APPROVED
by Order No.
of __ _____ 2014
of the Minister of Education and Science and the Minister of Economy of the Republic of Lithuania

ACTION PLAN OF THE PRIORITY "SMART SYSTEMS FOR ENERGY EFFICIENCY, DIAGNOSTIC, MONITORING, METERING AND MANAGEMENT OF GENERATORS, GRIDS AND CUSTOMERS" OF THE PRIORITY AREA OF RESEARCH AND ENVIRONMENTAL (SOCIO-CULTURAL) DEVELOPMENT AND INNOVATION (SMART SPECIALIZATION) "ENERGY AND SUSTAINABLE ENVIRONMENT"

CHAPTER I
GENERAL PROVISIONS

1. The action plan of the priority "Smart Systems for Energy Efficiency, Diagnostic, Monitoring, Metering and Management of Generators, Grids and Customers" of the priority area of research and environmental (socio-cultural) development and innovation (smart specialization) "Energy and Sustainable Environment" (hereinafter - the Priority RDI development area) (hereinafter – the Action Plan) was drawn up in the implementation of the Implementation Programme of Priority Areas of Research and Experimental (Socio-cultural) Development and Innovation (Smart Specialization) and their Priorities approved by Order No. 411 of the Government of the Republic of Lithuania of 30 April 2014 *On the Approval of the Programme for the Implementation of Priority Areas of Research and Experimental (Socio-Cultural) Development and Innovation (Smart Specialization) and Their Priorities* (hereinafter - the Programme).

2. The Action Plan was drawn up for establishing the provisions of the implementation of the Priority "Smart Systems for Energy Efficiency, Diagnostic, Monitoring, Metering and Management of Generators, Grids and Customers" of the Priority RDI development area "Energy and Sustainable Environment".

3. The Action Plan shall be implemented in 2015–2020.

4. Concepts used in the Action Plan shall bear the following meanings in this legal act:

4.1. **Active system for monitoring equipment condition** shall mean an integrated system for registering various glitches in the grid and assessing and controlling the impact on the reliability of the operation of equipment.

4.2. **Autonomous grid mode** shall mean disconnection of a part of customers and generators from the common energy system occurring for various reasons and its independent operation by maintaining stable voltage, frequency and power balance.

4.3. **Diagnostic technology** shall mean the evaluation of the impact of actions and glitches affecting the system and the equipment thereof on their technical characteristics by registering various parameters, analysing and systemizing them, also, forecasting resource costs.

4.4. **Fault detection device** shall mean a device used for detecting a fault on the grid by applying special algorithms of the transition process analysis and recognition caused by the fault.

4.5. **Smart building** shall mean a building (object, structure), for the use and maintenance thereof management technology has been installed, linking the buildings structure, its engineering systems, users and functional technologies, global environment, smart grids and future technologic development.

4.6. **Smart grid** shall mean an entirety of systems for the optimum mode control and ensurance of reliability, control of grid element condition and resource use control, customer communication, maintenance of generating sources and grid operators.

4.7. **Distributed generation** shall mean the connection of low power (wind, solar, etc.) electric generators or co-generators into the common energy system.

4.8. **Reliability evaluation technology** shall mean an integrated system including control and forecast of reliability level of equipment and energy transmission lines necessary for efficient functioning of energy market.

4.9. **Grid structure simulation** shall mean fast-functioning digital structure models controlling the grid's operating mode required for solving a task of selecting the optimal grid structure, when it is necessary to evaluate characteristics of the reliability of grid elements and forecast their changes for the ensurance of the efficiency and reliability of smart grid.

5. Other concepts used in the Action Plan shall correspond to concepts used in the Programme.

CHAPTER II
DESCRIPTION OF THE CURRENT SITUATION

6. Increased dependence on imported energy having closed down the Ignalina nuclear power plant, soaring energy prices, obsolete and inefficient energy infrastructure (especially district heating systems, inefficient and aging buildings, old generation lighting systems have an adverse impact on the well-being of population, exacerbate the country's energy independence and energy security problems. Increasing energy prices restrict the international competitiveness of the Lithuanian economy, especially that of industry.

