an increase in the capacity of power units

The activity of emitted radionuclides depends on the capacity at which a reactor is operating, on whether fuel cladding is leak-proof and on the condition of scrubber systems used for treating atmospheric emissions from an NPP power unit. During the operation of NPP power units at an increased capacity, no leaking fuel assemblies were found. The projected increase in radionuclide emissions (by no more than 6-7%) following an increase in the capacity of a power unit equipped with a VVER-1000 reactor to 104% is offset by effective operation of special scrubbers used for capturing gas and aerosol emissions. At the same time, the level of emissions remains significantly below the allowable limits.
10.3.11. RADIATION IMPACT ON THE POPULATION AND THE ENVIRONMENT

The radiation impact of nuclear facilities on the population and the environment is insignificant. The analysis of field data on the gamma radiation dose rate shows that gamma radiation doses in buffer and radiation control areas of all NPPs are within the limits of natural background radiation which was formed before the start-up of the nuclear power plants. This indicates that natural power plants have no impact on the areas where they are located.

Additional radiation exposure of the population due to the NPP operation is assessed by the relevant regional departments of the Russian Federal Biomedical Agency (FMBA) during radiation and hygienic certification of organizations. According to the findings of radiation and hygienic certification in the Russian Federation in 2018, additional radiation exposure of the population at the locations of nuclear enterprises associated with their day-to-day operation on average does not exceed 1.1% per person of the basic dose limits for the population set in the NBB-99/2009 Standard (1 mSv on average for any consecutive five years).

According to the Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing (Rosпотребнадзор), the key factors behind radiation exposure of the Russian population are natural (over 85%) and medical uses of ionizing radiation (about 14%). The contribution of enterprises using nuclear technology is estimated at a fraction of a percent. Over many years, 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 their 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 Koporye Bay in the Gulf of Finland) or increase (as in the Beloyarsk Reservoir through the relocation of fish species that prefer warmer temperatures, such as bream and zander).

Such changes can be observed at existing nuclear power plants using once-through and recycled process water supply systems with a cooling pond, which require large amounts of recycled water. In order to minimize this impact and maintain a stable and sustainable condition of ecosystems in the area where they are located, NPPs allocate considerable sums of money for environmental monitoring 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.

Contribution to biodiversity conservation

JSC TEnEX, an organization of ROSATOM, participates in projects to preserve rare and endangered species of animals in Russia. In 2019, charitable assistance was provided for:

- Upgrading the infrastructure of the Lazovsky Nature Reserve, the Zov Tigr National Park and the Sikhote-Alin Nature Reserve as part of the project to support environmental initiatives to study and conserve the Siberian tiger population;
- Creating a unique photographic monitoring network to assess the status and size of the leopard population as part of the project to support environmental initiatives aimed at preserving Amur leopards and creating an international molecular genetics database.

10.3.12. FORECAST FOR THE ENVIRONMENTAL IMPACT OF ROSATOM AND ITS ORGANIZATIONS AND PLANS FOR CHANGING THE IMPACT AND ENSURING ENVIRONMENTAL SAFETY IN 2020 AND IN THE MEDIUM TERM

In 2020 and in the medium term, ROSATOM’s organizations will continue to annually carry out large-scale work and implement a large number of measures to upgrade and build structures and systems for environmental protection (wastewater treatment facilities, dust collectors and gas scrubbers, waste disposal facilities, etc.). Forecasts for the period until 2024 predict:

- A reduction in fixed asset investment related to environmental protection due to the completion of the construction of new power units at NPPs;
- Contaminated wastewater discharge remaining at the current level (its share in the total volume of wastewater discharge by the Corporation’s organizations is significantly lower than the national average);
- No major changes in emissions of harmful pollutants into the atmosphere;
- A continuing downward trend in the generation of hazard class 1 and 2 waste.
Key results in 2019

- ROSATOM’s Public Annual Report for 2018 was awarded 5 stars (the highest rating) in the competition of annual reports held by the RAEX-Analytics agency.
- ROSATOM’s Public Annual Report for 2018 was ranked in the top 10 in the annual corporate transparency ranking of the largest Russian companies compiled by the Russian Regional Integrated Reporting Network.
- ROSATOM was included in the top group in the Sustainable Development, Corporate Responsibility and Reporting Indices compiled by the Russian Union of Industrialists and Entrepreneurs (RSPP) (based on data provided in public reports).

11.1. PUBLIC REPORTING SYSTEM

Since 2009, ROSATOM has been developing a public reporting system whereby the Corporation prepares integrated annual reports. These reports are designed to give stakeholders a comprehensive picture of the Corporation’s strategy, business sustainability, operating, financial and economic results of the reporting year, initiatives in the sphere of nuclear and radiation safety, environmental safety, contribution to the development of ROSATOM’s regions of operation and other socially important aspects of its business. In addition, the Corporation annually submits a report to the Russian Government. Some of ROSATOM’s organizations and enterprises prepare environmental reports.

ROSATOM prepares its public annual reports in accordance with the following international standards: the GRI Sustainability Reporting Standards, the International Integrated Reporting Framework and the AccountAbility AA1000 Series of Standards. They provide the basis for the Uniform Industry-Wide Public Reporting Policy and the Public Reporting Standard of ROSATOM and Its Organizations.

In order to improve the public reporting system, in 2019, ROSATOM and its Divisions (JSC TVEL, JSC ASE EC, JSC Rosenergoatom, JSC Atomenergomash, JSC ASE EC, JSC Rosenergoatom, JSC TVEL and JSC TENEX) made the decision to switch over to a single comprehensive reporting format. Starting from the 2019 reporting year, public reports will include the Public Annual Report on the Performance of State Atomic Energy Corporation Rosatom and reporting materials of the Divisions based on a standardized structure. All public reports on the performance of ROSATOM and its organizations (including reports for previous reporting periods) and information on the public reporting system will be posted on an integrated digital platform at www.report.rosatom.ru/en.

In the future, public reporting will be based on the GRI Sustainability Reporting Standards 2019 General Protocol — Core, as well as the International Integrated Reporting Framework and the AccountAbility AA1000 Series of Standards. 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.


256 257
11.2. DIALOGUES WITH STAKEHOLDERS

In order to improve transparency and accountability at ROSATOM, representatives of key stakeholders are engaged in the preparation of the report through participation in discussions of socially important aspects of the Corporation’s business and their reflection in the report to be prepared. In addition, stakeholder representatives also participate in public assurance of the report. Stakeholder engagement is one of the key requirements of international standards such as the Accountability AA1000SES standard, the Global Reporting Initiative Sustainability Reporting Standards (GRI SRS) and the International <IR> Framework. When preparing the previous report, ROSATOM assumed a number of obligations that were later fulfilled in the 2019 report.

