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Mechanisms of scientific and technological cooperation of Russian and European organizations in the field of energy efficiency within the EU Framework Programme for scientific and technological and innovative development «Horizon 2020»

Mecanismos de cooperación científica y tecnológica de organizaciones rusas y europeas en el ámbito de la eficiencia energética dentro del Programa Marco de la UE para el desarrollo científico y tecnológico y el desarrollo innovador «Horizonte 2020»

Andrey Sergeevich KUZMINOV 1; Sergey Sergeevich GUSEV 2; Elena Nikolaevna CHISTYAKOVA 3

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ABSTRACT:

The article describes the main opportunities of the scientific and technological cooperation of Russian and European organizations within the EU programme for scientific and technological and innovative development "Horizon 2020" and the Federal Target Programme of the Ministry of Education and Science of the Russian Federation "Research and Development

RESUMEN:

El artículo describe las principales oportunidades de la cooperación científica y tecnológica de las organizaciones rusas y europeas dentro del programa de la Unión Europea para el desarrollo científico y tecnológico e innovador "Horizonte 2020" y el Programa Federal Objetivo del Ministerio de Educación y Ciencia de la Federación Rusa "Investigación y

in the Priority Development Directions of the Scientific and Technological Complex of Russia for 2014-2020". The main directions and objectives of the programme "Horizon 2020" were submitted and analyzed in the context of the Russian priorities of scientific and technological project activity. The problems arising during the interaction of Russian potential participants in joint project activity with the European partners were distinguished. The data regarding the current state of joint project activity were specified.
Keywords: scientific and technological cooperation, energy efficiency, program, project, priority, direction.

Desarrollo en las Direcciones de Desarrollo Prioritario del Complejo Científico y Tecnológico de Rusia para 2014-2020 ". Las principales direcciones y objetivos del programa "Horizonte 2020" se presentaron y analizaron en el contexto de las prioridades rusas de la actividad de proyectos científicos y tecnológicos. Se distinguieron los problemas que surgen durante la interacción de los posibles participantes rusos en la actividad de proyectos conjuntos con los socios europeos. Se especificaron los datos con respecto al estado actual de la actividad del proyecto conjunto.
Palabras clave: cooperación científica y tecnológica, eficiencia energética, programa, proyecto, prioridad, dirección.

1. Introduction

Despite the existing restricting measures in some fields, the development of the international scientific and technological cooperation in the field of energy efficiency with the countries of the European Union (EU) is an integral part of the economic integration that determines the prerequisites of formation of the economic models based upon the rational use of energy resources, diversification of energy sources and new technologies and means of power supply connected to them. The interaction, building a constructive dialogue with the European partners in the sector of research and development of the key directions and developments in the field of energy saving stipulate the possibility of intensifying the processes of the technical reequipment and modernization of the existing energy systems, provide the access to the advanced knowledge, achievements in the field of science and technology, and finally it leads to the improvement of people’s living standards.

The main tendencies of the EU science and technology development for the nearest future are determined by the Europe 2020 Strategy (European Commission, 2010), positioned as the strategy of intelligent, sustainable and "inclusive" growth. At the same time, sustainable growth is understood as the competitive economy, based upon the efficient use of natural resources including all types of energy. The strategy planned, in particular, the following achievements by 2020:

- investments into science and technology development (sector of R&D) – 3% of GDP;
- a reduction in greenhouse gas emission by 20% in comparison with the level of 1999;
- an increase in the energy efficiency of GDP by 20%;
- an increase in the share of renewable power generation in the energy balance of the EU countries up to 20%.

2. Content of the Framework Programme "Horizon 2020"

The distinctive features of the strategy caused by the global challenges are its commitment to the improvement of the entrepreneur climate, a decrease in the share of state expenditures for implementation of the key objectives while maintaining the high level of social protection of population. The implementation of the objectives of the science and technology development determining the main tendencies and directions of the EU activity for the nearest perspective is specified in the Framework Programme for Research and Innovation "Horizon 2020" (2017), which is the main financing tool for the European scientific research and development for the period from 2014 till 2020. "Horizon 2020" that has started in 2014, includes three tools of financial support of research and development: the Seventh Framework Programme for Research and Technological Development (7FP), the Competitiveness and Innovation Framework Programme, and the European Institute of Innovation and Technology. The main feature of "Horizon 2020" is the extension of participation of small and medium-sized businesses in the research and development to provide financing for creation of innovative products at all stages: from an idea till its technical implementation and commercialization. In this regard, "Horizon 2020" provides the

stimulation measures for potential of small and medium-sized businesses (SMSB) and extension of their contribution to the development of technologies and developments. "Horizon 2020" consists of three main priorities and 4 cross-thematic directions, including:

- priority "Advanced science";
- priority "Industrial leadership";
- priority "Social challenges";
- cross-thematic directions.