Reduction of energy consumption and evasion of energy loss are one of the most important goals of the European Union, since decreasing energy consumption leads to more economic opportunities opening up. In order to reduce energy consumption and increase the efficiency of the use thereof, it is important to mobilize the public, decision-makers and market participants.

7. The energy market has at least 20 growing knowledge-intensive companies, which create, apply and modernize smart distributed generation, grid and consumer management technologies.

8. The scope of investments of business companies into research and experimental (socio-cultural) development (hereinafter - R&D) projects during 2007-2013 was EUR 0.95 million.

9. According to data of 2011, the Lithuanian producers exported various heating, cooling, metering and control equipment for EUR 47 million.

10. In the implementation of the programmes for the development of integrated centres for science, studies and business (valleys), research centres are being established in various science and education institutions, R&D infrastructure whereof can be used in the implementation of the Priority.

11. The Lithuanian science and education institutions and business companies closely cooperate in participating in the activities of the Modern Home Building Cluster, Smart Technology Cluster, Innovative Energy Supply - Consumption Cluster and "Smart IT" Cluster.

12. The potential of the Lithuanian science and education institutions in the areas of electricity and electronics, computer science, mechanics, construction, measurement engineering, energy and thermal engineering is relatively high, significant progress has already been achieved. Top-level international scientists have been brought together in science and education institutions, who are engaged in R&D activities in areas most relevant to the Priority. The scope of preparing specialists of these areas has been increasing each year.

Challenges and problems expected to be solved in the implementation of the Priority have been relevant for a long time. A significant progress was achieved in support of research from the 2007-2013 European Union structural funds. The national research programme *Future Energy* being implemented since 2010 from the Lithuanian state budget funds, the aim whereof is to solve most relevant scientific problems related to the Lithuanian energy security, increase of energy consumption efficiency and future energy production as well as the improvement of supply technologies and optimum application thereof in the country's energy sector, contributed a lot to this progress. In the

formation of a combination of tools necessary for implementing the Priority, the progress achieved in the area of fundamental research was also taken into account.

In the implementation of the programmes for the development of integrated centres for science, studies and business (valleys), research centres are being established in science and education institutions, the R&D infrastructure present wherein can be used for the activities relevant to the implementation of the Priority. The National Open Access Scientific Centre for Future Energy Technologies in the Lithuanian Energy Institute, also Vilnius University Information Technology Open Access Centre set up on the basis of information technology science potential with the largest and most modern supercomputer in the country can be distinguished among such research centres. Also, Civil Engineering Research Centre operating in the Vilnius Gediminas Technical University, which has brought together researchers working in R&D areas, also tools relevant to the implementation of the Priority, is worth mentioning here. These research centres serve the needs of both the scientific community and the private sector.

The new EU Framework Programme for Research and Innovation *Horizon 2020* provides for public tasks "Safe, Clean and Efficient Energy", "Fighting Climate Change, Efficient Use of Resources and Supply of Raw Materials" in the implementation whereof active involvement of Lithuanian researchers and other specialists is expected. Significant participation of the Lithuanian researchers is also expected in the implementation of such priorities of the *Horizon 2020* programme as "Smart Cities and Communities" and "Energy Efficiency".

Cost-effective and efficient use of energy, reduction of adverse energy impact on the environment are one of the most important challenges and priorities of the country seeking for efficient and sustainable development of the economy. The optimization of the smart systems for energy efficiency, diagnostic, monitoring, metering and management of generators, grids and customers and the installation of related technologies can quite significantly contribute to resolving the above-listed challenges. Research and innovation capabilities are very important for the process of the development of application of energy efficiency principles. The successfully implemented Priority is expected to have a rather significant impact on the implementation and development of principles of cost-effective and efficient energy consumption in Lithuania.

