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The Russian Corporation of Nanotechnologies was established in 2007 to realize government strategies in nanotechnology and infrastructure for innovation. RUSNANO supports commercialization of scientific and technological developments in the nanoindustry and coordinates innovative work to promote advances in the field. In addition to investing financial resources to establish high-technology production, RUSNANO works to create a legislative framework and infrastructure in technology and finance to take Russia’s nanotechnology industry into the future. Once each year, in Moscow, it conducts the International Nanotechnology Forum.

The success of the corporation’s efforts is to be measured in two objectives for 2015: the value of nanoproduets produced by project companies in which RUSNANO co-invests will reach or exceed 300 billion rubles; the aggregate worth of the entire Russian nanoindustry’s output will reach 900 billion rubles.

RUSNANO is the first of the Russian Federation government corporations to be reorganized as an open joint-stock company. That change will make us more comprehensible and more attractive to business, primarily to potential co-investors in our projects.
1. Making Investments

The investment activity of the corporation centers on selecting nanotechnology projects that hold high potential for commercialization and coinvesting to transform them into full-scale businesses. RUSNANO’s priority is to invest in projects that produce nano-enabled products. To obtain financing, a project must be technically realizable and economically effective. Each application goes through a multistage procedure of expert review. RUSNANO participates as a minority partner in cofinancing the projects it approves.

RUSNANO finances projects whose annual income in five years is forecasted at 250 million rubles or greater. The form of RUSNANO’s investment varies by project. It may involve one or more of following: investment in owner’s equity of the project company, lending, credit guarantees, and leasing operations.

The corporation invests resources in a broad range of projects—from solar energy and energy conservation to mechanical engineering and metalwork. All projects must relate to nanotechnology. Production must take place in Russia.

RUSNANO finances projects whose annual income in five years is forecasted at 250 million rubles or greater.
Many of the projects that RUSNANO has approved will produce goods at the forefront of global technology—with considerable potential for export and import replacement. The nanotechnology in the new materials Virial metal ceramics project, for example, uses silicon carbide to obtain highly durable ceramic composites that have no analogue elsewhere in the world. Similarly, in a project with Mircrobor, material synthesized from powder of up to 25% boron nitride nanoparticles has twice the microhardness and three to four times the abrasive resistance of the best cutting tools now in use. Optoelectronics and nanoelectronics is another area in which products surpass competitors: The optical modules project produces a new generation of transmitter-receivers using vertical laser beams for optical communications links. These devices excel in maximum modulation frequency, continuous wave, range of working temperature, and breadth of spectral line. In photodetectors, take up speed and range of working temperature and operating wavelength are all superlative.

Thermoelectric cooling of micromodules for optics and microelectronics exceeds global competitors in minimal overall dimensions, power density, and mean time between failures. And in medicine, as well, instruments to diagnose abnormal clotting conditions in an individual’s blood system are without parallel.

The first manufacturing plant built with the participation of RUSNANO began operating in Rybinsk, Yaroslavl Oblast, in April 2010. That facility is producing high-quality hard-alloy metal cutting instruments with nanostructured coatings. Two other plants will be commissioned before yearend: the main production line for polycrystalline silicon in the Irkutsk Oblast town of Usolie-Sibirskoe and the full production cycle for manufacturing LEDs in St. Petersburg.

In 30 regions of the Russian Federation today, new plants are being built and existing facilities modernized to manufacture a wide variety of nanotechnology products.

In 30 regions of the Russian Federation today, new plants are being built and existing facilities modernized to manufacture a wide variety of nano-enabled products.
2. Building Infrastructure

A network of nanotechnology centers

One of the most important areas in which RUSNANO has taken initiative is to help form the scientific, technological, and financial infrastructure for Russia’s nascent nanoindustry. This infrastructure will be the crucible for generating new projects and developing innovative businesses.

The corporation invests in creating nanotechnology centers to aid and promote commercialization. Each center will house a complex of experimental, diagnostic, metrological, scientific, and technological equipment and a team of research scientists, engineers, manufacturing technicians, marketing professionals, and managers specializing in innovation.

To determine whether these centers have satisfied their raison d’être, we shall look to new investment project proposals in nanotechnology, particularly at whether the proposals we receive can make a claim to financing from private investors and RUSNANO.

Nanotechnology centers will conduct design and engineering and empirical processing work on contract with private businesses, provide the material and technical base necessary...
RUSNANO plans to establish as many as 19 nanotechnology centers for which it will allocate about 19 billion rubles. Selection of those projects is being conducted in open tenders.

for applied engineering, protect intellectual property, assist with seed money and incubation for small innovative companies, and organize training and seminars.

The selection of projects to establish nanotechnology centers is being conducted in open tenders with scientific and engineering and investment evaluations by the corporation’s experts. At the end of the first competition, projects were awarded to applicants in Kazan, Dubna, Zelenograd, Tomsk, and Novosibirsk.

Financial infrastructure

RUSNANO is taking part in creating venture investment funds to fill a void in essential infrastructure. These funds will encourage the emergence of innovative companies in Russia, aid in the commercialization of technology, help spur a culture of innovative entrepreneurship, and improve communications among the scientific, educational, and business communities at home and with foreign colleagues.

Because funds will be created for different types of projects—small-budget, sector-specific, and international projects—the form of the funds will vary. For instance, the joint fund with international venture market leader Draper Fisher Jurvetson, the Russian-Kazakh fund, and the international fund are all tailored to the corporation’s entry into global capital markets, gaining access to innovative foreign developments through international partnership, and drawing on foreign professional experience to manage and perfect infrastructure for innovation. By establishing the fund for small-budget projects, we expect to impact the evolvement of nanotechnology in subjects of the Russian Federation and encourage nanotech dispersal across our large country.

The Supervisory Council of the Russian Corporation of Nanotechnologies has approved the corporation’s involvement in seven venture investment funds with total budgets of 47.3 billion rubles. RUSNANO will invest 22.6 billion rubles in these funds.
A marketplace for innovation and investment

In cooperation with RUSNANO, the Moscow Interbank Currency Exchange has created a new exchange sector, the MiCEX Innovation and Investment Market—a transparent mechanism for attracting investments into the high-tech sector of the Russian economy. Investors may step into the market at any point along the investment chain, from financing the innovative company in its early stages to the period of preparation for an initial public offering. This project will serve small and medium-sized high-technology companies that are taking their first steps in capital markets.

Educational programs

When it embarked on educational programming, the corporation set itself the task of building professional potential to meet the needs of the nanindustry. RUSNANO supports programs to prepare staff, particularly employees of project companies that have won cofinancing from the corporation. Specialists at RUSNANO monitor and forecast personnel requirements in the nanindustry and develop professional standards and certifications for educational programs.

Educational programs that the corporation commissions for its project companies are chosen on a competitive basis.

During 2008 and 2009 the corporation released 11 educational programs. During 2010 another 25 will be added. Cumulatively, by 2015 RUSNANO plans to develop and test 120 educational programs prepared at the request of project companies.

120 RUSNANO-supported educational programs are to be developed and tested by 2015.
The Nanotechnology International Forum RUSNANOTECH was created in 2008 as an annual forum for discussion of the most topical issues in the nanoindustry, domestic and worldwide. Attracting scientists, engineers, entrepreneurs, investors, and politicians, the forum has proved its worth in filling a void that previously existed.

President of the Russian Federation Dmitry Medvedev opened the Nanotechnology International Forum held in 2009. More than 10,000 people from 75 regions of Russia and 38 other countries participated in the forum. During its 17 sessions, more than 200 specialists from leading scientific institutions working all over the world made presentations. At the exhibition accompanying the forum, the latest developments in the nanoindustry could be seen and touched and their creators questioned. As part of the forum, more than 50 young researchers, winners in the International Competition of Scientific Papers in Nanotechnology for Young Researchers, received special awards in 17 categories.

The Third Nanotechnology International Forum RUSNANOTECH will feature presentations by sector and product foresights, road maps, products, new technologies, companies, roundtable discussions, master classes, and an exhibition of the latest nanotechnology products, prototypes, and equipment for the nanoindustry. The conference that is part of this year’s forum is titled Institutions for Development, and it will focus on the innovation economy through discussions of foreign and domestic experience, the development of infrastructure to promote innovation in the nanoindustry, and an analysis of the potential for innovation in regions of the Russian Federation.
3. International Cooperation

RUSNANO conducts its energetic international program in fulfillment of several goals: to advance innovative Russian nanoprojects, to attract cofinancing from foreign investors, and to transfer state-of-the-art foreign technology to Russia. The corporation sponsors professional exchanges and staff training for those working in nanotechnology. It draws Russian scientists and other specialists living abroad to projects within the Russian Federation.

The numerous forms that RUSNANO’s work takes in the international arena include organizing and conducting competitions, participating in foreign high-tech forums and conferences, and concluding and executing agreements with the world’s nanoindustry leaders.

IN 2010 RUSNANO made its first appearance as a sponsor of the Global Technology Symposium at Stanford University—Silicon Valley’s most prominent conference in business, finance, technology, and policymaking.

In collaboration with Intel Corporation and with support from SKIF-GRID (the Supercomputer Program of the Union State of Russia and Belarus) and the Supercomputer Consortium of Russian Universities, RUSNANO conducts an annual contest for the best applications of high-performance computing.

At the first Russian-Israeli Business Forum, in March 2010, the countries signed a bilateral agreement for cooperation in industrial
scientific-research and design-experimental work. RUSNANO was named the organization authorized to work on behalf of Russia to realize the collaboration, the resulting commercialization of products, and their distribution in the global market.

More recently RUSNANO and American company MP Biomedicals (Milan Panich) signed an agreement to cooperate in organizing nanotechnology research and development. MP Biomedicals is a leading manufacturer-supplier of life science, fine chemical, and diagnostic products. The agreement is expected to lead to the development and production of innovative medications, including personalized pharmacogenetics.

As of October 1, 2010, RUSNANO had received 186 applications seeking project financing from abroad. They came from 28 foreign countries, the largest number of them coming from the United States (65), Israel (22), and Germany (22).

