Mechanism for financing scientific projects of “Megascience” class in Russia

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Abstract. This article is dedicated to consideration of legal framework for financing scientific projects of Megascience class in the territory of the Russian Federation in terms of “PIK” reactor and NICA collider. These projects intend new breakthrough research practice aimed at acquiring knowledge important for development of the whole humanity. Successful accomplishment of these projects integrally depends on financing, its sufficiency and promptness. As far as projects of megascience class are first of all aimed at receipt of fundamental knowledge, the leading role for financing is played by public funds contributed in Russia in the framework of state programs. Furthermore it is possible to attract extra-budgetary funds from different sources. It is defined that global character of research practice determines engagement of foreign financing inclusively. Therefore, today megascience projects are accomplished basing on the principle of financing sources multiplicity.

1. Introduction

The term “megascience” has been brought into use since 1960s, when discussion of breakthrough research practice important for the future of the whole humanity started in the international level [1]. Accomplishment of such projects requires large scale international cooperation and concentration of huge financial resources. Big science is the cornerstone for stable development of the whole world as well as basis for the competitive development of national economies. At present time there are six facilities of the kind utilized in Russia:

• “PIK” Scientific and Research Reactor Facility;
• NICA Nuclotron-based Ion Collider;
• The 4th Generation Specialized Synchrotron Radiation Source SSRS-4;
• International Exawatt Center for Extreme Light Studies (XCELS);
• Super Charm-Tau Factory at “Budker Institute of Nuclear Physics” (electron-positron collider);
• Igniter (project on development of magnetic confinement fusion research reactor) [2].

Each project is unique both by its technical specifications and its history of accomplishment and difference in financing mechanisms. In this concern, it is necessary to highlight the foregoing special features in the context of two projects having completely different background: “PIK” reactor and NICA Nuclotron-based ion collider.
2. “PIK” reactor
Megascience project of “PIK” reactor intends development of research nuclear reactor at the premises of federal state budgetary institution Petersburg Nuclear Physics Institute named by B.P. Konstantinov of National Research Centre «Kurchatov Institute» (NRC «Kurchatov Institute» - PNPI) in Gatchina with the following features:

- Thermal power - 100 mW;
- Flux density of thermal neutrons (maximum) - 5*10^15 cm^-2 s^-1;
- Flux density of thermal neutrons in the reflector - 1.5*10^15 cm^-2 s^-1;
- Energy release in the reactor core (average) - 2.0 MW/L;
- Energy release in the reactor core (maximum) - 6.6 MW/L;
- Coolant - light water;
- Reflector - heavy water;
- Number of horizontal experimental channels – 10;
- Number of inclined experimental channels – 6;
- Number of vertical experimental channels – 6;
- Number of cold neutron sources – 3;
- Number of hot neutron sources – 1;
- Number of experimental stations – 50 [3].

The concept of the reactor under discussion was developed in the middle of 1960s by the staff members of a branch of Physics and Technology Institute named by A.F. Ioffe of AS USSR in Gatchina. Since 1976 the work for construction of technological buildings complex has begun. However Chernobyl nuclear power-generating station catastrophe caused a decision to revise requirements for safety of all nuclear power industry, and therefore, at the end of 1980s the “PIK” reactor project was subject to necessary changes which elaboration and approval postponed accomplishment of the project. After the collapse of the USSR the work on “PIK” reactor was almost stopped and the contributed funds allowed performance of minimal amount of works for the reactor completion.

As pointed out at the website of PNPI Neutron Research Unit «the situation changed only in 1999 when administration of three institutions – Russian Academy of Science, Ministry of Nuclear Energy and Ministry of Science of Russia signed “Joint resolution for construction completion of “PIK” high-flux research nuclear reactor and organization in its framework of International Neutron Research Center” which the parties defined as the unit of “priority” and “cross-sectoral” character and agreed to join their financial efforts for its most rapid launching» [4]. After signing the Resolution substantial increase of the project financing takes place: if in 1999 the amount of funds reaches 78.4 mln roubles, then already in 2000 this amount has been doubled and reaches 158.5 mln roubles, and in 2003 – 197 mln roubles [4]. However in spite of surge in interest of governmental bodies to the “PIK” reactor project and understanding of its importance for the Russian science development and international scientific cooperation, it was required to engage much bigger amount of financial resources as well as centralize financing processes.

For this purpose in 2007 Federal Atomic Energy Agency conducted an expertise of capital construction object [5], and after its positive result the Government of the Russian Federation under the Decree of August 11, 2007 № 1039-p contributes additional funds.

Financing increase allowed putting in place the first launching facility of buildings and constructions and two years later accomplishing actual reactor launch.

Thereafter, the RF Government Decree of November 19, 2012 № 1194 «On public funding of “PIK” scientific and research reactor complex reconstruction, Gatchina, Leningrad region, of Petersburg Nuclear Physics Institute named by B.P. Konstantinov, declared the foregoing RF Government Decree of August 11, 2007 № 1039-p to be no longer in force and provided contribution in 2012 – 2013 of public funds from federal budget allocations for reconstruction of “PIK” scientific and research reactor complex of federal state budget institution Petersburg Nuclear Physics Institute
named by B.P. Konstantinov. As a result the RF Government devoted funds for construction of 2nd and 3rd launch device with thermic power of 100 MW, and commissioning capacity of 65000 square meters.