13. In order to implement the Priority, it is very useful to enhance and concentrate R&D resources is such thematic R&D areas as electric and electronic engineering (the creation of smart grid characteristics analysis and management models, devices for the assessment of reliability and condition control, smart metering and lighting tools), construction engineering (assessment of a building's (object's) condition and its life cycle), energy and thermal energy (optimization of sources of energy, especially of renewable and decentralized control and integration into the grid, analysis of the building's energy flow, energy evaluation of system combinations, optimization of energy conversion technologies), computer engineering (creation of data collection, processing, storage and specific communication protocols), mechanical engineering (tests of optimal operating modes of engineering systems), measurement engineering (development of registration measures of short-term high-speed processes). In order to enhance the capabilities of human resources in this area, high-skilled professionals should be prepared (including targeted doctoral and master's study places) in the areas of computer science, energy, electronics and mechanics. In order to successfully implement the Priority, it is also necessary to organize trainings of all participants in the process and to encourage R&D activities of innovative energy technology trends.

CHAPTER III
ALLIGNMENT OF THE ACTION PLAN TO THE IMPLEMENTATION PROGRAMME OF RDI PRIORITIES AND OTHER STRATEGIC LEGAL ACTS

14. The Action Plan contributes to the implementation of the strategic goal and goals provided for in subparagraphs 19.1 and 19.2 of the Programme as well as of the task established in subparagraph 20.1 – to promote R&D and innovation activities, which would allow for greater

diversification of energy sources, reduction of energy prices, cost-effective and efficient use of energy and sustainable change of ecosystems (especially, efficient control of waste, reduction of air and water pollution).

15. Actions of the Action Plan:

15.1. to create and introduce new technologies, products process and methods in the market;

15.2. to promote the creation of knowledge-intensive business, the development of enterprises with huge potential;

15.3. to encourage clusterization, integration into international value creation networks and investments into R&D and innovation;

15.4. to promote cooperation between research and business, transfer of knowledge and technologies with the aim to commercialize R&D results;

15.5. to enhance the potential of science and education institutions and their abilities in the creation and commercialization of knowledge, also, to prepare research and innovation management specialists.

16. In the implementation of the Action Plan, the intension is to contribute to changes, which are expected in the implementation of the National Progress Strategy *Lithuania 2030* approved by Resolution No. XI-2015 of the Seimas of the Republic of Lithuania *On the Approval of the National Progress Strategy Lithuania 2030* of 15 May 2012. Results achieved during the implementation of the Priority are inseparable from the installation of advanced, resource-saving and climate change-mitigating technologies and products in the industrial, energy and transport sectors, thus the Priority will mostly contribute to the implementation of the smart economy creation vision - to achieve energy independence and engage in sustainable development of the use of environmentally friendly resources.

CHAPTER IV
STAGES OF THE IMPLEMENTATION OF THE PRIORITY

17. Measures for the implementation of the Priority have been selected pursuant to the Lithuanian Innovation Development Programme approved by Resolution No. 1281 of the Government of the Republic of Lithuania of 18 December 2013, the National Programme for the Development of Studies, Research and Experimental (Socio-Cultural) Development for 213-2020 approved by Resolution No. 1494 of the Government of the Republic of Lithuania of 5 December 2012 and the implementing legislation thereof.

18. A set of study, R&D and innovation policy measures necessary for the implementation of the Priority has been identified in light of the report *Priority Implementation Signposts* drawn up on 21 February 2014 by international group of independent experts. Pursuant to this report, the following Priority implementation stages can be distinguished:

18.1. the stage of generation of scientific potential critical mass includes activities related to the creation of appropriate environment for the search for new ideas and solutions, development of technologies and prototypes and the readiness to carry out these activities;

18.2. the search for new ideas and solutions includes fundamental research of general and targeted nature necessary for the implementation of the Priority;

18.3. the stage of the creation of technologies and their prototypes includes industrial research and experimental development activities necessary for the implementation of the Priority;

18.4. the stage of introduction into the market includes activities related to introducing new products into the market;

18.5. the stage of generating critical mass of business potential includes activities related to the transmission and dissemination of knowledge and innovation, and the use thereof at large.

19. Actions established in subparagraphs 15.1–15.5 of the Action Plan are implemented by executing the measures set forth in Annex 1 to the Action Plan.

20. Annex 2 to the Action Plan provides for a set of education and RDI policy measures relevant in each Priority implementation stage.

21. Annex 1 to the Action Plan establishes actions and measures implemented given the set of education and RDI policy measures presented in Annex 2.