To improve transparency and accountability at ROSATOM and to ensure compliance with international standards during the preparation of the Report, in May and June 2020, ROSATOM’s Divisions held dialogues with stakeholders (in a remote format). During these events, stakeholder representatives voiced their requests and provided recommendations as to what information should be disclosed in the Report, and put forward proposals for developing the public reporting system (minutes of the dialogues are included in the interactive version of the report)\(^\text{86}\). The Corporation also conducted a special poll to identify material aspects of its business to be disclosed in the Report (see Appendix 1 ‘Report Profile and the Process of Determining the Report Content and Materiality of Information’). In addition, in the second half of 2020, ROSATOM plans to give a presentation of the Report for 2019; during the presentation, stakeholder representatives will be given an opportunity to put forward their recommendations concerning the content of the Public Annual Report for 2020 and the development of the Corporation’s public reporting system.

\(^{86}\) During the preparation of the Public Annual Report on the Performance of State Atomic Energy Corporation Rosatom in 2019, no dialogues with stakeholders were held. Minutes of dialogues with stakeholders held as part of the preparation of the Public Annual Report on the Performance of State Atomic Energy Corporation Rosatom for 2018 are available in the interactive version of the report (https://report.rosatom.ru/708.html).

11.3. INCORPORATION OF STAKEHOLDERS’ PROPOSALS

<table>
<thead>
<tr>
<th>Stakeholders’ proposals</th>
<th>Fulfilment of obligations by ROSATOM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FULFILMENT OF COMMITMENTS TAKEN ON BY ROSATOM DURING THE PREPARATION OF THE 2018 REPORT</strong></td>
<td></td>
</tr>
<tr>
<td>To present ROSATOM’s contribution to the implementation of Russia’s national projects.</td>
<td></td>
</tr>
<tr>
<td>To provide information on environmental benefits for a town or city and its residents from the implementation of the Smart City system.</td>
<td></td>
</tr>
<tr>
<td>To provide information not only on projects implemented by ROSATOM in ‘nuclear’ towns and cities, but also on their impact on the quality of people’s lives (changes in the indicators and metrics reflecting the standard of living).</td>
<td></td>
</tr>
<tr>
<td>To provide an assessment of efficiency of measures implemented by ROSATOM from the perspective of those who these measures are targeted at (including the Lean Polyclinic project) and to include the findings of opinion polls conducted among residents of ROSATOM’s regions of operation and their statements.</td>
<td></td>
</tr>
<tr>
<td>To add information on the market for the production of stable isotopes, where ROSATOM is a leader, and provide information on projects in this area.</td>
<td></td>
</tr>
</tbody>
</table>

Incorporated in various sections of the Report.
To be incorporated in a subsequent Report (as the Smart City system is rolled out in Russian towns and cities).
Partly incorporated in the section ‘Developing the Regions of Operation’.
The request has been forwarded to the relevant divisions of ROSATOM. The information will be disclosed, to the extent possible, in a subsequent Report.
Incorporated in the section ‘Markets served by ROSATOM’.

\[\text{https://report.rosatom.ru/708.html}\]
11.4. STATEMENT OF PUBLIC ASSURANCE

BACKGROUND

ROSTATOM has suggested that we assess its public annual report for 2019 (the Report). Our analysis and evaluation during the public assurance process focused on the materiality and completeness of information disclosed in the Report and on the Corporation’s response to stakeholders’ requests and proposals. Our conclusion is based on an analysis of the Report, additional materials provided to us (minutes of stakeholder engagement events and tables reflecting the incorporation of stakeholders’ proposals) and the feedback provided by ROSTATOM’s employees during public assurance of the Report.

We received no remuneration from ROSTATOM 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, ROSTATOM 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 will demonstrate strong commitment to ensuring that the development of nuclear technology is publicly acceptable and will benefit from public assurance of the Report. 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.

First of all, it should be pointed out that key proposals made by stakeholder representatives during the preparation of the Report for 2018 have been taken into account (the relevant information is provided in Chapter 11 of the Report).

To incorporate stakeholders’ requests as fully as possible, ROSTATOM and its Divisions conducted a questionnaire survey among stakeholders to identify material topics to be disclosed in the Report (the information received was compared with the results of a questionnaire survey conducted among the Corporation’s managers). We highly appreciate this initiative and recommend that ROSTATOM 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 are willing to take part in subsequent events aimed at discussing the Report and formulating proposals concerning the Report for 2020 and the development of ROSTATOM’s public reporting system.

To summarize, we would like to point out that in recent years ROSTATOM has made significant progress in public reporting and, consequently, continues to improve confidence in its business. We hope that ROSTATOM will continue to consistently implement the principles of responsible business conduct in the future, work systematically on the sustainable development agenda and disclose information on its performance in this context.

We highly appreciate this initiative and recommend that ROSTATOM 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.
PERSONS WHO TOOK PART IN THE PUBLIC ASSURANCE OF ROSATOM’S PUBLIC ANNUAL REPORT FOR 2019

ALEXANDER AGEEV
Director General of the Institute for Economic Strategies of the Social Sciences Division of the Russian Academy of Sciences

SERGEY BARANOVSKY
President of the Inter-Regional Environmental Non-Governmental Organization Green Cross, Deputy Chairman of ROSATOM’s Public Council

LEONID BOLSHOV
Director of the Nuclear Safety Institute of the Russian Academy of Sciences

MARINA VASHUKOVA
Executive Director of the Association National Network of the Global Compact

ANDREY VETLUZHESKIKH
Member of the State Duma Committee on Economic Policy, Industry, Innovation and Entrepreneurship

NATALIA DAVYDOVA
Director of the Environmental Projects Consulting Institute, member of ROSATOM’s Public Council

KONSTANTIN DOLOGOV
Deputy Chairman of the Committee on Economic Policy of the Federation Council of the Federal Assembly of Russia

GENNADY SKLYAR
Member of the State Duma Committee on Energy

ELENA FEOKTISTOVA
Managing Director for Corporate Responsibility, Sustainable Development and Social Entrepreneurship of the Russian Union of Industrialists and Entrepreneurs (RSPP)

IGOR FOMICHEV
Chairman of the Russian Trade Union of Nuclear Power and Industry Workers

REGINA YURYEVA
Director of the Regina Yuryeva Foundation
The National Report on the Performance of State Atomic Energy Corporation Rosatom for 2019 has been prepared in an integrated format and provides a comprehensive picture of the following:

- The implementation of ROSATOM’s strategy, including contribution to the sustainability of the Corporation’s business in the reporting year, as well as short-, medium- and long-term plans;
- Significant financial, economic and operating results of the Corporation’s core businesses;
- Results achieved in the sphere of nuclear and radiation safety, environmental protection, contribution to the development of the regions of operation, implementation of social policy and other aspects of sustainable development;
- The economic, environmental and social impact on the external and internal environment;
- The approach of ROSATOM’s executives to managing various aspects of its business.

