ROSATOM
VALUES

- Efficiency
- One team
- One step ahead
- Respect
- Safety
- Responsibility for the result

ROSATOM
KEY FACTS
In 2015, we reached the targets that the government of the country had set for us. Moreover, we managed to exceed the targets for some indicators considerably.

We successfully accomplished the following key tasks of the year:
• increase of ROSATOM’s share on international markets, continued growth of the portfolio of overseas orders;
• reduction of the cost of our products and lead time;
• development of new products for the domestic and international markets.

CEO of ROSATOM
Sergey Kirienko
## Global Presence of ROSATOM

The table below lists the regions and countries where ROSATOM has projects or centers with areas of responsibility.

<table>
<thead>
<tr>
<th>Region/Area</th>
<th>Projects/Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>Construction of research reactors, Supplies of LEU and uranium enrichment services, Oil and gas exploration and production, Nuclear fuel cycle back-end.</td>
</tr>
<tr>
<td>Europe</td>
<td>Uranium exploration and mining, Construction of research reactors, Service and modernization, Products and services based on radiation technologies.</td>
</tr>
<tr>
<td>Asia</td>
<td>Uranium exploration and mining, Services of LEU and uranium enrichment services.</td>
</tr>
<tr>
<td>Americas</td>
<td>Uranium exploration and mining, Construction of research reactors, Service and modernization, Products and services based on radiation technologies.</td>
</tr>
</tbody>
</table>

![Map of ROSATOM's Global Presence](map.png)

### Key Facts

- **Construction of research reactors**: Promising project/Ongoing project
- **Service and modernization**: Promising project/Ongoing project
- **Nuclear fuel cycle back-end**: Promising project/Ongoing project
- **Uranium exploration and mining**: Promising project/Ongoing project
- **NPP construction**: Promising project/Ongoing project
- **Supplies of LEU and uranium enrichment services**: Promising project/Ongoing project
- **Supplies of nuclear fuel and its components**: Promising project/Ongoing project
- **Products and services based on radiation technologies**: Promising project/Ongoing project

### ROSATOM Regional Centers

- **Regional Centers**: With areas of responsibility

### Countries

- **Ukraine**: Kiev (Eastern Europe)
- **Belarus**: Minsk (Central Europe)
- **Georgia**: Tbilisi (Central Asia)
- **Netherlands**: The Hague (Western Europe)
- **UKRAINE**: Kyiv (Eastern Europe)
- **ARGENTINA**: Buenos Aires (South America)
- **BRAZIL**: Brasilia (South America)
- **U.S.A.**: Washington (North America)
- **CANADA**: Ottawa (North America)
- **MEXICO**: Mexico City (North America)
- **PERU**: Lima (South America)
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International business

Due to an increase in the scope of work under contracts signed earlier, overseas revenue increased to USD 6.3 billion (as against USD 5.2 billion in 2014).

Russia and Egypt signed an intergovernmental agreement on construction and operation of a nuclear power plant equipped with four power units with a capacity of 1,200 MW each in Egypt.

Cooperation in the field of nuclear energy between Russia and India continues successfully. The start-up of unit No. 2 of Kudankulam NPP is scheduled for 2016.

An EPC contract for NPP construction in Bangladesh was signed.

A Russian-Indonesian consortium won the tender for the preliminary engineering design of a multi-purpose experimental reactor in Indonesia.

The share of ROSATOM on the NPP service market is growing steadily. Three years ago, ROSATOM started off with five power units with VVER reactors abroad, whereas now the company provides service for 18 out of 37 Russian-design units currently in operation. In 2013, a contract for the extension of service life of unit No. 2 of Armenian NPP was signed.

NPP construction cost management remains an important prerequisite for competitiveness. In 2015, the introduction of a special incentive system for design engineers enabled us to reduce the cost of construction of Hanhikivi NPP in Finland by 11% without detriment to design solutions.
ROSATOM KEY FACTS

The design includes the most powerful type of VVER reactor with a capacity of 1,200 MW, as well as a high-speed turbine specially designed for new-generation NPPs.