NRC «Kurchatov Institute» acted as chief controller of public funds. Pursuant to p.3 of the RF Government Decree № 1194 the chief controller of public funds, Ministry of Education and Science of the Russian Federation, Ministry of Economic Development of the Russian Federation and Ministry of Finance of the Russian Federation were entrusted with a duty of financing relative works. Total (maximum) volume of public funding from federal budget allocations pursuant to Annex to the indicated RF Government Decree amounted to 6236.4 mln roubles (including public funding in the amount of 982, 400 mln roubles, made in 2007 – 2009 for construction of the 1st launching facility), in particular for 2d and 3d launching facility – 5254 mln roubles (1396.1 mln roubles in 2012 and 200 mln roubles – in 2013). Scheduled works were accomplished in time – in 2013 construction of the complex consisting of 38 buildings and structures of total area of 65 thd square meters was over.

Later on as it was mentioned in the Forecast of Social and Economic development of the Russian Federation for the year 2015 and for planned period 2016 and 2017, pursuant to the records of meeting of interagency working group in the field of “Scientific research infrastructure” of the Presidential Council of the Russian Federation on Science and Education of May 21, 2014 № 8, it was recommended to continue financing of “PIK” reactor and NICA complex megaprojects from federal funds and non-budgetary sources.

Today the main financing sources for megascience projects and for “PIK” reactor in particular are federal funds. However, financing is performed on the basis of program-oriented and goal-oriented approach conducted in the framework of result-oriented budgeting. Program budget development is one of the main directions for performance improvement in use of budgetary funds [6].

At present financing works connected to “PIK” reactor are conducted on the basis of the Budget Code of the Russian Federation, Federal Law on federal budget for the successive financial year and scheduled period, Federal Target Program “Research and development in priority growth areas of science and technological complex of Russia for 2014 – 2020” [7], Russian Federation state program «“Development of science and technology” for 2013 – 2020» [8], as well as some other regulatory legal acts.

3. NICA (Nuclotron-based Ion Collider)
The purpose of «NICA» megascience project is development of NICA Nuclotron-based Ion Collider facility. The project was presented and approved at the Government Commission Session on Innovations and High Technologies of July 5, 2011. The project provides development of protons and heavy ion collider at V.I. Veksler and A.M. Baldin Laboratory High Energy Physics (LHEP) of Joint Institute of Nuclear Research (JINR), situated in Dubna of Moscow region.

In the framework of the project the following shall be conducted:

- experimental research of fundamental nature;
- applied research (for example waste reprocessing of nuclear industry, development of new methods of generating power (accelerator beam driven nuclear reactors), cancer diseases therapy etc.);
- accomplishment of education program for preparing science and engineering personnel for member countries of JINR.

Unlike the “PIK” reactor project which accomplishment required several decades and which financing mechanism in conditions of radical changes of economic relationship connected to transition to market economy, experienced material changes, «NICA» megascience project has clearly defined financing order. As with regards to other projects of the kind the leading role in its development is played by federal budget monetary funds contributed in the order defined by the Budget Code of the Russian Federation, Federal Law on federal budget for the successive financial year and scheduled period, as well as state programs. At the same time «NICA» project financing has its differences driven by the fact that it is conducted by Intergovernmental Science and Research Organization Joint
Institute of Nuclear Research (JINR) in the framework of regional innovation cluster «Cluster of nuclear and physics nanotechnology in Dubna».

In its turn art. 12 of the Statute defines the list of financing sources for JINR activity which includes moneys of the Institute members contributions; of scientific projects target financing; funds received under contracts and protocols of scientific and technical cooperation; earnings from the Institute economic activity; proceeds from use of intellectual property rights; from bank credits and loans; other proceeds.

In general it is worth saying that financing works on development of NICA nuclotron-based ion collider are conducted by the funds of the JINR itself, the Russian Federation and other participants of the project. For these purposes in 2016 the Russian Federation Government and International Intergovernmental Science and Research Organization Joint Institute of Nuclear Research (JINR) signed an Agreement on development and use of NICA nuclotron-based ion collider [9]. As it is mentioned in art. 1 of the Agreement, this document allows the parties to join their material technical and financial resources for development of NICA facility.

For the moment of signing the cost of the project defined in art. 4 of the Agreement was evaluated in 17500 mln roubles in the prices of 2013, which include 8800 mln roubles from the Russian Federation; 8700 mln. roubles from Joint Institute of Nuclear Research and other participants of the project. In case of new participants entrance, the cost of the project increases up to the amount of their contribution and percentage of other participants excluding the Russian Federation, is redistributed accordingly.