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

- The Public Reporting Policy and the Public Reporting Standard of ROSATOM and its organizations;
- The International Integrated Reporting Framework (International <IR> Framework);
- The AccountAbility AA1000 Series of Standards (AA 1000 AP 2018, AA1000 SES 2015);
- The Global Reporting Initiative Sustainability Reporting Standards (GRI SRS, Core option)\(^96\);
- The GRI Content Index and information on correspondence to the RSPP basic performance indicators are provided in the interactive version of the Report (www.report.rosatom.ru/1628.html).

The Report has been prepared in an integrated format and provides a comprehensive picture of the following:

- The implementation of ROSATOM’s strategy, including contribution to the sustainability of the Corporation’s business in the reporting year, as well as short-, medium- and long-term plans;
- Significant financial, economic and operating results of the Corporation’s core businesses;
- Results achieved in the sphere of nuclear and radiation safety, environmental protection, contribution to the development of the regions of operation, implementation of social policy and other aspects of sustainable development;
- The economic, environmental and social impact on the external and internal environment;
- The approach of ROSATOM’s executives to managing various aspects of its business.

\(^96\) The GRI Content Index and information on correspondence to the RSPP basic performance indicators are provided in the interactive version of the Report (www.report.rosatom.ru/1628.html).

The Report focuses on the history, achievements and long-term development priorities of the Russian nuclear industry; this topic has been prioritized by the top management and representatives of key stakeholders. Information on the selection of material topics to be disclosed in the Report is provided below in the sections ‘Process for determining the Report content’ and ‘Ranking map of material topics to be disclosed in the Report’\(^97\).

ROSATOM’s internal regulations stipulate an annual reporting cycle; the previous annual report was published in August 2019.

The Report covers the Corporation’s operations during the period from January 1, 2019 through December 31, 2019.

The Report covers several scopes of consolidation (the list of organizations within various scopes of consolidation is provided in the interactive version of the Report and ROSATOM’s compliance with the AA1000 AP principles (see Appendix 2)).

Rosatom’s Internal Audit Department conducted an internal audit of the business process ‘Public Reporting Procedure in ROSATOM’ (see Appendix 2).

Representatives of key stakeholders provided public assurance of the Report in accordance with the AA1000SES standard, which confirmed the materiality and completeness of the disclosed information and the Corporation’s responsiveness to stakeholders’ requests when preparing the Report (see the section ‘Statement of Public Assurance’).

The Report covers the operations of ROSATOM and its organizations in Russia and abroad.

The Report covers several scopes of consolidation (the list of organizations within various scopes of consolidation is provided in the interactive version of the Report). Integrated performance indicators are disclosed for the Corporation’s organizations within the scope of budget consolidation as at December 31, 2019 (95 organizations)\(^98\); GRI disclosures that belong to the Social Category are reported for organizations within the scope of budget consolidation; GRI disclosures that belong to the Environmental Category are reported for all significant organizations within ROSATOM which provide information on their environmental performance using corporate reporting forms (113 organizations). Financial and economic indicators in the section ‘Financial and Economic Results’ are disclosed for organizations included in the part of the scope of ROSATOM’s consolidated IFRS financial statements for which information is publicly available (199 organizations).

In accordance with international standards, some disclosures in the Report and related performance indicators (international cooperation, ROSATOM’s activities in its regions of operation, environmental protection, etc.) include information on the operations of ROSATOM’s key partners, counterparties and other stakeholders.

\(^97\) https://www.report.rosatom.ru/1628.html.

\(^98\) Hereinafter, not including State Atomic Energy Corporation Rosatom.
The Corporation’s management, members of the Working Group compiled a list of material topics related to the following process:

The materiality of information was determined through the following process:

- A working group compiled a list of material topics related to ROSATOM’s operations (GRI Reporting Principles: Sustainability Context, Materiality);
- The Corporation’s management, members of the Working Group preparing the Report and representatives of major stakeholder groups prioritized material topics (based on the assessment of materiality of each of the proposed aspects taking into account the materiality of ROSATOM’s impacts and its influence on stakeholders’ opinions and decisions) (GRI Reporting Principles: Stakeholder Inclusiveness, Materiality);
- Following the “two-stage filtering”, a list of material topics to be disclosed in the Report was compiled (GRI Reporting Principles: Completeness, Materiality).

As a result, a ranking map of material topics to be disclosed in the Report was prepared. The decision to include various GRI performance indicators and performance indicators stipulated in ROSATOM’s Public Reporting Standard was based on the materiality of the topics to which the indicators are related. The boundaries of information disclosure on various aspects were determined by the Working Group.

The map has been prepared based on the findings of a questionnaire survey conducted among internal and external stakeholders of ROSATOM in December 2019 and taking into account opinions obtained from stakeholders between 2016 and 2018.

As a result, ranking map of material topics to be disclosed in the Report was compiled. 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.

Process for Determining the Report Content

ROSATOM traditionally attaches great importance to determining the materiality of information to be disclosed in a public report. The 2019 Report was prepared in accordance with international reporting standards: the Global Reporting Initiative Sustainability Reporting Standards (GRI SRS) and the International Integrated Reporting Framework. Both standards require that material topics to be disclosed in the Report should be determined.

The materiality of information was determined through the following process:

- A working group compiled a list of material topics related to ROSATOM’s operations (GRI Reporting Principles: Sustainability Context, Materiality);
- The Corporation’s management, members of the Working Group preparing the Report and representatives of major stakeholder groups prioritized material topics (based on the assessment of materiality of each of the proposed aspects taking into account the materiality of ROSATOM’s impacts and its influence on stakeholders’ opinions and decisions) (GRI Reporting Principles: Stakeholder Inclusiveness, Materiality);
- Following the “two-stage filtering”, a list of material topics to be disclosed in the Report was compiled (GRI Reporting Principles: Completeness, Materiality).

As a result, a ranking map of material topics to be disclosed in the Report was prepared. The decision to include various GRI performance indicators and performance indicators stipulated in ROSATOM’s Public Reporting Standard was based on the materiality of the topics to which the indicators are related. The boundaries of information disclosure on various aspects were determined by the Working Group.