Every priority is divided into several thematic directions according to the objectives to be implemented within its framework.

The priority "Advanced science" is aimed at improving the level of scientific research, ensuring the competitiveness of European science, and generating advanced knowledge for the strengthening of EU position among the leading scientific states of the world.

The objectives of the priority "Advanced science" are the following:

- fundamental scientific research through the *EuropeanResearchCouncil, ERC* (2017);

- support of the developing technologies, know-how and "technologies of future";

- improvement of scientific human resources ("Shares of Maria Sklodowska-Curie");

- access to the research infrastructures.

The priority "Industrial leadership" is aimed at attracting investments into the R&D sector, and into the development of the key industrial technologies, growth and entrance of European companies to the world markets, support for business, including small and medium-sized innovative enterprises.

The objectives of the priority "Industrial leadership" are the following:

- achievement of leading positions in the sphere of information and communication technologies, nanotechnologies, technologies of creation of new functional materials, biotechnologies and space exploration;

- easy access to the management of financial risks;

- support of innovative small and medium-sized enterprises.

The priority "Social challenges" is directed to the solution of the main social problems such as:

- health care, demographic changes and well-being;

- provision of food safety, research in the agricultural sphere, use of sea and bioenergetic resources;

- safe, environmentally safe energy and energy efficiency;

- environmentally safe smart transport;

- solving of problems of climate change and rational use of resources;

- creation of innovative public opinion;

- protection of freedom and safety of citizens.

The cross-thematic directions of "Horizon 2020" are concentrated in the following fields:

- support of the *European Institute of Innovation and Technology, EIT (2017)*. One of the main problems of this institute is integration of the higher education, research and innovations to develop new approaches to the innovative activity, formation of sustainable growth and competitiveness, support of entrepreneurship. The tools used for integration within the framework of the institute's activity are *Knowledge and Innovation Communities, KICs*, formed on the base of the institute. Using these communities, the institute develops and tests new approaches to management, financing and implementation of innovations;

- an increase in the participation activity in the programme "Horizon 2020" including the attraction of new participants from the new countries – EU members;

- an increase in science attractiveness (especially for young researchers and scientists), an increase in the society's demand for innovative products, an increase in the awareness of the

society about the advanced scientific research, finding of new ways of interaction of science and society. The implementation of these objectives within the framework of the programme "Horizon 2020" presupposes the support of the projects of involving of the society into processes determining the essence of the performed research, that influence the everyday life of people;

- support of the *JointResearchCentre* (2017) that is a subordinate structure of the European Commission that represents the independent scientific and technological support in the implementation of the EU policy in the field of scientific and technical activity. Realizing the research and educational programme of the European Atomic Energy Community, the Joint Research Centre supports also the activity aimed at improving the atomic safety and protection from radiation.

The budget of the Programme "Horizon 2020" is 80 bln Euro and it is distributed among to the priorities according to the following – Table 1.

Table 1
Budget of the Programme "Horizon 2020"

Social challenges	31.7 bln Euro
Advanced science	24.4 bln Euro
Industrial leadership	17.8 bln Euro
European Institute of Innovation and Technology	2.7 bln Euro
Joint Research Centre	2 bln Euro
Science for society	0.5 bln Euro
Extension of participation	0.8 bln Euro

The activity within the framework of "Horizon 2020" is performed by scientific and technical projects that were selected as a result of the competitions held by the European Commission according to the approved annual working programs. According to the implementation, the projects are divided into several main types:

- Research and Innovation Actions;

- *Innovation Actions*;

- *Coordination and Support Actions*;

- projects organized using the "tools" for support of the SMSB, (*"sMEinstrument"*);

- projects within the framework of the programme of cofinancing of the partnerships of the state agencies (*ERA-nEtcofund*).