The main feature of the project is a combination of traditional active safety systems and additional passive systems whose operation is based on natural processes, which greatly reduces the impact of human error on safety.

Examples of innovative solutions in the field of safety applied in the project:
• an enhanced safety containment system: a double containment shell of the reactor hall and a core catcher located under the reactor vessel. It helps prevent radioactive releases into the environment and provides physical protection against natural disasters, industrial accidents and other emergencies;
• two completely separate safety trains with internal redundancy of active elements;
• a passive residual heat removal system enabling sustained heat removal from the reactor core in the absence of any power sources.

In addition, the NPP’s capacity factor has been increased to no less than 90%; the service life of main equipment of the reactor unit has been extended to 60 years, while the design life of the structures has been extended to 100 years. These technological solutions are designed to improve the efficiency and reliability of generation III+ NPP designs.

Currently, power units with VVER-1200 reactors at various stages of implementation can be found at Leningrad NPP-2 and Novovoronezh NPP-2 in Russia, as well as at NPPs in Belarus, Turkey, Egypt, Finland, Hungary and Bangladesh.
The key achievement of the year consisted in successful completion of the federal target programme on nuclear and radiation safety for the period from 2008 through 2015 (FTP NRS) and approval of a new programme for the period from 2016 through 2030 by the Government of the Russian Federation. The final level of performance against the targets set in FTP NRS amounted to 109.7%, despite a reduction in public funding.

A high level of performance against the targets set in FTP NRS was achieved through overall efficiency:

- the unit cost of remediation of contaminated areas was reduced fourfold during the implementation of the programme;
- the unit cost of removal of one spent fuel assembly was reduced by a factor of 3.2;
- the cost of decommissioning of facilities posing nuclear and radiation hazards was reduced by a factor of 2.5.

A storage facility for liquid radioactive process waste on Lake Karachay in the Chelyabinsk Region was completely buried and eliminated. Thus, we solved one of the most important environmental problems in the region.

For the first time in history, an EI-2 industrial uranium graphite reactor was decommissioned in Seversk: additional engineering barriers made of specially designed material were built, and a site for long-term storage of special RAW was developed.

Like in recent years, in 2015 no events rated at level 2 or higher on the international INES scale were detected at nuclear facilities of ROSATOM (level 1 and 0 deviations do not pose a risk to employees operating the facilities, local residents or the environment).
BN-800 is the world’s most powerful fast neutron reactor running on MOX fuel (a mixture of oxides of plutonium and uranium). In 2015, ROSATOM started industrial production of MOX fuel for power unit No. 4 of Beloyarsk NPP.

BN-800 and other fast neutron reactors are a new technological platform for transition to a closed nuclear fuel cycle in the nuclear power industry. A closed nuclear fuel cycle will significantly improve the efficiency of fuel usage and will help to solve the problem of nuclear waste and secure a reliable long-term source of clean energy.

Power start-up of BN-800 helped strengthen the leading position of Russia and ROSATOM in the field of closed fuel cycle technologies and makes it possible to examine the economic efficiency of fast neutron reactors and to start their large-scale commercial construction in the future.

Other important achievements in 2015 aimed at closing the nuclear fuel cycle:
• Experimental REMIX fuel was developed, and its production was started. This unique fuel will help reduce the consumption of natural uranium in nuclear power generation, since it reuses not only plutonium contained in spent fuel but also residual amounts of uranium-235;
• Researchers from ROSATOM and the Russian Academy of Sciences created the technology for americium recovery from spent nuclear fuel, which is planned to be burnt in fast neutron reactors, thus helping solve the problem of radioactive waste.

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Power unit No. 4 of Beloyarsk NPP has been connected to the unified power system of Russia

On December 10, 2015, power unit No. 4 of Beloyarsk NPP equipped with a BN-800 reactor was connected to the grid and started electricity generation for the power system of the Urals region and Russia.
In 2015, the enterprises of ROSATOM produced 7,849 tonnes of uranium:

- Russian enterprises of the Mining Division produced 3,055 tonnes of natural uranium;
- uranium production at overseas deposits in Kazakhstan and the USA totalled 4,794 tonnes.