Strong Russian-Finnish relations in the nanoindustry are reflected in an agreement to create a program for shared investment in rapidly growing nanotech companies. RUSNANO represents Russia in the endeavor and the Finnish government has appointed state investment company Finnish Industry Investment Ltd to work on its behalf. Each party has pledged up to 25 million euros for joint investment. The agreement, which has a term of three years, may be extended.
4. How a request becomes a project financed by RUSNANO

RUSNANO has developed a multistep process of expert review that enables us to select technically realizable and economically substantiated projects from the hundreds of requests we receive each year. The corporation finances projects whose annual earnings after five years will reach 250 million rubles or more. It limits investment in a single project to 10 percent of the book value of its assets. The share in owner’s equity in the project company that RUSNANO is permitted may not exceed 50 percent less one share. The remaining equity belongs to the company’s founder and private investors. As soon as a project can function on its own, RUSNANO sells its share to invest the proceeds in other projects.

**SUBMISSION OF AN INQUIRY FOR PROJECT COFINANCING OFFERS THE APPLICANT THE OPPORTUNITY:**

- to receive expert evaluation of the project he proposes
- to bring to light new application for innovative products
- and, if the application successfully passes consideration, to establish a promising business
STEPS IN EVALUATING A REQUEST
A request to RUSNANO for cofinancing of a project will go through seven steps:

STEP 1. SUBMITTING A REQUEST FOR PROJECT REVIEW
The applicant will need to register on the official site of RUSNANO, www.rusnano.com, after which he will complete several standard documents:

- project application
- applicant’s form
- project specifications
- scientific and technical feasibility analysis of the project, including information on key project members (an appendix to the business plan)

The full business plan, whose development is the most complicated for many applicants, may be prepared and sent later.

Aggregate budgets for the 94 projects approved for cofinancing by RUSNANO to date equal 303.5 billion rubles. The corporation will coinvest 123.3 billion rubles of that sum.

STEP 2. ENTRY REVIEW
During this stage, the application is assessed for its completeness and its connection to other projects in RUSNANO portfolio. The entry review is limited to five working days. When an application is incomplete, the applicant is invited to make corrections or additions.

STAGE 3. SCIENCE AND TECHNOLOGY EXPERT EVALUATION
The science and technology expert evaluation ascertains whether project content is relevant to nanotechnology and assesses the scientific validity and technical feasibility of the proposed project.

Each project is evaluated by three to five Russian and international experts, leading specialists in the project’s field whom the corporation has accredited for this purpose. The experts work independent of RUSNANO, one another, and the applicant. If, at the conclusion of the evaluation, the experts’ opinions diverge, intramural review, to which new experts are invited, begins. Science and technology expert evaluation may last 70 calendar days.

STAGE 4. INVESTMENT EVALUATION
During this stage, detailed analyses are made of the applicant’s business plan, the sales market for proposed products, and the investment attractiveness of the project. Discussions are held with potential coinvestors in preparation for the investment agreement for the project. Investment evaluation may take from two months to four months.
STAGE 5. PROJECT REVIEW BY THE
SCIENCE AND TECHNOLOGY BOARD
The Science and Technology Board, composed of prominent scientists, studies the conclusions that have been drawn through expert evaluations. The board then issues a recommendation on the practicability of cofinancing the project with resources of the corporation or suggests that the application be declined.

STEP 6. PROJECT APPROVAL
After passing the Science and Technology Board, the project passes to the Investment Commission for consideration by the Executive Board. If the proposed coinvestment is less than one percent of the book value of RUSNANO’s assets as of the last reporting period, the board may decide independently whether to finance the project. If the proposed coinvestment exceeds one percent of book value, or if agreement must be obtained for RUSNANO to enter the project company, the project must go to the Supervisory Council of the corporation. Approval may take as many as 50 days.

STEP 7. PROJECT FINANCING
Once a project is approved, RUSNANO moves to execute coinvestment so that the project may be realized. From the moment the corporation receives material for the request, that is, step 1, through project consideration and then expert review and structuring takes, on average, 185 days.

At all stages of project realization, RUSNANO controls expenditure of the financial resources it has contributed to the project through a treasury mechanism that assures fulfillment of the budget and through participation in the management of the project company.
RUSNANO projects

Production Sites for RUSNANO Projects
Solar energy and energy conservation

Aggregate budgets for projects in this area exceed

32.5 billion rubles

71.5 billion rubles

RUSNANO’s financing, equity capital, and loans exceeds
Li-ion batteries using technology from Thunder Sky
Project company Li-ion Technologies

Project participants
- RUSNANO
- Thunder Sky Group
- Sberbank

- Russia’s first large-scale manufacturer of new generation lithium-ion batteries for electric vehicles and power supply systems

Project stages

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>2010</td>
<td>Project initiation June</td>
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<tr>
<td>2011</td>
<td>Production start up Q4</td>
</tr>
<tr>
<td>2012</td>
<td>Design capacity December</td>
</tr>
<tr>
<td>2015</td>
<td>Sales volume 13,114 million rubles annually</td>
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</tbody>
</table>

Total budget 13,580 million rubles
RUSNANO financing 7,590 million rubles

Competitive advantages
- High-capacity batteries
  (600 Ah for electric transport)
- Rapid battery charging (10 minutes, 70%)
- Safe batteries
- Low production costs

Production location
Novosibirsk, Novosibirsk oblast
500-550 new jobs created by 2015

Under a project with Chinese company Thunder Sky, which is also project co-investor, manufacturing facilities will be built in Novosibirsk with four of Thunder Sky’s production lines. Thunder Sky is the only company in the world engaged in mass production of rechargeable batteries for mini- and electrobuses. This will be the first Russian-based enterprise to produce lithium ferro-phosphate batteries used in electric vehicles, primarily buses with electric motors. The batteries have the great advantage of being free of “memory effect” after numerous charge and discharge cycles. When used in public transportation, the batteries guarantee a 350-kilometer energy reserve after one charge. These batteries can be given a quick recharge in only 30 minutes. In the future, new technologies will expand the energy reserve to 600 kilometers after one charge.
Solar electric units using nanotechnology
Project company New Solar Stream

**Project participants**

- RUSNANO
- Coinvestor

- Production of nanoheterostructured photoconverters, highly efficient solar modules, and power plants that incorporate these elements

Concentrator solar power plants in this project employ new-generation cascading solar elements based on nanoheterostructures that photoelectrically convert concentrated light, Fresnel lenses that provide up to 900-fold solar power concentration, and high-precision sun-tracking systems.

In these concentrator photovoltaic modules, direct solar radiation falling on the surface of a Fresnel lens (e.g., 50 mm x 50 mm) is focused on a highly efficient cascade solar cell of less than four square millimeters. Specially designed naturally cooling heat sinks protect the solar modules from overheating.

The cascade solar photo elements that are to be used in tandem with the concentrators will be produced with a chemical vapor deposition method which has been modified to accommodate different semiconductor materials on a germanium substrate. The project will establish full-cycle production: grow nanoheterostructures, produce chips, assemble modules, produce sun-tracking systems, and assemble solar photovoltaic units. Production volume for the units has been targeted at about 75 MW per year.

**Total budget**

5,430 million rubles

**RUSNANO financing**

1,290 million rubles

**Competitive advantages**

- Greater efficiency of multi-cascade photoconverters compared with other solar technologies

**Area of application**

- Solar power generation

**Project stages**

<table>
<thead>
<tr>
<th>Year</th>
<th>Production start up Q4</th>
<th>Production start up Q4</th>
<th>Sales volume 5,500 million rubles annually</th>
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<td>2015</td>
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**Production locations**

St.Petersburg, Stavropol

SOLAR INSTALLATIONS USING NANOTECHNOLOGY

PHOTOELECTRICAL MODULES
Section (2 lenses) of concentrator module comprising 144 Fresnel mini-lenses and cascade photoconverters

NANOHETEROSTRUCTURAL SEMICONDUCTOR
Structure of cascade photoconverter optimized for use with 1000x solar radiation concentrations; efficiency factor of 33% to 45%

- n-InGaP – top element 1.86 eV
- n-InGaP quantum well
- n-InGaP quantum well
- p-GaAs bottom element 1.46 eV
- Tunnel junction (20 nm)
- GaAs – middle element 1.46 eV
- Tunnel junction (20 nm)
- Buffer layers
- n-InGaP – top element 1.86 eV
Solid-state light engineering for environmentally sound energy-saving lights based on nanotechnology

Project company Optogan

**Project participants**
- RUSNANO
- Onexim Group and Optogan founders
- RIK

**Development and production of ultrabright nanoheterostructured LEDs**
- Production of lighting devices based in such LEDs

**Competitive advantages**
- Proprietary patented technology for the production of LEDs with efficiency exceeding 110 lm/W (170 lm/W in three years)
- Vertically integrated production
- Competitive prices

**Areas of application**
- Industrial and home lighting
- Backlighting in mobile devices, laptops, and TVs
- Car lighting

**Production location**
St. Petersburg
1,350 new jobs to be created by 2015

The project will establish high-technology industrial production of lighting systems based on gallium nitride semiconductor chips. Light-emitting diodes, LEDs, are semiconducting units that emit light when electric current passes through them. They have neither glass bulbs nor filaments, making them mechanically stable and reliable; with neither heat emission nor high voltage, the lights are electrically and fire safe. Their super-small size and built-in light distribution promote flat, compact, easy-to-install lighting devices.

The company will produce LED chips and lamps as well as lighting systems comparable in brightness to the best LEDs in the world. By using technology with record-low defects in semiconductor layers, these devices work with high-density current without losing effectiveness, yielding a high ratio of brightness to price for LED chips.

The unique chip production technology was developed by the founders of the German-Finnish company OptoGaN, Maxim Odinbolyudov and Vladislav Bougrov—once students of Nobel prize winner and Russian Academy of Sciences member Zhores Alferov. By creating this new business, these scientists bring to Russia one of the most promising developments made by Russian scientists in recent years.