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3. Conditions of project participation

Research and innovation actions include mainly the measures directed to the obtaining of the new knowledge and/or research of use of new and improved technologies, products, processes, solutions. This type of projects can include fundamental and applied research, development and integration of technologies, laboratory research and simulation. The duration of this type of projects is 3-5 years in the average. The conditions of participation: minimum 3 independent legal persons from three different countries-members of the EU or countries associated with the programme "Horizon 2020"; any number of organizations from other countries (including Russia) can join the consortium as additional participants.

Innovation projects consist mainly from the measures directed to the creation of improved developments, technologies, products containing innovative solutions. The project may

include the creation of prototypes or demonstration models, trials, pilot implementation, large-scale validation of the product and its launch for commercial purposes. The project can also include the research and development activity. The duration of the projects is 2-3 years in average. The conditions of project participation: minimum 3 independent legal persons from three different countries-members of the EU or countries associated with the programme "Horizon 2020"; any number of organizations from other countries (including Russia) can join the consortium as additional participants. More often this type of projects is used in the section "Industrial leadership" of the programme "Horizon 2020".

Projects of coordination and support consist of side events such as standardization, copying of results, an increase in the level of awareness and communications, network interaction, services of coordination and support, dialogue regarding the questions of tools' development for policy implementation, education and analysis, including the analysis of the project solutions regarding the new infrastructures and also the additional measures of the strategic planning, creation of communities and coordination of programs in different countries. The duration of such projects is 1-2 years. The conditions of project participation: minimum 1 legal person registered in the country-member of the EU or country associated with the programme "Horizon 2020". Any number of organizations from other countries (including Russia) can join the consortium as additional participants.

The support tool of small and medium-sized enterprises (sMEinstrument) is directed to the support of all types of innovative small and medium enterprises possessing the potential of development, growth and entrance to the international market. Within the framework of such projects, the phase-by-phase financing of the complete innovation cycle is provided, and also the additional services of training and assistance. The duration of the project: phase 1 lasts 6 months; phase 2 - 1-2 years. The conditions of project participation: minimum 1 commercial small or medium sized enterprise registered in the country-member of the EU or country associated with the programme "Horizon 2020".

The programme for cofinancing of the partnerships of the state organizations ERA-nEt (*ERA-nEtcofund*) is implemented in support of partnerships of the state organizations, including joint program initiatives between the countries-members of the EU, and it is directed to support of the development of joint programs, organization of network structures, implementation and coordination of activity. The additional financing from the EU can be attracted for holding of international contests. The main and obligatory component of the cofinancing programme ERA-nEt is to hold a joint contest, within the framework of which international research and/or innovation projects are cofinanced by all participating organizations. The formed consortiums can implement also other actions including joint contests without the additional financing from the EU. The organizations financing the scientific research and innovation from any country of the world, including Russia, can become the participants of consortiums within the framework of the cofinancing programme ERA-nEt.

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4. The order of participation of Russian organizations in the projects of «Horizon 2020»

Russian organizations can participate in the projects of "Horizon 2020" under the same conditions and the same rules of financing as other industrially developed countries, that is, under the conditions of the own (national) financing of the organization-participant in the project. To participate in the contest, Russian organizations shall join an international consortium, the requirements of which depend upon the type of the certain contest. In general case, the composition of the consortium, within the framework of joint projects, shall contain organizations-representatives of 3 different countries-members of the EU or associated countries, to which the Russian organization is joined as a partner of the project. At the same time, the coordinator of the consortium is assigned and the Russian organization concludes the coordination agreement with it.

Based upon the agreements achieved between the Government of the Russian Federation and the EU (Ministry of Education and Science of Russian Federation. (200 Ministry of Education and Science of Russian Federation, 2009), the functions of coordination and

financing of projects of the programme "Horizon 2020" are performed from the Russian side by the Ministry of Education and Science of the Russian Federation. Acting within the framework of the mentioned agreements, the EU-Russia Joint Science and Technology Cooperation Committee (JSTCC) became the base of the dialogue development with the European Commission at the level of the Ministry of Education and Science. A wide range of issues is discussed within JSTCC that are related to the realization of joint project initiatives taking into account the peculiarities of the policy of the Ministry of Education and Science of the Russian Federation for implementation of the focused support of the projects with foreign participation, including those under "Horizon 2020". At the same time, the thematic directions of research and development are determined that are of mutual interest for the EU and the Russian Federation. The key instrument of the national support of joint project activity at the level of the Ministry of Education and Science of the Russian Federation is a Federal Target Program "Research and Development in the Priority Development Directions of the Scientific and Technological Complex in Russia for 2014-2020" (Federal Target Programme "Research and Development in the Priority Development Directions of the Scientific and Technological Complex of Russia for 2014-2020", 2013), which presupposes, in particular:

- research within the framework of international multilateral and bilateral cooperation;

- support of research within the cooperation with states-members of the EU;

- organization of participation in the large international scientific and scientific and technological actions. Within the frameworks of the mentioned actions the contests for execution of the applied scientific research in the priority fields are held periodically.

The procedure of filling of application for the Russian organization consists of two parts:

- filling of application to the European Commission by the consortium coordinator (representative of the EU or associated countries), that includes the data of the Russian participant and its role in the project;

- filling of application for the contest of the Ministry of Education and Science of the Russian Federation within the frameworks of the Federal Target Programme "Research and Development in the Priority Development Directions of the Scientific and Technological Complex in Russia for 2014-2020".

At the same time the deadline for applications for the Russian and European contests are at different time and this gives the possibility for the Russian organizations to provide the data (executed, as a rule, in the form of letters of intent) of availability of the foreign partner. In general case the procedures of filling of application for the contests and the selection of winners are the following:

- the Ministry of Education and Science of the Russian Federation selects the priority directions within the frameworks of the announced opened (or planned to be opened) contests of “Horizon 2020” and provides a list of selected themes to the European Commission;

- as the coordinator the European Commission publishes the data of contests where the Russian organizations can participate in specifying the Russian financing body (the Ministry of Education and Science of the Russian Federation);

- the Ministry of Education and Science of the Russian Federation announces the open contest within the framework of the Federal Target Programme "Research and Development in the Priority Development Directions of the Scientific and Technological Complex in Russia for 2014-2020";

- the European and Russian partners form the joint project within the consortium. One application is filled for the contests of the European Commission by the coordinator of the Consortium. The Russian application is filled for the corresponding contests of the Ministry of Education and Science of the Russian Federation;

- the filled applications are estimated by the Committee of the European Commission and the Ministry of Education and Science of the Russian Federation. The expertise of the filled applications in the European Commission is made by the international experts. The Russian

expertise is performed according to the legislation regulating the procedures of the contest selections;

- after obtaining of the results of the independent estimations the parties (Russia and the EU) inform each other about the readiness to support the selected projects;

- the Russian winners conclude the Agreement on granting by the European Commission (without financing) and agreement of subsidies by the Russian financing organization. According to the agreement on granting by the European Commission, the Russian participants are released from the financial accounting to the organizers of the contest "Horizon 2020" but they shall provide the financial accounting and the project reporting of the project of the Russian financial organization.

The directions "Safe pure and efficient energy" of the programme "Horizon 2020" are included into the priority "Social challenges". The budget of the direction for the period of 2014-2020 is 5,782 mln euro. The groups of the project themes are distributed between the increase of the energy efficiency in the sectors of production and final consumption of the electrical and heat energy and the decrease of greenhouse gases' emission related to them, including also the sector of final consumption - buildings and structures, development and implementation of the renewable energy sources, intellectualization of the generation systems, distribution and use of energy resources.

Regarding the decrease of the energy consumption by the engineering systems of buildings and structures, "Horizon 2020" determined the support of the project activity directed to the research and development in the field of optimization of the production systems of heat and electric energy, optimization of the engineering systems of buildings, including the systems of heating, ventilation and air conditioning, and also due to the use of the renewable energy sources (RES), formation of the psychology of the caring attitude to the energy resources consumption.

Concerning the increase in the share of use of renewable energy, the priorities of "Horizon 2020" are concentrated on the directions of RES use for heating and conditioning, their implementation during modernization of the power networks and also the adaptation of energy systems for use of RES, including the use of biofuels.