Up to 2020 the Agreement provides development of:

- Acceleration complex for heavy ion and polarized particles beams;
- Set of engineering test facilities for study of hadronic matter and nucleon spin on external and colliding beams;
- Innovation solutions project center of NICA complex with high technology equipment for work of physicians and professionals;
- Center for education and training of scientific and engineering skills.

The following participants are expected to contribute for accomplishment of this project in total:

- Russian Federation – 8800 mln roubles;
- Joint Institute of Nuclear Research – 7050 mln roubles;
- Member countries – 1650 mln roubles.

4. Foreign financing

The foregoing projects received not only Russian but also foreign, in particular European financing. So at present time there is research and innovation program Horizon 2020, approved and effective in the European Union. This program represents a document of strategic planning which serves as an instrument for science and research financing programs. The program remains on force from 2014 to 2020 and provides contribution for accomplishment of its objectives of almost 80 billion euro.

In the framework of Horizon 2020 program CREMLIN project (Connecting Russian and European Measures for Large-scale Research Infrastructures) was accepted, which aim was in development of scientific cooperation between Russia and European Union in the field of development and scientific use of large scale research infrastructures. CREMLIN project had been valid since September 1, 2015 up to August 31, 2018 and provided contribution of 1,696,250 euro for the purpose of scientific cooperation development in view of large scale research infrastructures. 19 organizations from 6 countries including Russia, Belgium, France, Germany, Swiss, that CREMLIN project expired in August, 2018. European countries expressed the wish to continue collaboration on megascience projects conducted in the territory of the Russian Federation. In particular, on December 10, 2018, Ministry of Science and Higher Education of the Russian Federation and Federal Ministry of Education and Research of the German Federal Republic accepted Cooperation Roadmap in the Field of Education, Science, Scientific Research and Innovative Activity. This document was accepted...
pursuant to the Agreement between the Russian Federation Government and the German Federal Republic Government on Scientific and Technical Cooperation of July 16, 2009 and Joint Statement of Strategic Partnership between the Russian Federation and German Federal Republic in the Field of Education, Scientific Research and Innovations of April 11, 2015.

Pursuant to Annex I to the Roadmap the German party expressed its readiness «to contribute equipping and use for scientific purposes of Nuclotron-based Ion Collider complex (NICA) and research facility on the basis of “PIK” high-flux reactor (“PIK”), excluding construction and use of the “PIK” reactor itself». For the purpose of the collaboration development the following agreements are expected to be signed:

- on “PIK” project – between Petersburg Nuclear Physics Institute named by B.P. Konstantinov of National Research Centre «Kurchatov Institute»
- on NICA project – between Joint Institute of Nuclear Research and Helmholtz Centre for Heavy Ion Research [10].

In case the cooperation on these projects shall be considered successful the parties reserve their right to expand the force of the Agreement to other megascience projects.

5. Conclusion

The carried out research showed that today megascience projects in Russia are conducted mostly by means of federal budget which is determined by public interest in these projects. However, financing is performed on the basis of program-oriented and goal-oriented approach conducted in the framework of result-oriented budgeting. Furthermore, megascience projects may be funded from other sources, in particular, Russian and international organizations, foreign countries.

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References

[1] Gorlova E N, Tkachenko RV 2019 The Concept of "Megasience" Class Projects: the Case of ITER and FAIR Installations Actual Problems of Russian Law 102 207
[2] Boltinova O V, Arzumanova L L 2019 Legal Regulation of Mega-Science Projects in Russia Actual Problems of Russian Law 104 40
[3] Reactor PIK // URL: http://www.pnpi.spb.ru/ustanovki/reaktor-pik
[4] Construction of the PIK reactor, Available online: http://nrd.pnpi.spb.ru/reaktorPIK/stroitel.html#top_of_page
[5] State expertise report of Federal Atomic Energy Agency of February 27, 2007 № 66/37
[6] Tkachenko R V 2019 Projects of the Class "Megasciens" as One of the Main Directions of Implementation of the Budget Policy of Russia Courier of the Kutafin Moscow State Law University (MSAL) 59 46
[7] The RF Government Decree of 21.05.2013 № 426 «On Federal Target Program “Research and development in priority growth areas of science and technological complex of Russia for 2014 – 2020”» // CL RF. 2013. № 22. Art. 2810
[8] The RF Government Decree of 15.04.2014 № 301 «On Approval of the Russian Federation state program «‘Development of science and technology” for 2013 – 2020» // CL RF. 2014. № 18 (part I). Art. 2150
[9] The RF Government Resolution of 27.04.2016 № 783-p «On Execution of the Agreement between the Russian Federation Government and International Intergovernmental science and research organization Joint Institute of Nuclear Research on Development and Use of NICA Nuclotron-Based Ion Colliders» // CL RF. 2016. № 19. Art. 2720
[10] Deutsch-russische Roadmap für die Zusammenarbeit in Bildung, Wissenschaft, Forschung und
Innovation zwischen dem Bundesministerium für Bildung und Forschung der Bundesrepublik Deutschland und dem Ministerium für Wissenschaft und Hochschulbildung der Russischen Föderation, 10.12.2018