The key uranium mining company of the Mining Division, JSC PIMCU, managed to reduce the cost of uranium production by 12%.

A promising domestic uranium mining company, JSC Khiagda, launched a sulphuric acid production plant with a capacity of 110 thousand tonnes per year. It will fully meet the demand of JSC Khiagda for sulphuric acid, which is required for uranium extraction.

ROSATOM accounts for 17% of the global nuclear fuel market, as it supplies fuel to 78 power units at NPPs in 15 countries worldwide and to research reactors in 9 countries. In 2015, all contractual obligations towards Russian and foreign customers were met.

A new generation fuel, TVSA-12, was delivered to Kozloduy NPP in Bulgaria; starting from 2016, the use of this fuel will help improve the economic efficiency of the plant.

The world's largest uranium enrichment enterprise, JSC UEIP, put two new ninth-generation gas centrifuge units into operation. Tenth-generation centrifuges are currently being tested. These achievements will significantly improve the efficiency of the uranium enrichment process.
In 2015, the Atommash industrial complex in Volgodonsk was revived and integrated into the production and process chain of ROSATOM.

Today, Atommash is the only Russian plant producing complete sets of equipment for the nuclear island of NPPs: it can produce up to 4 sets of equipment per year. The aggregate capacities of the Mechanical Engineering Division enable manufacturing of up to 7 sets of reactor equipment a year at the enterprises of ROSATOM and related enterprises.

In 2015, the first reactor and certain items of key equipment for the Belarusian NPP were delivered. This is the first reactor vessel produced by Atommash after a nearly 30-year break and the first one produced by an enterprise forming part of ROSATOM.

Deliveries of steam generators to the construction site of power unit No. 4 of Tianwan NPP in China were completed, and a contract for the delivery of a complete set of equipment for the reactor building of power units No. 3 and 4 of Kudankulam NPP in India was signed.

Two reactor vessels of the RITM-200 power unit were assembled for the world’s largest new-generation Russian nuclear icebreaker, Arktika, which is now under construction.

In 2015, performance of the Mechanical Engineering Division continued to improve. JSC NPO TENITMASh developed and implemented a new technology for sectional forging and stamping of bottoms of steam generators. This will make it possible to reduce metal consumption by up to 40% and to reduce labour input and power costs.

In May and June 2015, the parent organization of the division, JSC Atomenergomash, conducted a unique logistical operation to deliver oversized steam generators from the production site in Podolsk to the construction site of Leningrad NPP-2 in Sosnovy Bor. A new method of delivery involving transportation by water enabled significant financial savings and helped reduce the delivery time (which totalled about three months).
Record power generation by Russian NPPs

Power generation at NPPs exceeded the target set by the Federal Tariff Service of Russia (189.15 billion kWh) by over 6 billion kWh and made a significant contribution to the annual revenue of ROSATOM.

The record power generation in 2015 was made possible by an improvement in operating efficiency of power units at NPPs:

• a shorter duration of repairs enabled additional generation totalling 2 billion kWh;
• an increase in the capacity of units currently in operation accounted for 2.5 billion kWh;
• power unit No. 3 of Rostov NPP was launched ahead of schedule and generated 1.3 billion kWh.

In 2015, ROSATOM actively continued serial construction of new NPPs in Russia: at the end of the year, 8 power units were being constructed simultaneously. In the future this will make it possible to meet the energy needs of the country’s economy and population without making any negative impact on the environment.

A high-priority task for the Power Engineering Division of ROSATOM, which operates NPPs, is to enter new markets, including ‘non-nuclear’ markets. In 2015, JSC Rosenergoatom Concern reached an agreement with PJSC Roskom on construction of Russia’s largest data centre which will host important state information systems. The centre will be located in the vicinity of Kalinin NPP, which will provide it with an independent and cheap source of uninterrupted power supply.

By the end of 2015, the total share of Russian NPPs in the country’s energy mix increased to 18.6% (compared to 17.2% in 2014).