In the direction of intellectualization of the energy supply systems, within the framework of "Horizon 2020" the financing of the project themes is provided regarding the development of scientific and technical solutions directed to the mutual integration of power networks, transport systems and information and communication technologies for the development of city objects (so called "smart cities"). The technological solutions in the field of large-scale implementation of intellectual systems are determined as the priority directions in this field; they combine the most wide-spread technological platforms, for example, smart lighting systems, Internet technologies and cybersecurity.

As it is seen from the provided data, the main priorities in the field of energy efficiency of the programme "Horizon 2020" correspond mainly to the priority development directions of science, technology and critical technologies of the Russian Federation, in particular:

- technologies of new and renewable sources of energy, including hydrogen energy;

- technologies of creation of the electronic component base and energy efficient lighting devices;

- technologies of creation of energy-saving systems of transportation, distribution and use of energy;

- technologies of energy efficient production and transformation of energy on organic fuel.

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5. Problems and perspectives of implementation of the potential of international scientific and technological cooperation

Thus, the potential of scientific and technological cooperation is rather high and includes the key branches of development of energy efficiency: bioenergy, RES, oxygen energy,

technology of heat and electricity supply, conditioning, intelligent control system.

During 2014-2017, within the framework of the Federal Target Programme "Research and Development in the Priority Development Directions of the Scientific and Technological Complex in Russia for 2014-2020", 15 projects are implemented on the priority "Energy efficiency, energy saving, nuclear power" where European organizations participate as partners; the total volume of budget financing is 258.3 mln roubles. The projects are focused in the fields of RES, development of energy efficient lighting sources, bioenergetics technologies, and intellectualization systems of energy supply processes (Federal Target Programme "Research and Development in the Priority Development Directions of the Scientific and Technological Complex of Russia for 2014-2020", 2013). Russian grant winners in the mentioned projects are the leading scientific organizations, institutions of higher education, and representatives of the business sector.

Speaking about the organizational problems of joint scientific and technical project activity together with foreign partners, it is necessary to notice that the traditional difficulty of organization of contest joint procedures with "Horizon 2020" is the discrepancy of the terms of contests: on the one side, according to the terms of Russian contests, it is necessary for a Russian organization to file an application for the contest of "Horizon 2020" as a member of an international consortium; on the other side, according to the terms of contests of "Horizon 2020", a financial guarantee is necessary. At the same time, both terms shall be fulfilled when filing application documentation, that is, in the conditions when the winner is not determined. The partial solution of this problem is a Russian organization's joining an international consortium and the corresponding filing of an application for the contest of "Horizon 2020" till the moment of announcement of Russian contests; however, first, in this case the national financing of the Russian organization is absent, second, the condition of uncertainty of the winner in the contest of "Horizon 2020" is maintained, which means that serious risks of non-fulfilment of the declared obligations by the partners exist. Also, the issues of search and interaction with foreign partners, their joining the international consortiums cause difficulties for potential Russian participants in joint projects. As a rule, Russian organizations having the sustainable well-established connections with foreign partners can achieve the agreements of cooperation and their formalization in the form of project offers. It should be mentioned that the impact of the specified constraining factors can be minimized at the proper level of elaboration of the procedure aspects of joint project activity by all interested parties.

Conclusion

- The participation of Russian organizations in the programme "Horizon 2020" is intended to ensure access to advanced knowledge, modern technologies, to improve the quality and efficiency of research; it also allows creating new international partnerships and communities;

- for Russian organizations at the institutional level, there is a mechanism of organization of joint scientific and technical project activity together with foreign partners within the framework of "Horizon 2020" under the terms of the national financing of projects. This mechanism is realized in the Federal Target Programme "Research and Development in the Priority Development Directions of the Scientific and Technological Complex in Russia for 2014-2020" performed by the Ministry of Education and Science of the Russian Federation;

- priorities in the field of energy efficiency of the programme "Horizon 2020" correspond mostly to the priority direction of development of science, technology and technique "Energy efficiency, energy saving, nuclear power" and critical technologies of the Russian Federation;

- the main problem of implementation of the joint projects is the joining of the Russian organizations to the international scientific consortiums and also discrepancy of terms of holding of the Russian and foreign contests.

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2. FSBEI HE National Research University "Moscow Power Engineering Institute", 111250, Russia, Moscow, Krasnokazarmennaya, 14

3. ANCO RUSDEM-EE, 111250, Russia, Moscow, Krasnokazarmennaya, 14