Lighting based on semiconductor nanoheterostructures has already begun to replace incandescent, fluorescent, and other traditional light sources. Using LEDs will reduce significantly electric power consumption and costs for electric energy and exploitation of lighting systems.
Polysilicon and monosilane production
Project company Usolie-Sibirsky Silicon

Project participants

- RUSNANO
- NITOL Group
- Sberbank
- Alfa-Bank
- Russian Agricultural Bank
- Eurasian Development Bank
- Bank Saint Petersburg

- Russia’s first large-scale manufacturing of polysilicon and monosilane—5,000 tons and 200 tons, respectively

Total budget
19,723 million rubles

RUSNANO financing
4,500 million rubles

Competitive advantages

- Project implementation at integrated industrial complexes in proximity to rock salt deposits
- Previous experience of the NITOL Group in successfully implementing integrated projects in the chemical industry
- Proprietary production of trichlorosilane—the main raw material for polysilicon production

Production location
Usolie-Sibirskoye, Irkutsk Oblast
1,000 new jobs will be created by 2015

NITOL companies Usolie-Sibirsky Silicon and Usoliekhimprom in Usolie-Sibirskoye, Irkutsk Oblast, are setting up high-tech complexes where they will manufacture polycrystalline silicon and monosilane.

Polycrystalline silicon (polysilicon) is the basic semiconductor material used in modern microelectronics, electric power, solar energy, and micromechanics. Nearly 90 percent of production of the world’s solar cells is based on polysilicon. Four countries provide most of the polysilicon production: the United States, Japan, Germany, and Italy.

Monosilane is used widely in microelectronics and, increasingly, in photovoltaics for thin film solar modules.

The new plants in Irkutsk Oblast will produce raw materials for further development of Russian microelectronics. They are a meaningful step toward forming a new industry in Russia—solar energy engineering.
Solar modules using thin film technology from Oerlikon
Project company Hevel

Project participants
• RUSNANO
• Renova
• Solar modules based on thin film technology from Oerlikon Solar

Products
• Building-integrated and building-applied photovoltaics
• Solar photovoltaic power stations

This project for large-scale production of solar modules will have capacity of one million solar units per year, annual output of 130 MW. In its full-cycle solar module manufacturing, the project company will employ state-of-the-art thin film technology, micromorph silicon thin film photovoltaic cells developed by Swiss company Oerlikon Solar, world leader in the solar energy market.

The project will stimulate production of allied goods, particularly domestic production of ultrapure industrial gases and special glass. The main markets for the solar modules are Italy, Spain, Greece, and Germany. In the long term, the company expects to sell at least 15 percent of the solar modules in the Russian market.

Total budget
20,128 million rubles
RUSNANO financing
13,525 million rubles

Competitive advantages
• Low production costs
• Proprietary science and technology center
• Environmentally safe production and exploitation

Production locations
Novocheboksarsk, Chuvash Republic
300 new jobs to be created by 2015

Project stages

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<thead>
<tr>
<th>Year</th>
<th>Project initiation Q4</th>
<th>Production startup December</th>
<th>Design capacity</th>
<th>Sales volume 9,000 million rubles annually</th>
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Nanostructured materials

Aggregate budgets for projects in this area exceed

RUSNANO’s financing, equity capital, and loans exceeds
Flame retardant (fireproofing additive) of nanostructured magnesium hydroxide with modified surface
Project company NikoMag

Project participants
- RUSNANO
- NIKOCHEM Group
- Production of nanostructured magnesium hydroxide (fire-retardant additive)

Areas of application
- Nuclear energy
- Defense and rocket equipment
- Residential buildings
- Transportation

Total budget
3,083 million rubles
RUSNANO financing
1,280 million rubles

Competitive advantages
- Lower combustibility of polymer materials
- Considerable reduction in loss from fires
- Advanced production method
- Less danger for people and pets when fires occur

Production location
Volgograd, Volgograd Oblast
150 new jobs to be created by 2015

This project will establish Russian production of a halogen-free flame retardant (fireproofing additive), a nanostructured magnesium hydroxide with modified surface, and value-added products bromide and magnesium chloride.

It is imperative to reduce the flammability of products and lower smoke and poisonous gases released by burning polymers used in construction, electronics, and many other industries. Flame retardants will decrease mortality rates, as most deaths during fires are caused by poisoning from toxic combustion.

Russia does not produce flame retardants. The entire amount of aluminum trihydrate and magnesium hydroxide consumed each year—5,000 tons to 6,000 tons—is imported.

Project implementation will provide Russian producers of polymer compounds with high-quality raw material, nanostructured magnesium hydroxide. A portion of the goods produced within the project will be sold as exports.
High-barrier polymer film for flexible packaging
Project company DANAFLEX-NANO

Project participants
• RUSNANO
• Danaflex
• High-barrier polymer films and flexible packaging materials

Areas of application
Packaging:
• Food products
• Household cleaning products
• Cosmetics
• Food for animals

Project stages
2009 2010 2013 2015

Production location
Kazan, Republic of Tatarstan
500 new jobs to be created by 2015

High-barrier polymer films and flexible packaging materials

Total budget
2,450 million rubles

RUSNANO financing
1,200 million rubles

Competitive advantages
• Reduces preservatives in foodstuff
• Extends product shelf life
• Lowers cost and weight of packaging
• Reduces production cycle to 1/7th of traditional methods
• Environmentally sound materials replace damaging ones

Flexible packaging is lightweight, safer for the consumer, uses less energy to produce, and requires less space during transportation and warehousing in comparison with traditional packaging materials like metal and glass. Barrier properties of the film prevent penetration of moisture, oil, fat, petroleum products, most household chemicals, gases, microbes, and UV radiation, maintaining the product’s quality. Flexible packaging is usually produced from polymer film, aluminum foil, and paper, which are used separately or combined. The main products in this segment are thin-layer polymers (monofilms) or compounds for multi-layer structures containing plastics, cellulose (paper or cardboard), or thin layers of aluminum. The new project company will manufacture high-barrier polymer film and flexible packaging materials based on the film. This material is designed mainly for packaging of food, household chemicals, cosmetics, and pet food. High-barrier flexible film is heat resistant, making it possible to process contents in hot or cold temperature regimes and to heat products in microwave ovens without unwrapping them. Because of its barrier characteristics, preservatives can be significantly reduced and shelf life extended for products packed with this film. Flexible high-barrier film is being introduced in many industries worldwide, but Russia has not had domestic production to date.
New composite materials—prepregs
Project company Prepreg-SKM

Project participants
• RUSNANO
• Unikhimtek-Composite
• Holding Company Composite

• High-quality carbon and mineral fiber prepregs based on nanomodified and nanofilled polyimide and epoxy resins

Project stages

Total budget
3,460 million rubles

RUSNANO financing
3,252 million rubles

Competitive advantages
• Lighter weight of final products with better mechanical properties
• Only product of its kind in the Russian market

A prepreg is a semi-finished composite material produced by saturating a reinforced fibrous base with a uniformly distributed binder. Impregnation is carried out in such a way as to maintain maximally the physical and mechanical properties of the reinforcing material. Prepreg technology makes it possible to obtain monolithic articles of complex forms with minimal tooling.

In the civil aircraft industry, these materials are used to manufacture airplane and helicopter bodies, wings, fairings, propellers, and rotors. Composite materials reduce aircraft weight and, as a result, fuel consumption; they increase the strength and service life of the carriers.

Use of prepregs in production of blades for wind turbines is a promising market for expansion. In addition, prepregs can be used in shipbuilding and automobile industries, for making ship hulls and non-structural auto body parts. In construction, prepregs could be used to reinforce concrete structures. They are adaptable for the manufacture of prostheses and medical devices as well as sports equipment.

The project’s realization will lead to competitive domestic industrial production of nanofilled and nanomodified prepregs from carbon fibers for polymer composite materials and finished goods. This will improve the competitiveness of Russian composite materials and increase significantly their use in Russia’s industrial sector.

Production locations
Moscow; Klimovsk, Moscow Oblast
300 news jobs to be created by 2015

PREPREgS ARE SEMI-FINISHED COMPOSITE MATERIALS
Prepregs are produced by impregnating a reinforced fibrous base with a premeasured and uniformly distributed binder. The surface of the reinforcing material (carbon or glass-fiber) is nanomodified by electrochemical or plasma etching or nanoparticle coating. Polymer epoxy binders are nanomodified with polyimide oligomers.

1D - unidirectional reinforcing material
2D - bidirectional fibres of different weaving. Reinforcing material is positioned in two directions at a specific angle.
Multi-axial fiber is a fiber in which reinforcing material has no layer weaving and is positioned in more than two directions, for example, at 0, +45, 90, and -45 degree angles.
At the base of this new technology for obtaining polymer nanocomposites lie developments by Russian scientists working at some of the country’s leading institutes: A.V. Topchiev Institute of Petrochemical Synthesis of the Russian Academy of Sciences, Institute of High-Molecular Compounds of the Russian Academy of Science, and Karpov Institute of Physical Chemistry.

Approximately 80 percent of the products will be polymer nanocomposites of a moldable polymer base (matrix) and filler—nanosized particles (10 nm to 200 nm) of organomodified montmorillonite. When compared with conventional composites, these nanocomposites have better properties, e.g., tear and heat resistance, fire protection, gas- and watertightness.

Polymer nanocomposites are already used in industry to manufacture special coatings, packaging films with barrier properties, automotive parts and electronic devices, and in aircraft construction and the cable industry.

In the future, their application is virtually unlimited.

These nanocomposites have no analogue. They have been designed to replace expensive imported materials such as EVOH in packaging materials, adhesives, soft cable compounds containing magnesium hydroxide and aluminum hydroxide, and many other less efficient products.