CHAPTER V
THEMATIC SPECIFICS OF THE PRIORITY

22. The implementation of the Action Plan is aimed at:

22.1. the development of technologies for managing distributed energy generators and controlling characteristics allowing to ensure reliable and efficient functioning of energy systems under market conditions. These are technologies, which will allow for an optimal and reliable management of distributed energy generators and determination (evaluation) of management characteristic parameters important for efficient operation of generator control algorithms, and have an impact on functioning of the entire energy system. These technologies would allow increasing the reliability and efficiency of the energy system, facilitate the integration of distributed generation sources into the energy system and encourage the development of the energy market;

22.2. exploring and developing technologies for the control of stability and quality characteristics of the transition of micro-grids to short-term or long-term autonomous grid mode. These are technologies allowing to identify actions, which will impact the grid mode parameters and characteristics, observe them and, if necessary, change them in order to ensure a stable, reliable and efficient operating mode of autonomous grid, energy quality to consumers and a possibility to participate in the energy market;

22.3. creating technologies for active monitoring of the condition of energy grid equipment, resource cost control, fault prevention and diagnostics. These are technologies allowing to monitor the work of energy equipment, register short-term disruptions and determine the impact thereof on the resource of the equipment, and, based thereon, to foresee an advance replacement of the equipment (replacement time) until it has not yet broken down. These technologies would allow reducing energy grid operating expenses and increasing the reliability of energy systems as well as their operational efficiency and energy quality to consumers;

22.4. the development of technologies and products for detecting a fault in the energy grid, assessing grid reliability, selecting and modelling optimal structure for the grid, effectively managing the smart grid. These are technologies and products, which can help shorten the search of a fault, facilitate the determination of fault reasons, speed up the time for the elimination of faults and improve grid reliability indicators, help carry out the optimal development of the grid assessing the data of measurements and incident registration in order to replace the elements thereof (or install new ones) in a timely manner, thus increasing the reliability and efficiency of the grid;

22.5. creating and installing the technology for diagnosing and auditing the condition (of a structure (building, object). Such technology is necessary for preparing a smart control solution (smart structure) of a specific building. In the implementation of the Action Plan the aim is to create and implement the methodology for diagnosing (along with energy auditing) the condition of technical systems of different structure groups, the algorithm for the application procedures thereof and to select or create appropriate measures for conducting them, also, to prepare laws governing the application of this technology;

22.6. creating and producing efficient systems (heating, ventilation, cooling, lighting) for forming natural microclimate and (or) the components thereof. These are systems, individual equipment comprising them and/or products having a higher general criterion linking energy efficiency, economic and lifecycle rationality and acceptability of environmental protection and comfort;

22.7. creating integrated systems carrying out the functions of simulating, measuring (smart metering), monitoring, data transmission, storage and control of efficient use of energy, water and air on the basis of information and communication technologies. The prepared products and measures would be comprehensively evaluated based on the criteria listed in subparagraph 22.6 hereof;

22.8. creating and installing expert systems for the selection of combinations of measures for modernizing the existing buildings. These are automated management systems of a building supplementing expert systems for the selection of combinations of measures continuously operating on the basis of the analysis of data on actual energy and other resource consumption. The prepared solutions would be comprehensively evaluated based on the criteria listed in subparagraph 22.6 hereof.

23. Successful performance of activities listed in subparagraphs 22.1–22.8 of the Action Plan is inseparable from R&D activities carried out by public and private institutions.

24. Important role in the implementation of the Priority is played by joint initiatives for educational, research and experimental (socio-cultural) development and innovation (hereinafter - joint initiatives), on the basis whereof problems relevant to sectors of economy are planned to be solved conducting R&D activities on topics relevant to the sectors of economy and hoping for the inclusion of private sector entities in the realization of R&D activity results. The implementation of joint initiatives seeks that activities listed in subparagraphs 22.1–22.8 of the Action Plan would allow the following:

24.1. creating mathematical models for optimizing and forecasting ongoing rapid electrical grid mode;

24.2. searching for possibilities for the development of smart energy grid management systems evaluating the existing solutions and technologies;