<table>
<thead>
<tr>
<th>RANKING MAP OF MATERIAL TOPICS TO BE DISCLOSED IN THE REPORT**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Outcomes of implementation of ROSATOM’s strategy and contribution of performance in the reporting year to the achievement of strategic goals</td>
</tr>
<tr>
<td>2. Ensuring nuclear and radiation safety during the operation of nuclear facilities (including international cooperation in this sphere) (GRI 416: Customer Health and Safety)</td>
</tr>
<tr>
<td>3. ROSATOM’s performance in the sphere of international business and international cooperation (including building relationships with customers and partners and obtaining feedback)</td>
</tr>
<tr>
<td>4. ROSATOM’s presence on the markets for nuclear technologies and services (markets for natural uranium, uranium conversion and enrichment, nuclear fuel, NPP construction, etc.) and the markets for new non-nuclear businesses, and the development prospects of these markets</td>
</tr>
<tr>
<td>5. ROSATOM’s financial and economic performance (GRI 201: Economic Performance)</td>
</tr>
<tr>
<td>6. Development and implementation of technologies and practices reducing the environmental footprint</td>
</tr>
<tr>
<td>7. ROSATOM’s impact on local communities (social programmes, philanthropy, volunteering) (GRI 413: Local Communities)</td>
</tr>
<tr>
<td>8. Compliance of ROSATOM’s organizations with national and international environmental and technical standards (GRI 307: Environmental Compliance)</td>
</tr>
<tr>
<td>9. Key personnel characteristics (including personnel costs)</td>
</tr>
<tr>
<td>10. Implementation of ROSATOM’s Innovative Development Programme</td>
</tr>
<tr>
<td>11. Emissions, waste and effluents (GRI 305: Emissions, GRI 306: Effluents and Waste)</td>
</tr>
<tr>
<td>13. ROSATOM’s performance in the sphere of international business and international cooperation (including building relationships with customers and partners and obtaining feedback)</td>
</tr>
<tr>
<td>14. 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</td>
</tr>
<tr>
<td>15. ROSATOM’s impact on local communities (social programmes, philanthropy, volunteering) (GRI 413: Local Communities)</td>
</tr>
<tr>
<td>16. Compliance of ROSATOM’s organizations with national and international environmental and technical standards (GRI 307: Environmental Compliance)</td>
</tr>
<tr>
<td>17. Development and implementation of technologies and practices reducing the environmental footprint</td>
</tr>
</tbody>
</table>

** The map has been prepared based on the findings of a questionnaire survey conducted among internal and external stakeholders of ROSATOM in December 2019 and taking into account opinions obtained from stakeholders between 2016 and 2018. During the survey, stakeholders were asked to assess the materiality of topics primarily 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 topics or references to other sources of information, such as the online version of the report, the corporate website, reports of ROSATOM’s organizations, etc.);
2 – it is important to disclose this information in the report (the information should be disclosed in the report in detail);
3 – it is very important to disclose this information in the report (the information should be disclosed in a separate section/presented at the beginning (in the first chapter) of the report).

Topics are considered to be material for information disclosure in accordance with the GRI Standards if they were given a score of 1.5 points or higher during the assessment.

100 Due to the absence of an official Russian translation of the GRI Standards, the titles of the Standards and the names of indicators are provided in English in the Russian version of the report.
# PERFORMANCE OF STATE ATOMIC ENERGY CORPORATION ROSATOM IN 2019

## Highest materiality (a score of 2.5 points or higher)

- **7.** Prospects for the development of the nuclear power industry in Russia and globally. Forecasts for the needs of the energy system in Russia and the energy systems of foreign countries.
- **19.** Development of the Northern Sea Route.
- **20.** Emergency preparedness.
- **21.** Digitization of the industry, contribution to the digitization of the Russian economy and development of digital products.

## High materiality (a score of 2 points or higher)

- **12.** ROSATOM’s performance in the sphere of business diversification (wind power, nuclear medicine, composite materials, irradiation centres, non-nuclear mechanical engineering, NPP servicing, etc.)
- **13.** Key business risks and opportunities.
- **24.** Participation in international mega research projects (ITER, FAIR, etc.).
- **26.** Management of disturbed and contaminated areas.

## Medium materiality (a score of 1.5 points or higher)

- **14.** Environmental measures and expenses and their efficiency (GRI 307: Environmental Compliance).
- **27.** Occupational health and safety (including injury rates) (GRI 403: Occupational Health and Safety).
- **28.** Cooperation with universities and recruitment of young professionals.
- **29.** Implementation of the social policy with regard to employees (GRI 401: Employment).
- **30.** Financial management and implementation of ROSATOM’s investment programme.

## Low materiality (a score lower than 1.5 points)

- **15.** Environmental measures and expenses and their efficiency (GRI 307: Environmental Compliance).
- **24.** Participation in international mega research projects (ITER, FAIR, etc.).
- **26.** Management of disturbed and contaminated areas.