In 2015, 351 power units of 10 operating NPPs generated a record amount of electricity in the entire history of Russian nuclear power generation: 195.2 billion kWh. This electricity output is comparable to electricity consumption in Moscow and the Moscow Region for two years.

1 Including power unit No. 4 of Beloyarsk NPP, which is currently being tested.
In 2015, the Company started the construction of the world’s most powerful multi-purpose fast neutron research reactor (MBIR) in Dimitrovgrad which will be used for running projects required for the development of the global nuclear power industry in the future.

MBIR

ROSATOM is the global leader in the operation of research reactors. There are 52 reactors of this type in Russia; they make up about 20% of the global reactor fleet. Overall, over 130 research reactors have been built based on Russian technologies, with over 20 of them built abroad; many of these reactors are still successfully operating.

TANDETRON, which is unique in Russia and is the world’s best-in-class particle accelerator, has been launched. It will be used for radiation doping (ion beam irradiation) of silicon wafers used in micro- and nanoelectronics for the manufacture of diodes and transistors. TANDETRON will also enable the development of medical technologies for neutron capture therapy of cancer which is resistant to gamma irradiation, as well as production of short-lived isotopes for positron emission tomography.

The company also started to produce source materials for second-generation HTSC (high temperature superconductor) devices, namely HTSC tapes. The first kilometre of the tape was produced in 2015. HTSC tapes will make it possible to create electrical devices that are much more efficient (without any power losses in the course of operation) and compact.

In 2015, a superconducting cable for toroidal field coils was delivered as part of the ITER international project aimed at harnessing thermonuclear fusion power. They will help to keep hot plasma in the ITER reactor.
In 2015, ROSATOM actively developed new business areas and made efforts to enter new markets, including non-nuclear markets.

The ALABUGA-VOLOKNO plant designed to produce carbon fibre was opened in the Alabuga special economic zone in the Republic of Tatarstan (the plant was built by order of ROSATOM). Carbon fibre is a composite material used in high-tech industries. The plant's annual capacity totals 1.7 thousand tonnes per year with a potential for a ramp-up to 2 thousand tonnes per year. It fully meets the needs of the Russian market, which used to be covered largely by import; in the future, this project will enable Russia to hold at least 2% of the global carbon fibre market.

First surgical operations for treatment of cancer were performed using domestically produced microsources manufactured by ROSATOM which use the iodine-125 isotope. A high-tech product was produced in Russia whose quality is comparable with its foreign analogues and which is 2.5 to 4 times cheaper. This development has a significant export potential.

Under the agreement with OJSC Rosneft Oil Company, the first sets of equipment for geological exploration, automated management systems, monitoring systems, pumping equipment and security systems were delivered.

The first test sample of Russian beryllium was obtained using laboratory equipment of Tomsk Polytechnic University. Future plans include creation of a pilot plant at JSC SCC (an organization forming part of ROSATOM). The production capacity of the plant to be created will depend on the needs of the market.

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In 2015, nuclear icebreakers conducted 195 vessels with a total gross tonnage of 2.04 million tonnes along the Northern Sea Route.

A two-year contract for conducting tankers transporting crude oil from the Novoportovsk field has been signed with PJSC Gazprom Neft.

Contracts have been concluded with Russian shipbuilders for the construction of five port vessels for the port of Sabetta as part of the Yamal LNG strategic gas production project. This will help diversify the operations of the nuclear icebreaker fleet and create new jobs.

In addition, as part of the Yamal LNG project, a contract for conducting liquefied natural gas tankers has been signed; the contract is valid until 2040.

The world’s only nuclear LASH carrier, Sevmorput, has been restored; its service life has been extended by 15 years at the least.

Construction of a new-generation flagship icebreaker, Arktika, is nearing completion; its launch is scheduled for the first half of 2016. Simultaneously, a new Russian nuclear super-icebreaker, Lider, is being designed; it will enable year-round operation in the High Arctic.

Russia owns the world’s only nuclear icebreaker fleet and has a long track record in construction and operation of nuclear icebreakers. Icebreakers equipped with a nuclear power unit enable the use of the Northern Sea Route and help Russia maintain a presence in the Arctic Region.
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