### Project participants
- RUSNANO
- Licz AMT Ltd

### Total budget
**2,060 million rubles**

**RUSNANO financing**
**1,101 million rubles**

### Competitive advantages
- Products with superior qualities and lower price
- Manufacturing process suitable to developing new products to meet individual customer requirements

### Areas of application
- Packaging
- Food industry
- Pharmacological and pharmaceutical industries
- Automotive and aircraft industries
- Paints and coatings production
- Cable industry
- Construction and building materials industry

### Project stages

<table>
<thead>
<tr>
<th>Year</th>
<th>Project Start</th>
<th>Production Start</th>
<th>Design Capacity</th>
<th>Production Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
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<td>2012</td>
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<td>2013</td>
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<td></td>
</tr>
<tr>
<td>2015</td>
<td></td>
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</tr>
</tbody>
</table>

### Export share
10%

### Project location
Karachev, Bryansky Oblast
Road paving modifier Unirem
Project company Unicom

Project participants
• RUSNANO
• Novy Kauchuk LLC
• Unirem composite material derived from rubber powder and used in road construction as a modifier for asphalt and bitumen mixtures

Social impact by 2015
Utilization of used tires

This project centers on technology for manufacturing paving asphalt modifiers with micro- and nanomosaic structures based on active rubber powder. The Unirem modifier is produced by grinding used tires at high temperatures and under high pressure. After the addition of the modifier, road surfaces become highly durable, extending the time between road repairs by 25 percent to 30 percent. In 2005 through 2009, when road sections with Unirem-based asphalt were monitored, the surfaces showed higher resistance to shearing, cracks, ruts, and water as well as excellent resistance to cyclic deformations at very high and very low temperatures.

In accordance with plans for development of Russian’s transportation system, up to 4.3 trillion rubles will be allocated for road construction and reconstruction in 2010 through 2015. The potential domestic market for road surface modifiers, considering the total volume of road construction, reconstruction, and repair in Russia, is estimated at more than 10 billion rubles in 2015.

Total budget
1,850 million rubles

RUSNANO financing
1,290 million rubles

Competitive advantages
• Greater durability and service life
• Fewer ruts and reflective cracking
• Higher resistance to moisture and freezing
• Low repair and maintenance costs

Areas of application
• Construction of roads, highways, and airports

Project stages
<table>
<thead>
<tr>
<th>Project initiation</th>
<th>Production start up</th>
<th>Design capacity</th>
<th>Sales volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>2010</td>
<td>2014</td>
<td>2015</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5,300 million rubles annually</td>
</tr>
</tbody>
</table>

Production locations
Podolsk, Serpukhov, Moscow Oblast

ACTIVE RUBBER POWDER FOR UNIREM COMPOSITE MATERIAL
High-temperature shear grinding technology

PARTICLE OF DISCRETE DEVULCANIZED RUBBER WITH NANO- AND MICROBLOCK STRUCTURE
Nanostructures membranes and separating modules based on them
Project company RM Nanotech

Project participants
• RUSNANO
• Vladipor-M

• Nanostructured membranes and separating modules for water purification in social spheres and industry

Total budget
1,927 million rubles

RUSNANO financing
810 million rubles

Competitive advantages
• Competitive prices
• High-quality products

Customers
• Engineering companies producing systems for water purification for end users
• Companies engaged in the chemical, pharmaceutical, and food industries

Production locations
Vladimir, Vladimir Oblast
160 new jobs to be created by 2015

The project will offer two products: membrane plating and membranous roll-fed modules that are used in filtration and reverse osmosis. They have pore sizes ranging from one nanometer to 100 nanometers. Membrane technology is widely used in all areas of industry that require water and waste treatment. Membrane technology used in electro energy, microelectronics, pharmaceu-ticals, and the food industry reduces costs in obtaining water that is ultraclean, salt-free, and free of dangerous microbes. Sewage treatment and concentrated solutions in the chemical and milk industries are obtained at lower cost with membrane technology. This project will replace imported goods with domestic products that have better consumer qualities. High-quality and low prices will make the membrane technology competitive globally.
Nanocomposite flexible polymer packaging material
Project company Uralplastic-N

Project participants
• RUSNANO
• Uralplastic

• Production of flexible polymer packaging using the company’s own modified nanocomposites

Project stages

<table>
<thead>
<tr>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project initiation</td>
<td>Production start up</td>
<td>Design capacity Q3</td>
<td>Sales volume 6,000 million rubles annually</td>
</tr>
</tbody>
</table>

Total budget
2,301 million rubles

RUSNANO financing
826 million rubles

Competitive advantages
• Exceptional tensile strength
• Better barrier characteristics (permeability and resistance to steam, solvents, aromas, and gases)
• Better thermal characteristics (withstands heat and freezing, resistant to sterilization and burning)
• Antiblocking properties

Areas of application
Packaging:
• Foodstuffs
• Household products
• Industrial chemicals

Production locations
Aramil, Sverdlovsk Oblast
450 new jobs to be created by 2015

URALPLASTIC: FLEXIBLE POLYMER PACKAGING MODIFIED WITH NANOCOMPOSITES

A section of polymer packaging produced with a mechanochemistry method. Gas-permeation of material is reduced by inhibiting migration through the low-porosity, nanodispersed structure of the polymer and nanoparticles.

Russia’s first full-cycle production of medium-barrier flexible packaging for consumer products is based on technology for modifying polymer materials with nanocomposites. The materials combine properties from each of their heterogeneous constituents—polymers and ceramics: the flexibility, elasticity, and processability of polymers and the hardness and heat and wear resistance of ceramics.

The film that the project manufactures will be used in packaging synthetic detergents, meat products, dairy, pasta, and other consumables. The new technology will lower manufacturing costs, replacing more expensive traditional PA, EVOH, and PvdC barrier materials.
Medicine and biotechnology

Aggregate budgets for projects in this area exceed 30.9 billion rubles and 13.4 billion rubles.

RUSNANO’s financing, equity capital, and loans exceeds...
Development and commercialization of domestic pharmaceuticals at the CHEMRAR high-tech center

Project company: iPharma

Project participants
- RUSNANO
- CHEMRAR high-tech center
- Coinvestor

Products
Pharmaceuticals for treatment of AIDS, hepatitis C, diseases of the central nervous system, pancreatic cancer, other diseases

Project stages
2010 2013 2018

Total budget
5,127 million rubles

RUSNANO financing
1,200 million rubles

Competitive advantages
- Sophisticated medical research base
- Existing drug candidates and other potential pharmaceuticals in process
- Collaboration with more than 100 scientific organizations, laboratories, and universities worldwide

Social impact by 2015
Innovative, domestically produced drugs to cure communicable and other diseases

Production location
Khimki, Moscow Oblast

Development of innovative pharmaceuticals is based on the understanding of their biological targets. By blocking or activating target molecules, the drugs produce their therapeutic effects.

For example, the anti-HIV drug candidate blocks an enzyme that is crucial to the life cycle of the virus, effectively stopping the progression of AIDS. In contrast to first generation anti-HIV pharmaceuticals, the new medication does not induce drug tolerance.

The anti-hepatitis C drug candidate attacks a new biological target, one that could not be reached with earlier pharmaceuticals. While it prevents the virus from entering uninfected cells, the medication is most effective in combination with drugs that fight other stages of the disease’s progression.
Cascade plasmapheresis equipment using track membranes
Project company Trackpore Technology

Project participants
• RUSNANO
• Company founders

- Trackpore membrane with pore diameters of 20 nm to 100 nm
- Multifunctional apparatuses for membrane plasmapheresis, cascade plasmafiltration, and other afferent therapies

Total budget
2,690 million rubles

RUSNANO financing
1,290 million rubles

Competitive advantages
• Unique cyclotron production technology for track membranes
• Simplicity of use
• Mobility
• Accessibility to the general public

Areas of application
• Medicine

Production location
Dubna, Moscow Oblast

NANOTECHNOLOGICAL ASPECTS OF THE PROJECT
Production of filtration elements based on track-etched membranes with nanoscale (20-nm to 100-nm diameter) pores

Cascade filtration is a high-tech procedure for selectively removing viruses and harmful proteins from the blood while retaining the blood’s beneficial components.

The new filters are distinguished by track membranes of polyethylene terephthalate with nanosized (20 nm to 100 nm) pores. Nanosizes are obtained by bombarding the polymer with ions of inert gases with high atomic mass accelerated to high energies using a cyclotron. Traces left by the ions in the material (tracks) are selectively treated with ultraviolet radiation and chemical etching to create pores with the required geometric characteristics. The new procedure will be used to treat atherosclerosis, coronary heart disease, angina pectoris, heart failure, acute poisoning, and other diseases. The project is at the interface of a number of high-tech fields: medicine, nuclear physics, and instrument making. In addition to its use in medicine, nanofiltration of liquid and gaseous media is finding increasing application in other industries. This will open the way for Russian company Trakpore Technology to develop a range of track membrane filtration technologies that will be in high demand.
Microsources, microspheres, and components for brachytherapy

Project company Bebig

Project participants
• RUSNANO
• Santis
• IBt Bebig

• Preparation and packaging of microsources for brachytherapy using isotope $^{125}$I
• Development and manufacturing of a new class of microsources using nanotechnology: nanostructured microspheres of amorphous material with isotope $^{90}$Y for treating liver and pancreatic cancer

Market share
2010 – 10%
2011 – 40%
2012 – 70%
2013–2015 – 80%

Project stages

<table>
<thead>
<tr>
<th>Project stages</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project initiation (October)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production start up (microsources)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Design capacity (microspheres)</td>
<td></td>
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<td></td>
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<tr>
<td>Production start up (microspheres)</td>
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<td></td>
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<tr>
<td>Design capacity (microspheres)</td>
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</tr>
<tr>
<td>Production location</td>
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</tr>
<tr>
<td>Glass and polymer microspheres (40 micron) containing $^{90}$Y isotope</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Silicon microspheres (40 micron) containing $^{32}$P isotope</td>
<td></td>
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</tbody>
</table>

Total budget
928 million rubles

RUSNANO financing
735.6 million rubles

Competitive advantages
• Products without Russian analogue
• Competitive price

Areas of application
• Medicine

Production location
Dubna, Moscow Oblast

MICROSOURCES
New class of microsources based on amorphous materials modified with nanotechnology

Microsources for brachytherapy

Glass and polymer microspheres (40 micron) containing $^{90}$Y isotope

Silicon microspheres (40 micron) containing $^{32}$P isotope

Brachytherapy is used to treat malignant tumors. In this method of radiotherapy, the radiation source is placed within the diseased organ. The optimal dose of radiation is delivered directly to the tumor without exposing adjacent tissues and organs. Brachytherapy is used extensively worldwide; it has been used in 800 medical centers in the United States and Western Europe for over 13 years. This project will establish domestic production of microsources, titanium capsules containing a gold wire (x-ray marker) and radionuclide $^{125}$I (iodine-125) in the form of silver iodide whose surface has been modified for better ultrasound visualization. Bebig will also produce nanostructured microspheres of polymer, glass, or silicon particles whose structures incorporate atoms of radioactive isotopes. They will have a diameter of about 30 microns.