24.3. creating mathematical models aimed at ongoing and quick forecasting of the distribution of generated capacity and its flows and voltages in the electrical grid;

24.4. searching for the possibilities to improve devices for registering and identifying incidents in the smart grid;

24.5. creating layouts of optimization, development and forecasting systems of smart energy (electrical) grid;

24.6. creating algorithms of systems aimed at ongoing and rapid forecasting of generated capacity and distribution of its flows and voltages in the electrical grid;

24.7. creating and testing prototypes of systems for optimizing and forecasting smart energy (electrical) grid working modes, evaluating reliability indicators;

24.8. creating optimal control models of smart energy system efficiency and distributed generation intended for optimal integration of new, low-capacity generating sources into the energy system;

24.9. creating prototypes of incident detection devices by applying nanosecond process analysis technologies;

24.10. analysing management systems of heat and water supply management technologies and smart energy grids, searching for technologies allowing to increase the reliability and efficiency of these solutions;

24.11. identifying the specifics and potential of Lithuanian electric, heat and water supply companies;

24.12. preparing smart metering system models of heat and water supply networks, selecting technical tools appropriate for that;

24.13. preparing models of smart metering systems of heat and water supply networks, systems of monitoring and management of network accidents and losses, also, of smart grid information management systems, selecting appropriate technical tools, creating operating algorithms of these systems, establishing technical - economic standards;

24.14. creating and testing prototypes of smart metering systems of heat and water supply networks;

24.15. creating and testing prototypes of systems for monitoring and control of heat and water supply network accidents and losses, implementing pilot projects in Lithuanian municipalities and evaluating technical-economic indicators based on the data thereof;

24.16. creating and testing prototypes of information management systems of smart heat and water supply networks, implementing pilot projects in Lithuanian municipalities and evaluating heat and water network efficiency based on the data thereof;

24.17. searching for possibilities for integrating smart system associated with data centre secure data collection, processing, distribution and efficient energy control into the "smart building" and other systems;

24.18. creating smart technical concepts of smart systems in line with data centre secure data collection, processing, distribution and efficient energy management into the "smart building" and other systems;

24.19. creating smart system prototypes intended for efficient data centre energy management;

24.20. reviewing the need for technical system diagnostics for multi-purpose buildings;

24.21. reviewing and evaluating mobile diagnostic systems of the condition of technical systems of a building;

24.22. creating and improving more reliable methodologies for conducting diagnostic procedures of the condition of technical systems of a building, selecting appropriate technical tools;

24.23. creating and testing prototypes of new generation diagnostic procedures and equipment of the condition of technical systems of a building;

24.24. evaluating the need for innovative energy efficient new product prototypes and solutions for the existing or new structure technical (heating, cooling, hot water preparation, lighting, energy accumulation, sewage, etc.) systems and possibilities for the development thereof;

24.25. searching for implemented product prototypes and solutions aimed at developing technical systems of the existing and a new building, possibilities for reuse of the results;

24.26. creating technical concepts of innovative energy efficient new product prototypes and solutions for the existing or new structure technical (heating, cooling, hot water preparation, lighting, energy accumulation, sewage, etc.) system products and prototypes;

24.27. creating and testing innovative energy efficient solutions for the existing or new structure technical (heating, cooling, hot water preparation, lighting, energy accumulation, sewage, etc.) systems, also, prototypes of products for these systems;

24.28. exploring analogous energy efficiency, cost-effectiveness and microclimate condition acceptability expert systems in constant operation, reviewing application markets, evaluating patenting possibilities, searching for possibilities for experimental system development and integration into the "smart city" systems;

24.29. creating models (algorithms) of energy efficiency, cost-effectiveness and microclimate condition acceptability energy systems in constant operation, functioning on the basis of resource consumption and user behaviour analysis, realizing them under real conditions after testing;

24.30. creating prototypes of management systems of a building and building groups adapted for engineering systems, aligning with engineering systems of a structure located in the object, control and consumption metering devices;

24.31. evaluating the overall and achievable integrity level of new generation management system prototypes for a building or building groups.