---

**Highest materiality**

**High materiality**

**Medium materiality**

**Low materiality**

<table>
<thead>
<tr>
<th>Highest materiality (a score of 2.5 points or higher)</th>
<th>High materiality (a score of 2 points or higher)</th>
<th>Medium materiality (a score of 1.5 points or higher)</th>
<th>Low materiality (a score lower than 1.5 points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Prospects for the development of the nuclear power industry in Russia and globally. Forecasts for the needs of the energy system in Russia and the energy systems of foreign countries.</td>
<td>12. ROSATOM’s performance in the sphere of business diversification (wind power, nuclear medicine, composite materials, irradiation centres, non-nuclear mechanical engineering, NPP servicing, etc.)</td>
<td>8. Radiation impact on the environment (including on biodiversity) (GRI 304: Biodiversity, GRI 305: Emissions, GRI 306: Effluents and Waste)</td>
<td>15. Environmental measures and expenses and their efficiency (GRI 307: Environmental Compliance).</td>
</tr>
<tr>
<td>19. Development of the Northern Sea Route.</td>
<td>13. Key business risks and opportunities.</td>
<td>9. Contribution to the economic development of the regions of operation (contribution to economic value creation and distribution in the regions of operation, contribution to the energy security of Russian regions, tax payments to the budgets of various levels, investments in infrastructure, job creation, etc.) (GRI 203: Indirect Economic Impact).</td>
<td>24. Participation in international mega research projects (ITER, FAIR, etc.).</td>
</tr>
<tr>
<td>22. Performance of ROSATOM’s Divisions.</td>
<td>27. Implementation of the social policy with regard to employees (GRI 401: Employment).</td>
<td>12. RAW and SNF management and addressing ‘nuclear legacy’ issues.</td>
<td>29. Implementation of the social policy with regard to employees (GRI 401: Employment).</td>
</tr>
<tr>
<td>23. Implementation of the Patriots project and progress on the development of a new technological platform and transition to a closed nuclear fuel cycle in the nuclear power industry.</td>
<td>30. Financial management and implementation of ROSATOM’s investment programme.</td>
<td></td>
<td>31. Prevention of corruption and other offences (GRI 205: Anti-Corruption).</td>
</tr>
<tr>
<td>41. Outcomes of import substitution initiatives.</td>
<td>42. External communication projects (exhibitions, nuclear energy information centres, online communication, etc.)</td>
<td>42. External communication projects (exhibitions, nuclear energy information centres, online communication, etc.)</td>
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</tr>
<tr>
<td>43. Improvement of corporate governance mechanisms, including the implementation of the Corporate Governance Code recommended by the Bank of Russia.</td>
<td>44. Performance of the ROSATOM Production System (RPS).</td>
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<td>44. Performance of the ROSATOM Production System (RPS).</td>
<td>45. Labour/management relations (including the ability of employees to influence managerial decision-making, measures to safeguard the legal rights of employees, the collective agreement) (GRI 402: Labour/Management Relations).</td>
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</tr>
<tr>
<td>46. Communication projects aimed at increasing employee engagement, recognition and motivation.</td>
<td>47. Development of the corporate culture and horizontal cooperation among employees.</td>
<td>47. Development of the corporate culture and horizontal cooperation among employees.</td>
<td>47. Development of the corporate culture and horizontal cooperation among employees.</td>
</tr>
<tr>
<td>48. Organizational change management (responsible change management measures (personnel rotation, retraining, downsizing, etc.).</td>
<td>49. Approaches to determining remuneration for employees and executives.</td>
<td>49. Approaches to determining remuneration for employees and executives.</td>
<td>49. Approaches to determining remuneration for employees and executives.</td>
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<tr>
<td>50. Industry media coverage.</td>
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<td></td>
<td>50. Industry media coverage.</td>
</tr>
</tbody>
</table>
### Highest materiality (a score of 2.5 points or higher)

- Performance of government functions by ROSATOM: law drafting, implementation of federal target programmes and government programmes, provision of public services (GRI 415: Public Policy)

### High materiality (a score of 1.5 points or higher)

- Development of closed administrative and territorial formations (CATFs) and areas where NPPs are located

### Medium materiality (a score of 1.5 points or higher)

- Procurement and supply chain management (including sustainability requirements for suppliers and contractors and measures to prevent unfair competition) (GRI 204: Procurement Practices)

### Low materiality (a score lower than 1.5 points)

**DISCLAIMER**

The Report contains information about ROSATOM’s medium- and long-term objectives and initiatives. The objectives are forward-looking, and their actual achievement depends, among other things, on a number of economic, political and legal factors beyond ROSATOM’s control (the global financial, economic and political environment; situation on the key markets; amendments to the tax, customs and environmental legislation, etc.). Therefore, actual performance in the future years may differ from the forward-looking statements contained herein.

**APPENDIX 2. REPORT OF THE INTERNAL AUDIT DEPARTMENT OF STATE ATOMIC ENERGY CORPORATION ROSATOM**

**REPORT**

of the Internal Audit Department of ROSATOM

on the findings of internal audit of the business process

"Public Reporting Procedure in ROSATOM"

Internal audit of the business process “Public Reporting Procedure in ROSATOM” has been performed pursuant to the Consolidated Monitoring Plan of Specialized Internal Control Bodies of ROSATOM for the Second Half of 2020 signed off by the Director General of ROSATOM and approved by the Chairman of the Supervisory Board of ROSATOM.

The audit has involved:

- An assessment of efficiency of internal controls in the public reporting process.
- An assessment of compliance of the public reporting procedure with applicable legislation, international standards and internal regulatory requirements for public reporting.
- Producing recommendations for improving internal controls in public reporting and enhancing the efficiency of this process.

It should be pointed out that, starting from this year, ROSATOM’s public report includes reporting materials on the performance of ROSATOM’s Divisions, which are attached to the report as appendices.

The findings of the audit lead to the conclusion that the business process “Public Reporting Procedure in ROSATOM” complies with applicable legislation, international standards and internal regulatory requirements governing the public reporting process. At the same time, the auditors would like to point to the need for more detailed disclosure of information required by individual provisions of the GRI Sustainability Reporting Standards.

**Head of the audit team**

A.P. Ivanova

**Member of the audit team**

I.Yu. Stepuk
APPENDIX 3. INDEPENDENT AUDITOR’S REPORT ON THE NON-FINANCIAL REPORT OF STATE ATOMIC ENERGY CORPORATION ROSATOM

INDEPENDENT PRACTITIONERS’ LIMITED ASSURANCE REPORT (TRANSLATION FROM RUSSIAN ORIGINAL)

To the management of State Atomic Energy Corporation Rosatom

We have undertaken a limited assurance engagement of State Atomic Energy Corporation Rosatom (hereafter referred to as ROSATOM) stakeholder engagement in the course of sustainability activities implementation compliance with the principles of the AKU000 Accountability Principle 2018 (hereafter referred to as AKU000 AP 2018) as well as in relation to the accompanying Public Annual Report “Performance of State Atomic Energy Corporation Rosatom in 2019” (hereinafter referred to as the Report) prepared in accordance with GRI Sustainability Reporting Standards. 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

ROSATOM is responsible for the compliance with the principles of AKU000 AP 2018 in stakeholder engagement in the course of sustainability activities implementation as well as for preparation of the Report in compliance with the requirements of GRI Sustainability Reporting Standards to the report prepared in accordance with the Core option and with the requirements of the International Integrated Reporting Framework. This responsibility includes the design, implementation and maintenance of internal control related to the preparation of the Report and the use of such internal control to prevent or detect 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 Board of Directors of the Institute of Internal Auditors, as well as in accordance with International Code of Ethics for Professional Accountants (Including International Independence Standards) issued by the International Ethics Standards Board for Accountants, which is founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality and professional service, and we have fulfilled our other ethical responsibilities in accordance with those Rules.

The firm who has prepared the Report has a comprehensive system of quality control including documented policies and procedures regarding compliance with ethical requirements, professional standards and applicable legal and regulatory requirements for the firm. The firm’s policies and procedures are designed to provide us with reasonable assurance that the firm maintains professional standards and practices in order to provide services that are consistent with the firm’s reputation for integrity, objectivity, proficiency and due care as well as consistent with the independence and other ethical requirements of the Rules of Independence. The firm’s policies and procedures are designed to be in accordance with all applicable professional and ethical requirements.