The microsources will be used to treat prostate, liver, and pancreatic cancers, which gives this project high social significance. There are more than 2.5 million cancer patients in Russia for whom these effective treatments are essential. Prostate cancer is one of the most common diseases in the country.
Creation of GMP-standard production of nanovaccines and biopharmaceuticals based on pseudo-adenoviral nanoparticles and nanostructures containing carbohydrate-binding domain
Project company NTpharma

Project participants
- RUSNANO
- Technology developers
- Coinvestor
- Nanovaccines and nanopharmaceuticals

Products
- Flu vaccines produced without antigens
- Immune activators carried to the organism in nanocontainers

Areas of application
- Medicine

Total budget
1,547 million rubles
RUSNANO financing
1,300 million rubles

Competitive advantages
- Production cycle, twice as fast as the conventional one
- No viruses multiplying in the cells

Project stages

Social impact by 2015
- Independence from import of vaccines

Production location
Pereslavl-Zalessky, Yaroslavl Oblast
150 new jobs to be created by 2015

RECOMBINANT ADENOVIRAL NANOPARTICLES AND NANOCONTAINER

The project will bring two nanovaccines and four pharmaceuticals to the market. The vaccines will be used for protection against avian and human influenza viruses. The technology to be used in manufacturing the nanovaccines will reduce the time for obtaining the drugs in industrial scale from 60 days to 28 days, something vital for development of vaccines against pandemic strains of the influenza virus. The pharmaceuticals will be used to treat various types of ischemia, urogenital infections, and toxicosis and to activate the immune system. All drugs and vaccines are exclusive products of NTpharma.
Blood coagulation-testing instruments
Project company Hemacore

**Project participants**
- RUSNANO
- Medical Innovations
- Sberbank Capital
- Medical equipment for diagnosis of insufficient (hemophilia) and excessive (thromboses) clotting in the blood system

**Products**
- Diagnostic device to detect disorders in the blood coagulation system in a single test

**Production location**
Moscow Oblast

For diagnostic purposes, natural blood clotting mechanisms are modeled in the cuvette of the coagulometer. The instrument’s digital camera follows the formation of the blood clot on the walls of the activator, which have been covered with a 30-nm to 50-nm nanostructured coating. The coating imitates the damaged vascular walls. It is an artificial analogue of the cellular membrane covered with correctly oriented molecules of blood clotting protein that triggers the entire complex coagulation mechanism. This method determines, in a single test, the duration of various phases of coagulation and diagnoses excessive and insufficient blood coagulability. Not one of the systems currently in use or otherwise known offers these features. The instrument can analyze blood samples from four patients simultaneously. The diagnostic cycle requires only 30 minutes, giving a unit an efficiency rate of eight tests per hour. Thanks to the highly precise diagnoses of the unit, the low cost of a test, and the ease with which even a junior medical worker can carry out tests, the new instrument is expected to take a dominant position in the Russian market for coagulometers and to enter the global market.

**BLOOD COAGULATION DIAGNOSTIC METHOD**
This diagnostic method is based on the fact that an accurately oriented nanolayer of tissue factor triggers blood coagulation in vitro in a test system. The layer thickness in the test system (including the artificial phospholipid membrane) is 30 nm to 50 nm, which is identical to the cell membrane and its coagulation factor.

**Total budget**
1,079 million rubles

**RUSNANO financing**
575 million rubles

**Competitive advantages**
- Unique ability to predict thromboses
- Competitive price

**Areas of application**
- Clinical-diagnostic laboratories

**Project stages**

<table>
<thead>
<tr>
<th>Project</th>
<th>Initiation</th>
<th>Production start</th>
<th>Market share</th>
<th>Export up to</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>July</td>
<td>September</td>
<td>7%</td>
<td>25%</td>
</tr>
<tr>
<td>2012</td>
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<tr>
<td>2013</td>
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<tr>
<td>2015</td>
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</tbody>
</table>

**Design capacity**
May

**Market share**
16%

**Export**
up to 25%

**Project participants**
- INSTRUMENT
- Tissue factor, integral membrane protein
- Single phospholipid layer identical to cell’s
- Covalently bound hydrocarbons on a substrate
- Polystyrene substrate

**Tissue factor, integral membrane protein**

**Body**
- Double-layer phospholipid membrane of the cell
- Tissue factor, integral membrane protein

**Instrument**
- Tissue factor, integral membrane protein
Pharmaceuticals based on mitochondrial nanotechnology (Skulachev ions) for treatment of age-related illnesses

Project company Mitotech

**Project participants**
- RUSNANO
- GC Basic Treatment
- Rostok Group
- Mitotech S.A. (Luxembourg)
- Institute of Mitoengineering, Moscow State University

**Total budget**
2,141 million rubles

**RUSNANO financing**
692 million rubles

- New type of pharmaceuticals to treat various age-related diseases: glaucoma, cataracts, coronary heart disease, cardiac arrhythmia, rheumatic arthritis, scleroses, and other diseases

**Products**
- Eyedrops—pharmaceutical treatment for ophthalmic diseases currently considered incurable
- Capsules—systemic action drug for cardiovascular and autoimmune diseases

**Production location**
Moscow, Moscow Oblast

Skulachev ions are innovative antioxidants with molecule size of about 1.5 nanometers. The ions neutralize reactive oxygen species in the energy center of the cell—the mitochondria. The unique characteristic of Skulachev ions is that its positively charged molecules retain their hydrophobic properties, allowing the ions to penetrate the membrane of the mitochondrion and concentrate in its interior. With this targeted delivery to the mitochondria, only a very small amount of the powerful antioxidant is required to achieve the desired effect. The size and structure of the molecule have been designed so that the antioxidant positions itself inside the cell with the accuracy of only a few nanometers and rests close to the spot in the mitochondrial membrane that is most susceptible to the reactive oxygen species. That is exactly where the antioxidant effect is most needed. This explains why the Skulachev ions demonstrate such high—for an antioxidant—biological activity and underlies their potential use in innovative medicinal preparations that will effectively treat diseases that are regarded today as difficult to treat and even incurable.
The capsules of these drug nanoparticles (micelles) are composed of phospholipids, natural fat molecules that form in cell membranes of living organisms. Phospholipid nanoparticles penetrate cells easily and release the active drug ingredients precisely where they are needed.

Phagocytes and other cells in the human defense system that imbibe objects foreign to the organism are unable to distinguish the 15-nm to 25-nm drug nanoparticles. This allows the nanoparticles to circulate in the bloodstream longer and exit where blood vessel walls are most penetrable. The places that are most penetrable—for example, the locus of inflammation or tumor—are often where therapeutic intervention is required. Patients derive maximum therapeutic effect from the medical substance while minimizing side effects with lower drug dosage.

At first stage, the project plans to produce innovative nanoforms of indomethacin, a non-steroid anti-inflammatory drug, and prednisolone, a steroid anti-inflammatory drug. At the second stage it will produce nanocapsules of verospirone (diuretic) and phospholip (used for treating cardiovascular diseases).

**Project stages**
- Production of a range of pharmaceuticals: anti-inflammatories, diuretics, and statins in the form of nanoparticles covered with a phospholipid layer. The size of particles does not exceed 15 nanometer to 25 nanometer

**Total budget**
- 831 million rubles
- RUSNANO financing 340.7 million rubles

**Competitive advantages**
- Proprietary technology for encapsulating up to 75% of drugs into nano-sized micelles
- The fastest way to build innovative pharmaceuticals on well-studied and proven generic medicines
- More rapid market entry for innovative forms of known drugs

**Area of application**
- Medicine

**Production location**
- Moscow Oblast
Mechanical engineering and metalwork

Aggregate budgets for projects in this area exceed 30.2 billion rubles and 9.1 billion rubles.

RUSNANO’s financing, equity capital, and loans exceed
Porous nanostructured inorganic nonmetallic coatings
Project company MANEL

Project participants
- RUSNANO
- EleSyt
- Tomsk State University

Process lines for applying porous, inorganic and non-metallic nanostructured coatings to aluminum, magnesium, titanium, and zirconium surfaces

Project stages

<table>
<thead>
<tr>
<th>Project stages</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project initiation</td>
<td></td>
<td></td>
<td></td>
<td>April</td>
</tr>
<tr>
<td>Production start up</td>
<td></td>
<td></td>
<td></td>
<td>Q1</td>
</tr>
<tr>
<td>Design capacity</td>
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<td></td>
<td></td>
<td>Q3</td>
</tr>
<tr>
<td>Sales volume</td>
<td></td>
<td></td>
<td></td>
<td>750 million rubles annually</td>
</tr>
<tr>
<td>Export</td>
<td></td>
<td></td>
<td></td>
<td>30%</td>
</tr>
</tbody>
</table>

Total budget
355 million rubles

RUSNANO financing
50 million rubles

Competitive advantages
- Environmentally clean technological process
- Low energy consumption
- Broad spectrum of functional applications

Areas of application
- Construction
- Automotive industry
- Machine building

Production location
Tomsk, Tomsk Oblast
190 new jobs to be created by 2015

Processing lines for applying inorganic, nonmetallic ceramic coatings to metal surfaces will be the main product of this project. The technology was developed by a group led by Professor Anatoly Mamaev, doctor of chemistry. Micro-arc oxidation technology provides resistance to wear (two to eight times greater resistance), corrosion, and heat and improves the decorative properties of aluminum, magnesium, titanium, and zirconium components. This opens new uses for the metals and reduces production costs. Because it is less likely to explode and produces no cyanide or nickel/chrome waste, the technology is safer for the environment.