24.32. searching for possibilities and solutions for mutual integration of smart measuring systems and their integration into the "Smart City" management systems;

24.33. creating layouts of devices for identifying incidents on a grid, searching for the possibilities of application of smart metering in the smart energy grid;

24.34. creating and examining module packages of smart measuring devices, measuring algorithms and their metrological parameters;

24.35. adapting smart metering, control and management systems in the smart grid;

24.36. creating, producing and testing smart measuring and metering device prototypes under operating conditions.

25. The implementation of joint initiatives seeks that activities listed in subparagraphs 24.1–24.36 of the Action Plan would allow the following:

25.1. installing smart energy (electrical) grid efficient management systems with reliability control;

25.2. installing smart grid metering systems smartly accounting for resources supplied to and withdrawn from the grid;

25.3. installing systems for monitoring and management of energy grid accidents and losses;

25.4. installing information management systems of smart energy grids;

25.5. installing smart energy systems with distributed generation sources for efficient management, optimal management systems of electric grid with distributed generation sources, efficient use of small generators in the distribution electrical grid;

25.6. installing smart systems for efficient data centre management in line with secure data collection, processing and distribution solutions at the Lithuania's regional and national level;

25.7. installing new generation mobile systems for remote diagnostics of technical systems of a building;

25.8. installing innovative energy efficient solutions for technical systems of the existing and a new structure (heating, cooling, hot water preparation, lighting, energy accumulation, sewage, etc.), also products for these systems.

25.9. installing, producing and exporting devices for registering incidents on a smart grid, metering, control and management systems related thereto, also, components for identifying faults on the smart grid;

25.10. installing, manufacturing and exporting smart measuring systems aimed for a more efficient management of distributed generation sources and users in the smart energy grid;

25.11. installing energy efficiency, cost-effectiveness and microclimate condition acceptability expert systems, systems for the energy efficient use of a building or a building group, close to the "Smart City" concept in terms of the level of integrity thereof.

26. Subparagraphs 24.1–24.26 of the Action Plan can be amended by crossing out or supplementing the planned activities upon the proposal of the coordination group of the research and experimental (socio-cultural) development and innovation priority implementation formed by Order No. V-576/4-409 of the Minister of Education and Science and the Minister of Economy of 20 June 2014 (hereinafter - the Coordination Group), given the data collected at the time of monitoring and evaluation of the implementation of the Programme and the Action Plan or other reasonable data and proposals.

CHAPTER VI
IMPLEMENTATION OF THE ACTION PLAN

27. Possible sources of the implementation of the Action Plan:

27.1. state budget funds of the Republic of Lithuania:

27.1.1. funds for measures of the 1st priority "Promoting Research, Experimental Development and Innovation" of the European Union structural fund action programme 2014-2020 (hereinafter - the Action Programme), 3rd priority of the Action Programme "Promoting Competitiveness of Small and Medium Enterprises" and 9th priority of the Action Programme "Public Education and Increase of Human Resource Potential";

27.1.2. Lithuanian state budget funds (excluding the European Union structural funds);

27.2. funds of science and education institutions;

27.3. funds of private legal entities;

27.4. funds of the European Union Research and Innovation Programme *Horizon 2020* and other international programmes.

28. A part of funds for measures of priority 1 and priority 9 of the Action Programme are intended for direct support of activities necessary for the implementation of the Priority, thus table presented in Annex 1 provides for a preliminary amount, which is planned to be used for the implementation of the Priority depending on need.

29. A part of funds for measures of priority 1 of the Action Programme unattributed to any specific priorities of priority areas of research and experimental (socio-cultural) development and innovation (smart specialization) (hereinafter - RDI priorities), the results of the implementation thereof can contribute to the implementation of all or the majority of RDI priorities. These measures are marked in the table presented in Annex 1 to the Action Plan with an asterisk.

30. Measures implemented by a part of priority 9 of the Action Programme and the Lithuanian state budget funds are relevant to the entire R&D and innovation system and are not attributed to any specific RDI priorities, but their implementation results can also contribute to the implementation of the Priority. These measures are marked in the table presented in Annex 1 to the Action Plan with two asterisks.