Our Responsibility

Our responsibility is to express a limited assurance conclusion on ROSATOM stakeholder engagement in the course of sustainability activities implementation compliance with the principles of AKU000 AP 2018, as well as in the Report prepared in accordance 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. The procedures we have performed and the evidence we have obtained, in our opinion, are adequate to provide a basis for our conclusion.

Limited Assurance Conclusion

Based on the procedures performed and evidence obtained, nothing has come to our attention that causes us to believe that ROSATOM stakeholder engagement in the course of sustainability activities implementation with the principles of AKU000 AP 2018, in the Report prepared in accordance with the Core option and with the requirements of the International Integrated Reporting Framework is not free from material misstatement.

A limited assurance engagement underlines that there is a higher level of assurance obtained in a limited assurance engagement 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.

Limited assurance engagements require that the procedures be designed to provide limited assurance that nothing has come to our attention that causes us to believe that ROSATOM stakeholder engagement in the course of sustainability activities implementation with the principles of AKU000 AP 2018, in the Report prepared in accordance with the Core option and with the requirements of the International Integrated Reporting Framework is not free from material misstatement.

The procedures performed in a limited assurance engagement vary in nature and timing from, and are less extensive 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.

The procedures were performed only in relation to data for the year ended 31 December 2019. The evaluation of reliability of the information on performance in the Report was conducted in relation to the requirements of the Statements for the report prepared in accordance with the Core option and in relation to the requirements of the International Integrated Reporting Framework. The procedures were performed only in relation to data for the year ended 31 December 2019.

We have undertaken a limited assurance engagement of State Atomic Energy Corporation Rosatom in 2019” (hereinafter referred to as the Report) compliance with the principles of AA1000 AP 2018 (Inclusivity, Materiality, Responsiveness and Impact) and AA1000AS 2008 (Moderate Assurance) in stakeholder engagement in the course of sustainability activities implementation as well as in the Report prepared in accordance with the Core option and with the requirements of the International Integrated Reporting Framework.

A limited assurance engagement underlines that there is a higher level of assurance obtained in a limited assurance engagement than for a reasonable assurance engagement. Consequently, the level of assurance obtained in a limited assurance engagement is substantially lower than the assurance that would have been obtained had we performed a reasonable assurance engagement. Accordingly, we do not express a reasonable assurance opinion about compliance with the requirements of AA1000 AP 2018.

The procedures performed in a limited assurance engagement vary in nature and timing from, and are less extensive 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.

The procedures were performed only in relation to data for the year ended 31 December 2019. The evaluation of reliability of the information on performance in the Report was conducted in relation to the requirements of the Statements for the report prepared in accordance with the Core option and in relation to the requirements of the International Integrated Reporting Framework. The procedures were performed only in relation to data for the year ended 31 December 2019.

We have undertaken a limited assurance engagement of State Atomic Energy Corporation Rosatom in 2019” (hereinafter referred to as the Report) compliance with the principles of GRI Sustainability Reporting Standards (Moderate Assurance) in stakeholder engagement in the course of sustainability activities implementation as well as in the Report prepared in accordance with the Core option and with the requirements of the International Integrated Reporting Framework.

A limited assurance engagement underlines that there is a higher level of assurance obtained in a limited assurance engagement than for a reasonable assurance engagement. Consequently, the level of assurance obtained in a limited assurance engagement is substantially lower than the assurance that would have been obtained had we performed a reasonable assurance engagement. Accordingly, we do not express a reasonable assurance opinion about compliance with the requirements of GRI Sustainability Reporting Standards.

The procedures performed in a limited assurance engagement vary in nature and timing from, and are less extensive 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.

The procedures were performed only in relation to data for the year ended 31 December 2019. The evaluation of reliability of the information on performance in the Report was conducted in relation to the requirements of the Statements for the report prepared in accordance with the Core option and in relation to the requirements of the International Integrated Reporting Framework. The procedures were performed only in relation to data for the year ended 31 December 2019.

We have undertaken a limited assurance engagement of State Atomic Energy Corporation Rosatom in 2019” (hereinafter referred to as the Report) compliance with the principles of Core option of Global Reporting Initiative in order to notify it of the use of the Standards in the Report preparation.

The procedures were performed in relation to the Russian version of the Report, which includes information to be published in a technical form as well as in a digital form on the ROSATOM website. The procedures were performed in relation to the version of the Report subject to sending to Global Reporting Initiative.

The procedures were performed in relation to the version of the Report subject to sending to Global Reporting Initiative.

The procedures were performed only in relation to data for the year ended 31 December 2019. The evaluation of reliability of the information on performance in the Report was conducted in relation to the requirements of the Statements for the report prepared in accordance with the Core option and in relation to the requirements of the International Integrated Reporting Framework. The procedures were performed only in relation to data for the year ended 31 December 2019.

The procedures were performed in relation to the version of the Report subject to sending to Global Reporting Initiative.

The procedures were performed only in relation to data for the year ended 31 December 2019. The evaluation of reliability of the information on performance in the Report was conducted in relation to the requirements of the Statements for the report prepared in accordance with the Core option and in relation to the requirements of the International Integrated Reporting Framework. The procedures were performed only in relation to data for the year ended 31 December 2019.
Limited Assurance Conclusion on Compliance of the Report with the requirements of the International Integrated Reporting Framework

Based on the procedures performed and evidence obtained, nothing has come to our attention that causes us to believe that the Report has not complied, in all material aspects, with the guiding principles of the International Integrated Reporting Framework and with requirements to the structure of content elements of integrated reports.

Basis for Limited Assurance Qualified Conclusion on Compliance of the Report with the GRI Sustainability Reporting Standards (Core option)

GRI Disclosure 102-8 has been reported without breakdown of total number of employees by employment contract (including by gender and region) as well as by employment type (including by gender).

Limited Assurance Qualified Conclusion on Compliance of the Report with the GRI Sustainability Reporting Standards (Core option)

Based on the procedures performed and evidence obtained, except for the effect on the matters described in the Basis for Limited Assurance Qualified Conclusion on Compliance of the Report with the GRI Sustainability Reporting Standards (Core option) section of our report, nothing has come to our attention that causes us to believe that the Report has not complied, in all material aspects, with requirements of GRI Sustainability Reporting Standards in the report prepared in accordance with the Core option.

Recommendations

Based on the results of the limited assurance engagement we recommend:

- Include a statement on compliance of the report with the requirements of the International Integrated Reporting Framework in the statement from those charged with governance.
- It is reasonable to disclose GRI indicators in relation to target values and plans for the future.
- In case of disclosure with omissions due to absence of a recording system, provide more specific information about plans to obtain data in future.