This method of micro-arc oxidation was developed in Russia in the late 1980’s. Due to high energy consumption, the cost of MAO coating was higher than traditional methods, preventing its adoption. The research team for the project overcame the major obstacle to MAO by using advanced power sources, and that made the method cost effective.
Researchers at the Kurchatov Institute developed the technology used in this project—application of nanostructured coatings to metal-cutting instruments. The coatings increase wear resistance of the tools by 2.5 times, decreasing the frequency of replacement and lowering overall tool costs. Nanostructured coatings are applied using vacuum deposition of plasma obtained from the evaporation of material from metallic or metal-ceramic cathodes with deep alloying of the coating layers assisted with an ion beam. Scientists at the new enterprise, established with the participation of RUSNANO, apply the nanocoatings using a Kremen unit. That technical solution enhances the wear resistance of the nanocoated tool, which permits metalworking at higher velocities and lengthens the service life of the tools. Better technical characteristics of the nanocoated tools—greater hardness and tensile strength—significantly improve labor productivity and reduce manufacturing costs. Compared with an uncoated tool, metal removal rises by 2.0 times to 2.5 times; cutting speed and intervals between sharpening are extended by 1.5 times to 2.0 times.

Agreements have been signed and work is underway to produce trial sets of instruments for leading mechanical engineering companies, including Saturn-Gazovie Turbini, Soyuz, UMPO, NICEVT, Avtodiesel, GAZ Group, Tutaevsky Motorniy Zavod (all Russian enterprises), and VIZAS, a Belarusian enterprise.

**Total budget**

1,000 million rubles

**RUSNANO financing**

499.8 million rubles

**Competitive advantages**

- Highest quality tools
- Custom tool design and production
- Flexible pricing
- Fast shipment

**Areas of application**

- Jet engine building
- Aviation and space industries
- Mechanical engineering for power and transportation
- Shipbuilding

**Project stages**

* Share of metal-cutting tools sold in Russia

**COATING A METAL-CUTTING TOOL**

Diagram of vacuum nanostructured coating using several plasma sources with an assisting beam of high-energy metallic ions (IBAD, ion beam assisted deposition technology)
Electrochemical equipment produced with nanostructured materials and nanometrically structured surfaces
Project company ECM

Project participants
• RUSNANO
• VC fund RVT-Invest
• TITAN ECM and Ufa State Aviation Technical University

• Serial production of state-of-the-art, environmentally clean precision electrochemical machines for manufacturing components from any metal or alloy
• Production of tools and details with high productivity and low operating costs

Production location
Ufa, Bashkortostan Republic

Total budget
285 million rubles

RUSNANO financing
120 million rubles

Competitive advantages
• Low operating costs
• High-precision copying and nanometric surfacing

Areas of application
• Aviation construction
• Energy
• Automotive industry
• Electronics industry
• Medicine
• Instrument manufacturing

Production location
Ufa, Bashkortostan Republic

The electrochemical machines that this project will produce have been designed for nanometer-precision processing of virtually the entire spectrum of metals, including hard alloys and nanostructured metals. The technology used in the machines is comparable to that of the world’s leading manufacturers and in some parameters—performance and cost of operation—superior. In addition, software that Russian engineers have developed expands significantly the units’ surface machining capabilities. The units are extremely versatile: they can be used to produce implants and surgical instruments and to manufacture complex parts from high-strength materials for aircraft engines and power turbines.

Production machines of this class have almost no presence in Russia today. Indeed, in 2008 they were less than 0.1 percent of the world market in the precision machinery industry. The project will employ cutting-edge developments from Russia’s electrochemistry institutes and put modern surface machining technology to work in high-tech industries: microelectronics, precision instruments, aerospace, energy, medicine, automotive, and other industries.
Abrasion-resistant parts from nanostructured ceramic and metal-ceramic materials
Project company Virial

Project participants
• RUSNANO
• Virial
• Siberian Organics

• Goods and parts with unique characteristics (high durability, resistance to cracking, corrosion, and heat): friction bearing and end seal rings, rotary cutting tools, interchangeable multifaceted blades

Project stages

<table>
<thead>
<tr>
<th>2009</th>
<th>2010</th>
<th>2013</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project initiation Q4</td>
<td>Production start up Q2</td>
<td>Design capacity Q2</td>
<td>Sales volume 3,417 million rubles annually</td>
</tr>
</tbody>
</table>

Total budget 1,607 million rubles

RUSNANO financing up to 561.5 million rubles

Competitive advantages
• Longer useful life of machinery and equipment
• Less material and energy required to produce goods

Areas of application
• Oil, chemical, atomic, cable, mining, pulp and paper industries
• Metalworking and woodworking industries

Production location
Leningrad Oblast
200 new jobs to be created by 2015

This project will establish full-cycle production of nanostructured ceramics and metal-ceramics for tribotechnical assemblages operating under difficult conditions, including pumping outfits. These units are subject to high friction and abrasive wear.

Nanostructured materials offer important advantages over metals and polymers: greater wear resistance, broader temperature range for operation, and chemical inertness. The use of nanostructured materials increases reliability and service life of industrial pumping outfits by 20 percent to 30 percent.

The project company will also produce ceramic and metal-ceramic cutting tools to process very hard, durable, and thermostable metal and metal-ceramic composite materials. The use of this machinery will expand the productivity of the processing equipment and raise the precision of operations.
Network of production centers offering inorganic non-metallic ceramic coatings
Project company Plakart

**Project participants**
- RUSNANO
- Pinorim Holding Limited

**Other participants**
- Rosatom
- ODK

This project will introduce advanced, import-replacing, energy- and resource-saving technology for applying functional coatings in a wide range of industries. In Russia penetration of this technology lags far behind that of other developed countries.
Industrial consumers will be offered services and complete solutions for applying multifunctional nanostructured coatings: thermal-barrier, wear-resistant, and corrosion-resistant coatings. The products are designed to protect drilling platforms, bridges, steel structures, and associated apparatuses from corrosion and safeguard stop valves and tubing fittings, drilling, oil, and gas production and processing equipment from wear and tear.
The project will employ physical vapor deposition and ion-plasma magnetron sputtering, currently among the most popular and promising technologies in the world. The new technology for applying nanostructured coatings will replace obsolete and environmentally harmful ones, particularly, galvanic technology. By combining technologies, scientists expect to develop coatings with entirely new properties.
Nanocoatings of various functionalities will increase significantly the performance, capacity, and service life of equipment.
One example of the use of protective coatings is applying them to gas turbine engines.

**Total budget**
4,018 million rubles

**RUSNANO financing**
1,220 million rubles

**Competitive advantages**
- Better quality characteristics (durability, wear resistance, adhesive properties)
- Competitive price
- Safe for the environment

**Areas of application**
- Oil and gas industry
- Energy
- Metallurgy
- Aviation industry

**Project stages**

<table>
<thead>
<tr>
<th>Year</th>
<th>Project initiation/initiation</th>
<th>Design capacity capacity</th>
<th>Production start up start up</th>
<th>Exports exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td></td>
<td></td>
<td></td>
<td>10%–15%</td>
</tr>
<tr>
<td>2012</td>
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<tr>
<td>2015</td>
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</tbody>
</table>

**Production locations**
Moscow, St. Petersburg, Surgut, Pern, Tyumen, Ufa, Kursk
300-500 new jobs to be created by 2015
Ultrastrength homogeneous nanostructured springs
Project company NPC Pruzhina

Project participants
• RUSNANO
• Izhmash
• BANK URALSIB

Project stages

Production location
Izhevsk, Udmurtia Republic
200 new jobs to be created by 2015

At the base of new technology for production of ultrastrength springs lies a process of hot winding that combines the optimal level of heating, degree of deformation during winding, and cooling-heating regime following each turn of the spring. As a result of these operations, nanosized substructures form, providing the products with ultrastrength properties.

The technology makes it possible to produce springs whose service life is several times longer, whose stress limit is at least doubled, whose capacity at low temperatures is greater, and whose compression and coil impingement are eliminated.

Use of the new springs for railway transport, for example, will reduce substantially the cost of repairs and maintenance for rolling stock and increase the volume of cargo transported by increasing the load on the car axle. By some estimates, the gain from equipping the entire fleet of rolling stock, one million cars, with new springs in Russia would equal four billion rubles.

Total budget
1,110 million rubles
RUSNANO financing
830 million rubles

Competitive advantages
• Significantly higher resistance to relaxation and longer service life without increasing raw materials costs
• Greater operating capacity at low temperatures
• Greater weight-bearing capacity
• Elimination of compression and coil impingement

Areas of application
• Rail transport
• Automotive industry
• Production of special equipment

Market share in 2013
• Railroad springs CIS countries: 10%
• Railroad springs Europe: 2%
• Automobile springs CIS countries: 7%

ULTRASTRENGTH SPRINGS: PRODUCTION TECHNOLOGY
Hot winding used to manufacture springs for railway rolling stock, agricultural machines, and other equipment

<table>
<thead>
<tr>
<th>Project</th>
<th>Production start up</th>
<th>Design capacity</th>
<th>Sales volume</th>
<th>Economic impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
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<td>2013</td>
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<tr>
<td>2015</td>
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</tr>
</tbody>
</table>
Cutting tools from cubic boron nitride nanopowder  
Project company Microbor Nanotech

**Project participants**
- RUSNANO
- Microbor Holding

- New generation of composite materials made of cubic and nanocubic boron nitride and instruments of these composites

**Project stages**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>Project initiation CBN</td>
</tr>
<tr>
<td>2010</td>
<td>Project initiation Nano CBN</td>
</tr>
<tr>
<td>2012</td>
<td>Design capacity</td>
</tr>
<tr>
<td>2015</td>
<td>Sales volume 2,000 million rubles annually</td>
</tr>
</tbody>
</table>

**Total budget**
904 million rubles

**RUSNANO financing**
661 million rubles

**Competitive advantages**
- Higher durability and resistance to abrasion
- Order of magnitude greater productivity from instruments of cubic boron nitride

**Area of application**
- Metalwork

**Production location**
Moscow Oblast

Cutting tools made of superhard cubic boron nitride nanopowder, second only to diamonds in hardness, will be used for rough, final, and extra-final finishes, primarily in mechanical and automotive engineering, mining, and the aerospace industry.

The project has set up the complete production cycle from synthesis of CBN nanopowder to manufacturing of the cutting tools.

The improved physical properties of tools made with CBN nanopowder (microhardness, wear, and heat resistance) yield much better performance while reducing their cost of operation by as much as 60 percent.
Optoelectronics and nanoelectronics

Aggregate budgets for projects in this area exceed

81.0 billion rubles

26.8 billion rubles

RUSNANO's financing, equity capital, and loans exceeds
Arsenide gallium wafers, chips, and optical components with VCSELs
Project company Connector Optics

Project participants
- RUSNANO
- VI Systems GmbH
- BANK URALSIB

Total budget
1,100 million rubles

RUSNANO financing
770 million rubles

Competitive advantages
- Unique experience and know-how in design, epitaxial growth, and processing of VCSELs
- Industrial production of micro-electronic components
- Data transfer rate of 40 Gbit/s per channel
- Competitive price
- Low power consumption
- Original technological solutions

Areas of application
- Producers of optical components, modules, transceivers, interconnects
- Systems integrators
- Computer manufacturers

Economic benefits by 2015
Tax revenue of 270 million rubles annually

Production location
St. Petersburg

VERTICAL-CAVITY SURFACE-EMITTING LASER
The structure of vertical-cavity surface-emitting laser is based on nano- and picotechnologies. Microchips are used in optical devices of high-speed data transmission for local area networks, active optical cables, supercomputers, communications lines of USB 3.0 and 4.0 advanced standards.

Project stages

2009 2011 2014 2015

St. Petersburg will be home to a new business that will manufacture gallium arsenide substrates, chips, and optical components based on VCSEL, or vertical-cavity surface-emitting lasers. These are semiconductor heterostructures that are grown with molecular beam epitaxy. MBE has ultralow internal optical loss.

The main products of the project will be chips and optical components based on vertical-emitting lasers for use in optical devices for high-speed data transmission in local networks, active optical cables, supercomputers, and communications lines of advanced standards USB 3.0, 4.0. Production is timely: during the next few years copper lines will be replaced by faster, more compact, and interference-free fiber optics.
90-nm technological process VLSI (very-large-scale-integration) integrated circuits
Project company SITRONICS-Nano

Total budget
16,566 million rubles

RUSNANO financing
6,480 million rubles

Competitive advantages
• First production at this level in Russia
• Proprietary microcircuit design and development center

Areas of application
• Digital television
• Navigation systems
• Consumer electronics

Project participants
• RUSNANO
• Ameks
• NIIME & Mikron

• Microchips produced using 90-nm technology

Project stages

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project initiation</td>
<td>January</td>
<td></td>
<td></td>
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<tr>
<td>Production start up</td>
<td>December</td>
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<tr>
<td>Design capacity</td>
<td>July</td>
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<tr>
<td>Sales volume</td>
<td>12,000 million rubles annually</td>
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<tr>
<td>Tax payments</td>
<td>2,300 million rubles annually</td>
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</tr>
<tr>
<td>Sales volume</td>
<td>12,000 million rubles annually</td>
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</tr>
</tbody>
</table>

Production location
Zelenograd (administrative subdivision of Moscow)
220 new jobs to be created by 2015.

A plant to produce 90-nanometer integrated circuits is under construction in the city of Zelenograd, an administrative subdivision of Moscow, on the industrial site of NIIME & Mikron. The plant will produce chips for digital televisions, GLONASS/GPS navigation systems, and industrial electronics. It will also make chips with extended functionality for biometric passports and other personal documents, bank and social security cards, SIM cards, and RFID markings.

The new integrated circuits will have higher performance, larger memory, lower power consumption, and more effective protection.

The project will manufacture products with a license from one of the world’s leading producers of semiconductor devices—STMicroelectronics. The license will permit the company to use STMicroelectronics's technology to manufacture 90-nanometer integrated circuits. In the future, the new company plans to establish a design center where it can develop proprietary chips.
Radio frequency identification tags and metalized packaging materials
Project company Galileo Nanotech

**Project participants**
- RUSNANO
- Compagnia Gestione Investimenti Industriali

**Other project participants**
Galileo Vacuum Systems spa (Italy)

- Radio Frequency Identification tags
- Metalized film and paper

**Production location**
Khotkovo, Moscow Oblast
300 new jobs to be created by 2015

**Total budget**
1,892 million rubles

**RUSNANO financing**
923 million rubles

**Competitive advantages**
- Ability to regulate thickness of metal layer
- Optimal use of materials
- Competitive price

**Project stages**

<table>
<thead>
<tr>
<th>Project initiation Q2</th>
<th>Production start up Q1</th>
<th>Design capacity</th>
<th>Sales volume 5,138 million rubles annually</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>2011</td>
<td>2013 2015</td>
<td>Exports up to 80%</td>
</tr>
</tbody>
</table>

**RFID technology uses radio frequency electromagnetic emissions to read and write information on a small device, a RFID tag. RFID tags are used to identify and register objects (e.g., goods in warehouses and retail chains), to protect against counterfeit products, to automate accounting and control (e.g., postal services, logistics, accounting of fixed assets), in transportation maps, and for various documents of identification. A RFID reader does not need to see the tag to obtain data; tags can be read quickly even through packaging material. The unique quality of the technology in this project is its ability to read several semi-active tags simultaneously within a radius of several hundred meters. During production, each tag is assigned an exclusive and unchangeable identification number for high level of protection against counterfeiting. Data on the tag may be encrypted. The project uses vacuum metallization of film and paper coatings, an innovative technology from Galileo Vacuum Systems spa. It facilitates selective metallization of any flexible surface according to a given pattern. The technology has high output and low production costs.**
Miniature sensors for detecting explosive gases
Project company Optosens

**Project participants**
- RUSNANO
- ICO
- REKS
- EMI

**Project stages**

<table>
<thead>
<tr>
<th>Year</th>
<th>Stage</th>
<th>Sales volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>Project initiation</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>Production start-up</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>Design capacity</td>
<td>578 million rubles annually</td>
</tr>
</tbody>
</table>

Total budget  
421.5 million rubles  
with production expansion, 571.5 million rubles

RUSNANO financing  
209 million rubles  
with production expansion, 359 million rubles

**Competitive advantages**
- Low power consumption
- Rapid reaction rate
- Wide temperature range
- Long-term durability

**Areas of application**
- Fixed detectors
- Portable detectors

**Production location**
St. Petersburg
110 new jobs to be created by 2015

This project will use semiconductor polycrystalline nanosized layers in mass production of radiation sources and photovoltaic receivers—key elements in sensors. The infrared optical sensor developed under the project has a high reaction rate (beginning at 5.5 seconds), while products of competitors react more slowly (in 10 seconds or more). It is more durable than other sensors (seven-year service life compared with an average five-year service life for sensors produced by competitors). Moreover, this sensor can work in high humidity and without oxygen. It is non-toxic and consumes little energy (7 mW compared with more than the 200 mW average consumption for competing sensors). All of these advantages make this infrared optical sensor a promising product for Russian and world markets.

Production of the new sensors will eliminate a number of problems: inability of sensors to work where humidity high, slow performance, interrupted operation of devices due to periodic battery discharge caused by high consumption of energy.
Nano-ink and equipment for high-tech digital printing
Project Company SUN-NSK

Project participants
• RUSNANO
• Founder
• BANK URALSIB

• Modernization and expansion of nano-ink production for high-technology digital ink-jet printing
• Production of printers using UV-LED ink curing technology

Project stages

Total budget
1,114 million rubles

RUSNANO financing
166 million rubles

Competitive advantages
• Nano-ink: better stability on any material
• Ink-jet printing: greater durability
• UV-LED printers: safer to operate, more durable, consume less power

Areas of application
• Advertising and design
• Printing
• Souvenirs
• Architecture
• Construction
• Interior design and decoration
• Furniture making

Production location
Berdsk, Novosibirsk Oblast
900 new jobs to be created by 2015

Novosibirsk company SUN has developed an innovative digital UV printing system that surpasses others in use across the globe today. The system owes its advantages largely to nanotechnology applications: the use of nanosized pigments and additives to the nanoink and ultrabright UV LEDs based on gallium nitride heterostructures in the printers. Printers produced with this technology can apply images not only to advertising and printing products, as traditional printers can, but also to furniture, tile, glass, appliances and electronics, stretch ceilings, panels, and other surfaces. SUN printers combine high productivity with low operational costs, which significantly reduces the cost of the printed product. SUN nano-ink offers a broad range of color, high resistance to light, exact color reproduction, and long shelf life—important for UV curable ink.
Tagged neutron detectors differ from conventional x-ray detectors in that they identify hidden substances by their elemental composition, not by their density. Airport x-ray machines can find a bottle in a suitcase easily, but they cannot distinguish liquid explosives from water in the bottle. The Joint Institute for Nuclear Research in Dubna has devised a new detector of explosives and narcotic substances that resolves this problem.

The detector identifies the composition of substances through the spectrum of gamma rays that are emitted when neutrons hit the surface of the substance. These spectra are unique for each chemical element. The birth of a neutron in the generator is accompanied by the appearance of “tags,” alpha particles that fly away from the neutron to the alpha-detector. The selection of coincident signals with alpha- and gamma-ray detectors suppresses up to 200 times the signals from background processes. This changes dramatically the conditions for registering the spectrum of gamma rays from unknown substances, making their identification faster and more reliable.

During production of semiconductor alpha detectors, the project company will use technology for obtaining high-alloyed nanolayers of less than 100 nanometer thickness.