The recommendations are not intended to detract from the practitioner’s conclusions. Our conclusions are not modified in respect of the matters referred to in the recommendations.

FBK, LLC

_____________________
V.Y. Skobarev
Practitioner
Partner
acting under Power of Attorney No. 76/18 of December 17, 2018

The Russian Federation, Moscow

September 02, 2020

**Translation Note:** Our report has been prepared in Russian and in English. In all matters of interpretation of information, views or opinions, the Russian version of our report takes precedence over the English version.

**LIST OF ABBREVIATIONS**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>APCS</td>
<td>automated process control system</td>
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<td>ARMS</td>
<td>automated radiation monitoring system</td>
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<td>CATF</td>
<td>closed administrative and territorial formation</td>
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<td>CNFC</td>
<td>closed nuclear fuel cycle</td>
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<tr>
<td>EUP</td>
<td>enriched uranium product</td>
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<tr>
<td>FAIR</td>
<td>Facility for Antiproton and Ion Research</td>
</tr>
<tr>
<td>FTP</td>
<td>federal target programme</td>
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<tr>
<td>HEU</td>
<td>highly enriched uranium</td>
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<tr>
<td>HLW</td>
<td>high-level waste</td>
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<tr>
<td>IAEA</td>
<td>International Atomic Energy Agency</td>
</tr>
<tr>
<td>IARMS</td>
<td>Industry-Wide Automated Radiation Monitoring System</td>
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<tr>
<td>IGA</td>
<td>intergovernmental agreement</td>
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<tr>
<td>ILW</td>
<td>intermediate level waste</td>
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<tr>
<td>INES</td>
<td>International Nuclear Event Scale</td>
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<tr>
<td>INPRO</td>
<td>International Project on Innovative Nuclear Reactors and Fuel Cycles</td>
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<tr>
<td>INS RAW</td>
<td>Integrated National System for Radioactive Waste Management</td>
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<tr>
<td>IP</td>
<td>intellectual property</td>
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<tr>
<td>IRAW</td>
<td>individual risk assessment workstation</td>
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<tr>
<td>ISRS</td>
<td>Integrated Standardized Remuneration System</td>
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<tr>
<td>ITER</td>
<td>International Thermonuclear Experimental Reactor</td>
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</tbody>
</table>
GLOSSARY

AA1000 Stakeholder Engagement Standard (AA1000SES) A regulatory framework for designing, implementing, evaluating, communicating and assuring the quality of stakeholder engagement, including as part of reporting and accountability processes of organizations

Becquerel (Bq) A unit of nuclide activity in a radiation source equal to nuclide activity where one nucleus decays per second

BOO (Build – Own – Operate) contract A contract imposing obligations related to the construction, ownership and operation of a facility

Capacity factor The ratio of actual electricity output of a reactor unit during its operation to electricity output that would have been produced during its operation at full nameplate capacity without shutdowns

Closed nuclear fuel cycle A nuclear fuel cycle in which spent nuclear fuel is processed in order to extract uranium and plutonium for nuclear fuel reprocessing

Corporate business model A model comprising key business processes used by the organization to create and maintain its value in the short, medium and long term

Corporate social responsibility A concept whereby an organization takes into account stakeholder requests. It is a set of obligations voluntarily assumed by the organization’s executives to take into account the interests of employees, shareholders, local communities in the organization’s regions of operation, government bodies and municipal governments and other stakeholders. These obligations are funded mainly from the organization’s own funds and are aimed at implementing significant internal and external social (in a broad sense) programmes whose outcomes help develop the organization, improve its reputation and image, and enable constructive stakeholder engagement

Depleted uranium Uranium with a lower content of the U-235 isotope than natural uranium (e.g. uranium in spent fuel from reactors fuelled with natural uranium)

Dialogue with stakeholders (as part of reporting processes) An event held in accordance with the international AA1000 Series of Standards to facilitate communication between the organization and representatives of key stakeholders when preparing and promoting its public reports

Digitization A systematic approach to the use of digital resources in order to improve labour productivity, gain a competitive advantage and promote overall economic development

Enrichment (isotopic) a) The amount of atoms of a specific isotope in a mixture of isotopes of the same element if it exceeds the share of this isotope in a naturally occurring mixture (expressed as a percentage); b) a process resulting in an increase in the content of a specific isotope in a mixture of isotopes per second

EPC (Engineering – Procurement – Construction) contract A contract imposing obligations related to the turnkey construction of a facility, i.e. obligations related to the engineering, procurement and construction of a facility. Unlike a BOO contract, it does not provide for ownership of the facility to be built

EPCM (Engineering – Procurement – Construction – Management) contract A contract imposing obligations related to the turnkey construction (engineering, procurement and construction) and management of a facility. Unlike a BOO contract, it does not provide for ownership of the facility to be built

IUEC International Uranium Enrichment Centre

KPI key performance indicator

LCBE life cycle back-end

LEU low-enriched uranium

LLW low-level waste

NF nuclear facility

NFA nuclear fuel assembly

NFE nuclear fuel element

NPP nuclear power plant

NRS nuclear and radiation safety

NS nuclear submarine

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

R&D research and development

RAW radioactive waste

RBMK high-power channel-type reactor

ROSATOM Corporation State Atomic Energy Corporation Rosatom

Rostekhnadzor Federal Service for Environmental, Technological and Nuclear Supervision

RSPP Russian Union of Industrialists and Entrepreneurs

SNF spent nuclear fuel

WPP wind power plant

AA1000 Stakeholder Engagement Standard (AA1000SES) A regulatory framework for designing, implementing, evaluating, communicating and assuring the quality of stakeholder engagement, including as part of reporting and accountability processes of organizations

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EPCM (Engineering – Procurement – Construction – Management) contract A contract imposing obligations related to the turnkey construction (engineering, procurement and construction) and management of a facility. Unlike a BOO contract, it does not provide for ownership of the facility to be built
ESG principles  Principles underlying an organization’s operations and taking into account environmental (E), social (S) and governance (G) factors. The term ‘ESG’ is widely used by the investment community; the ESG principles are essentially similar to sustainability principles

Fast neutrons  Neutrons whose kinetic energy exceeds a certain limit. This limit varies within a broad range and depends on the application (reactor physics, protection or radiation monitoring). In reactor physics, this limit is usually set at 0.1 MeV

First criticality  A stage in the commissioning of an NPP which involves loading nuclear fuel into the reactor, achieving first criticality and performing required physical experiments at a power level at which heat is removed from the reactor through natural heat losses

Fuel assembly  A set of fuel elements (rods, bars, plates, etc.) held together with spacer grids and other structural elements that are transported and irradiated in the reactor in one piece. Fuel assemblies are loaded into the reactor core