**Project participants**
- RUSNANO
- Joint Institute for Nuclear Research
- Explosives and Narcotics Detectors LLC

**Total budget**
- 462 million rubles
  - RUSNANO financing: 155 million rubles

**Competitive advantages**
- Identification of more than 30 explosives
- Automated identification, without human intervention
- Probability of identification approximately 98%

**Areas of application**
- Stationary luggage inspection systems
- Vehicle inspection systems
- Portable detectors
- Cargo container inspection systems

**Project stages**
- 2010: Project initiation
- 2011: Production start up
- 2012: Design capacity
- 2015: Sales volume
  - 1,000 million rubles

**Production location**
- Dubna, Moscow Oblast
Pure quartz concentrate and quartz powder for the nanoelectronic, optical, lighting, and chemistry industries
Project company: Polar Quartz

Project participants
- RUSNANO
- Polar Quartz

Other project participants
- Corporation Ural Industrial – Ural Polar
- Russia’s first vertically integrated complex for production of ultrapure quartz concentrates and powders
- Products will meet demand from Russian producers of quartz materials and goods

As Russia develops its lighting industry and its production of various types of solar batteries, the country will experience dramatic growth in the market for ultrapure quartz concentrates—the raw materials for making quartz crucibles in which electronic and solar monocrystalline silicon are grown. This project will produce quartz micropowders and nanopowders and ultrapure quartz concentrates. Quartz nanopowders with particles of less than 100 nanometers are used widely in microelectronics, construction, and exploitation of oil and gas fields. Quartz micropowder is a refined product whose particles are less than 100 microns that is obtained by grinding natural quartz. It is used as filler in the production of integrated circuits. Utrapure quartz concentrates are used in alternative energy and in the lighting, semiconductor, optical, and fiber optics industries.

Total budget
4,271 million rubles

RUSNANO financing
1,290 million rubles

Competitive advantages
- Higher chemical purity of concentrates
- Very low uranium and thorium content in micropowders

Areas of application
- Polysilicon and monosilicon production
- Solar energy
- Micro- and nanoelectronics
- Optics
- Lighting engineering

Project stages
- Design
- Project initiation
- Production start up
- Sales volume: 2,010 million rubles annually
- Exports: 90%
- Production location: Nyagan, Khanty-Mansiysk Autonomous Okrug-Yugra

Production location
Nyagan, Khanty-Mansiysk Autonomous Okrug-Yugra
250 new jobs to be created by 2015
Infrastructure projects

Aggregate budgets for projects in this area exceed

63.0 billion rubles
29.0 billion rubles

RUSNANO’s financing, equity capital, and loans exceeds
This project will manufacture FemtoScan scanning probe microscopes—precision instruments that use the mechanical movement of a probe (cantilever) to study the surface of an object. The precision of these microscopes is around one nanometer. The project company will also produce atomic scales that can register the presence of particles of various substances at the level of individual atoms. One promising application for these scales is as quick-response biosensors.

The project company plans to establish a R&D center that will conduct research to perfect technology, carry out engineering development, and test prototypes and models. The center will supply software to work in an instrument-managing mode and in an image-processing mode.
Russian warehouse and catalog of chemical and biochemical reagents
Project company Ruschembio

Project participants

- RUSNANO
- Company founder

- Storage and supply of ultrapure chemical and biochemical reagents, test systems, and consumables
- Substitution of imported reagents with Russian equivalents

Project stages

Today Russia lacks the infrastructure for full-range services for the ultrapure chemical and biochemical reagents that Russian manufacturers and research organizations require to conduct their work. Its absence hinders innovative developments and the appearance and growth of biomedical companies.

Project stages

During the first stage (2009–2010), the project company creates essential infrastructure—specialized licensed warehouses, a customs clearance system, transport logistics (rail, sea, road, and air), a database with on-line ordering function, an electronic system for accounting and control of reagents. This infrastructure ensures order delivery within 24 hours in Moscow and within 48 to 72 hours across Russia. At this stage, there is 10,000 to 15,000 reagents.

During the second stage (2010–2011), the assortment of reagents is increased to 20,000. The project company will start creating its own packaging lines and a quality control system. Russian manufacturers of ultrapure reagents, who currently largely supply foreign customers and whose considerable potential is undertapped, could become involved at this stage.

During the third stage (2012–2014), the assortment of reagents is brought to 25,000. The first Russian catalog of ultrapure chemical and biochemical reagents will be established.

Total budget

90 million rubles

RUSNANO financing

43 million rubles

Competitive advantages

- Wide assortment of reagents
- Advanced online systems for ordering and controlling products in the warehouse
- Rapid delivery of reagents throughout the Russian Federation
- Laboratories fully outfitted with sophisticated equipment

Customers

- Companies and organizations working in high-technology spheres
- Institutes of the Russian Academy of Sciences, the Russian Academy of Medical Sciences, and the Russian Academy of Agricultural Sciences
- Offices of standardization and certification
- Quality control laboratories for the food industry and veterinary services

Location

Moscow and Moscow Oblast

Oblast and within 48 to 72 hours across Russia. At this stage, there is 10,000 to 15,000 reagents. During the second stage (2010–2011), the assortment of reagents will be increased to 20,000. The project company will start creating its own packaging lines and a quality control system. Russian manufacturers of ultrapure reagents, who currently largely supply foreign customers and whose considerable potential is undertapped, could become involved at this stage.

During the third stage (2012–2014), the assortment of reagents will be brought to 25,000. The first Russian catalog of ultrapure chemical and biochemical reagents will be established.
Skolkovo-Nanotech closed-end mutual fund for venture investments
Project company Skolkovo-Nanotech Fund

Project participants
• RUSNANO
• Private investors

Managing company
Troika Dialog
• Venture investments in small nanotechnology projects
• Formation of innovative educational infrastructure in cooperation with the Moscow School of Management SKOLKOVO

Target capitalization of the fund
2,000 million rubles

RUSNANO financing
1,000 million rubles

Size of the fund at formation
300 million rubles

Competitive advantages
• Expertise in finding cutting-edge technology
• Scientific and educational expertise in assessing projects for the fund

Project objectives
• Obtain profits for fund stakeholders
• Narrow the considerable gap between a business idea and its implementation as an investment project
• Engage students and teachers of the Moscow School of Management SKOLKOVO, under the leadership of project managers and trainers, in business planning and pre-investment preparation for the most interesting projects submitted to the fund
• Consolidate educational and investment objectives of the corporation

Topicality of the project
• Focuses on realizing the commercial potential of Russian nanotechnology, provides fund investors with high return on investment, improves the quality of education in innovation management, and organizes practical training opportunities for business school students
• Provides exclusive contract among investors, business school, and management company of the fund, with private investors receiving a minimum guaranteed return and Moscow School of Management SKOLKOVO receiving the balance

Project stages

Location
Moscow Oblast
3d assembly technical center for production of electronic nanomaterials and 3d integrated circuits
Project company ELNAS

Total budget
1,703 million rubles

RUSNANO financing
225 million rubles

Competitive advantages
• Increased integration density, decreased form factor
• Increased functionality
• Heterogeneous integration of various materials and technology
• Lower power consumption

Areas of application
• Telecommunications
• Satellite navigation (GLONASS)
• Optoelectronics
• Medicine
• Electrical power
• Safety systems
• Specialized electronics

Production location
Voronezh, Voronezh Oblast
100 new jobs to be created by 2015

Project participants
• RUSNANO
• NANO3D SYSTEMS LLC
• Voronezh Semiconductor Plant–Assembly
• Coinvestor

• Technology center for 3D packaging of ICs in Russia
• Production of electrochemical materials for copper electroplating of damascene interconnects 3D TSV and solar cell metallization

Project stages

2010 2012 2014 2015

Three-dimensional crystal assembly technology offers considerable promise for chip advances: reducing chip size by increasing packing density, increasing throughput capacity of connections inside the crystal, and reducing its power consumption. This technology makes it possible to combine in one case digital and analog circuits and memory and microelectromechanical systems that have been created with different technological backgrounds. Three-dimensional assembly improves reliability and further reduces costs of microelectronic products. The project will build a center where technological processes for 3D assembly will be developed. It will produce microelectronic products using 3D assembly technology and electrochemical materials based on self-organizing additives that are employed in 3D assembly of crystals with electrically conductive silicon channels and metallization of integrated circuits and solar cells.
Molecular beam epitaxy and the planar process using technology from SemiTEq

**Project company** Semiconductor Technologies and Equipment

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**Project participants**
- RUSNANO, co-investors
- SemiTEq

**Production of high-vacuum equipment**
- for molecular beam epitaxy, electron beam evaporation, plasma etching, plasma-enhanced deposition, and rapid thermal annealing
- Development of customer-oriented technological processes
- Support for RUSNANO infrastructure projects

**Areas of application**
- Nanoelectronics
- Microelectronics
- Optoelectronics

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**Project stages**

<table>
<thead>
<tr>
<th>2010</th>
<th>2013</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales volume &gt;1,000 million rubles annually</td>
<td>Market share Molecular beam epitaxy 70%-80%</td>
<td>Market share Molecular beam epitaxy 30%-40%</td>
</tr>
</tbody>
</table>

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**Total budget**
- 630 million rubles

**RUSNANO financing**
- 140 million rubles

**Competitive advantages**
- Globally competitive equipment
- Patented technical solutions
- Well-established system of customer support
- Twenty years of experience inventing and modernizing thin film deposition

**Production location**
- St. Petersburg

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**Molecular beam epitaxy**

In molecular beam epitaxy technology, layers of various semiconductor and dielectric materials (e.g., silicon, sapphire, gallium arsenide) are applied to the surface of a substrate with layer thickness of up to a single atom. The materials are heated in the effusion chamber of the epitaxy unit. A beam of evaporated molecules is directed onto the substrate where it settles in a thin layer of predetermined structure. The process is repeated so that step by step a multilayer structure is built of alternating materials with different properties, such as different conductivity types or different band gaps. The process of growth is carried out in an ultrahigh vacuum because foreign molecules can distort the structure that is being created.

Heterostructures—new materials with unusual properties whose possibility Academician Leonid Keldysh predicted in the early 1960s—result. Since molecular beam epitaxy makes it possible to obtain ultrathin layers of only a few atoms thickness, quantum-mechanical effects appear in the materials, changing their optical and electrical properties. Molecular beam epitaxy technology is one of the first technologies for managing the structure of substances at the nanoscale, creating materials with unusual and useful properties. Molecular beam epitaxy opens the way to electronics based on new principles: ultrafast computers, solar cells with significantly higher efficiency, new optical devices for telecommunications, and other applications.
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