Global Reporting Initiative (GRI)  An international system for reporting on economic, environmental and social performance based on the Sustainability Reporting Standards

Global Reporting Initiative (GRI) Sustainability Reporting Standards  The Standards outline the Principles for defining report content and ensuring the appropriate quality of reporting information; disclosures comprising performance indicators related to an organization’s economic, environmental and social impacts, approaches to managing these impacts and other characteristics

Integrated report  A report consolidating all material data on the organization’s strategy, corporate governance, performance indicators and prospects to present a comprehensive picture of its economic, social and environmental status. The report gives a clear idea of value creation in the organization at present and in the future

International Integrated Reporting Council (IIRC)  An international organization responsible for promoting and updating the International Integrated Reporting Framework. The objective of the IIRC is to develop universal approaches to corporate reporting in order to promote sustainable development of the global economy

International Standard on Assurance Engagements (ISAE) 3000 (Revised), Assurance Engagements Other Than Audits or Reviews of Historical Financial Information  An international standard for the audit of non-financial reports

Nuclear fuel  The ability of an NPP to ensure radiation safety for personnel, the general public and the environment within required limits during normal operation and in the event of an accident

Nuclear fuel cycle (NFC)  A sequence of manufacturing processes aimed at ensuring the operation of nuclear reactors, ranging from uranium production to radioactive waste disposal

Nuclear power  A branch of power engineering that uses nuclear energy for electricity and heat generation

Nuclear safety  The ability of nuclear facilities to prevent nuclear accidents and radioactive leaks

Non-financial reporting  Reports provided by an organization on its performance beyond its core operational and financial activities (and the management of this performance). Examples of non-financial reports include sustainability reports, corporate social responsibility reports, environmental reports, reports on philanthropy, etc.

Ohio Nuclear (ON)  An organization that has obtained a permit from a regulator for the operation of an NPP or another nuclear facility

Pilot operation  A stage in the commissioning of a nuclear power plant from the power start-up to acceptance of the power plant for commercial operation

Pilot operation  A stage in the commissioning of a nuclear power plant from the power start-up to acceptance of the power plant for commercial operation

Power start-up  A stage in the commissioning of an NPP at which the NPP starts to generate energy, and the operation of the NPP is tested at various power levels, up to the level specified for commercial operation

Radioactive discharge  Controlled release of radionuclides into industrial reservoirs as a result of the operation of a nuclear facility

Radioactive discharges  Controlled release of radionuclides into industrial reservoirs as a result of the operation of a nuclear facility

Radioactive discharge  Controlled release of radionuclides into industrial reservoirs as a result of the operation of a nuclear facility

Radioactive waste  Materials and substances unsuitable for further use, as well as equipment and products with a radionuclide content above prescribed levels

Radioactive waste disposal  Safe placement of radioactive waste in repositories or any places that rules out waste withdrawal or a possibility of radioactive leaks into the environment

Radioactive waste disposal  Safe placement of radioactive waste in repositories or any places that rules out waste withdrawal or a possibility of radioactive leaks into the environment

Radioactive waste processing and conditioning  Process operations aimed at ensuring that the physical form and condition of radioactive waste are appropriate for its disposal

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Recommendations of the Russian Union of Industrialists and Entrepreneurs (RSPP) for Use in Governance Practice and Corporate Non-Financial Reporting (basic performance indicators)  A system of economic, social and environmental performance indicators for non-financial reports developed by the RSPP in order to facilitate the adoption of responsible business principles. It is based on a number of framework documents developed by UN organizations (including the UN Global Compact) and the Global Reporting Initiative, as well as methodological and procedural guidelines of the Federal State Statistics Service of the Russian Federation and guidelines developed by the RSPP (the Social Charter of Russian Business, Recommendations on the Preparation of Non-Financial Reports ‘Five Steps Towards Social Sustainability of Companies’, etc.)
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Research reactor</td>
<td>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.</td>
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<tr>
<td>Separative work unit (SWU)</td>
<td>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.</td>
</tr>
<tr>
<td>Spent nuclear fuel processing</td>
<td>A set of chemical engineering processes for removing fission products from spent nuclear fuel and for regeneration of fissionable material for reuse.</td>
</tr>
<tr>
<td>Stakeholder assurance of the report</td>
<td>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.</td>
</tr>
<tr>
<td>Stakeholders</td>
<td>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.</td>
</tr>
<tr>
<td>Sustainable development</td>
<td>A process of economic and social change whereby the exploitation of natural resources, allocation of investments, the focus of scientific and technical development, personal development and institutional changes are aligned with each other and strengthen the present and future potential for meeting human needs and aspirations.</td>
</tr>
<tr>
<td>Sustainable Development Goals</td>
<td>17 interdependent goals set in the 2030 Agenda for Sustainable Development adopted by 193 countries at the session of the UN General Assembly in 2015. The goals include eradicating poverty in all its forms, reducing inequality and addressing climate change.</td>
</tr>
<tr>
<td>Uranium conversion</td>
<td>A chemical engineering process involving the transformation of uranium-containing materials into uranium hexafluoride.</td>
</tr>
<tr>
<td>Uranium hexafluoride</td>
<td>A chemical compound of uranium and fluorine (UF₆), 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.</td>
</tr>
<tr>
<td>Uranium ore enrichment</td>
<td>A combination of processes for primary treatment of uranium-containing mineral resources in order to separate uranium from other minerals contained in the ore.</td>
</tr>
<tr>
<td>Water-cooled water-moderated power reactor (VVER)</td>
<td>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.</td>
</tr>
</tbody>
</table>
Dear reader,

You have read the public annual report of ROSATOM, which is intended for a wide range of stakeholders. We attach great importance to the opinion of the readers of our report. We would appreciate it if you helped improve the quality of the Corporation’s reports by completing the questionnaire below.

Please return the completed form by mail to the Communications Department at 24 Bolshaya Ordynka Street, Moscow, 119017 and/or by email (SSGolovachev@rosatom.ru).

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Accuracy and objectivity
☐ Excellent ☐ Good ☐ Satisfactory ☐ Poor

Was your opinion influenced by the independent auditors’ report and the statement of public assurance included in the report?
☐ Yes ☐ No

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Report structure, ease of reference, wording
☐ Excellent ☐ Good ☐ Satisfactory ☐ Poor

2. PLEASE SPECIFY WHICH SECTIONS OF THE REPORT YOU HAVE FOUND TO BE RELEVANT AND USEFUL.

3. WHICH TOPICS DO YOU THINK SHOULD BE COVERED IN THE NEXT REPORT?

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