31. Measures of priority 3 of the Action Programme are relevant to the entire system of improving business conditions and assistance for business, but they will indirectly contribute to the implementation of the Action Plan, mainly allowing private sector entities to introduce new products in the market and generating critical business potential mass.

In the implementation of measures of priority 3 of the Action Programme, the plan is to support such activities relevant to the implementation of the Priority as the creation of the design of produce and/or products, installation of high-impact technologies in traditional industries, presentation of produce in international exhibitions and/or fairs, certification of the products and services planned for export, increase of new capacities of production and service provision, development of infrastructure of business incubators, membership in international networks (platforms), increasing awareness of new products and services, and business start-up advice.

32. The plan is to have funds of science and education institutions attracted by supporting activities related to the creation and renewal of education and RDI infrastructure necessary for the implementation of the Priority (by implementing infrastructure projects, co-funding of science and education institutions is expected). These funds are included in the graph “State budget funds and other funds” in the table presented in Annex 1 to the Action Plan.

33. The plan is to have funds of private legal entities attracted by implementing measures, projects executed on the basis whereof are planned to be co-funded by the state; businesses will have to cover a part of the project value using their own funds. These funds are included in the graph “Private sector funds” in the table presented in Annex 1 to the Action Plan.

34. The Priority may be partially implemented by participating in the European Union Research and Innovation Programme *Horizon 2020* and other international programmes. Funds attracted participating in international programmes are not indicated in the table presented in Annex 1 to the Action Plan.

35. The implementation of the Action Plan seeks for quantitative and qualitative results in line with the evaluation criteria set in Annex 1.

36. Deadlines for publishing calls for applications for measures implementing the actions of the Action Plan or for concluding project lists will be planned for in accordance with the plans for publishing calls for applications and concluding project lists prepared by ministries, as provided for in administration rules of 2014-2020 EU fund investment action programmes approved by Resolution No. 1090 of the Government of the Republic of Lithuania of 3 October 2014 *On the Approval of Administration Rules of 2014-2020 EU Fund Investment Action Programmes*.

37. Development of the priority areas of research and experimental (socio-cultural) development and innovation (smart specialization) and the implementation of priorities thereof are coordinated by the Coordination Group.

38. The Programme and the Action Plans of the RDI Priorities are implemented to promote and support interaction and cooperation between business entities and science and education institutions. The promotion of cooperation between business entities and science and education institutions, in accordance with the procedure established by the Ministry of Education and Science and the Ministry of Economy, is implemented by the Agency for Science, Innovation and Technology. The implementation process of the Programme is continuously monitored by analysing and assessing the implementation of the Action Plans of RDI Priorities. Monitoring and assessment of the Programme

implementation, in accordance with the procedure established by the Ministry of Education and Science and the Ministry of Economy, is carried out by the Science and Studies Monitoring and Analysis Center (MOSTA).

39. Infrastructure created and equipment purchased during projects planned to be funded from EU funds or other sources and executed on the basis of education and RDI policy measures set in Annex 1 to the Action Plan shall not duplicate equipment currently possessed by science and education institutions or other public sector entities, except for cases when the capacity of the existing equipment is not enough for ensuring the implementation of the Priority.

40. A list of measures presented in Annex 1 to the Action Plan may be amended in light of the results of the interim evaluation of the Priority implementation planned in 2018, also having assessed the needs of potential executors of the measures.

Annex 1 to the Action Plan of the Priority "Smart Systems for Energy Efficiency, Diagnostic, Monitoring, Metering and Management of Generators, Grids and Customers" of the priority area of research and environmental (socio-cultural) development and innovation (smart specialization) "Energy and Sustainable Environment"

ACTIONS AND MEASURES OF ACTION PLANS, PRELIMINARY NEED FOR FUNDS FOR THE IMPLEMENTATION THEREOF AND EVALUATION CRITERIA

Actions and measures	Preliminary funds, thousand EUR			Institution in charge	Evaluation criteria of actions and measures	Criteria values	
	European Union structural funds	State budget and other funds	Private sector funds			2018	2023
Action 1. To create and introduce new technologies, products, processes and methods into the market:					**Created prototypes (concepts) of products, services or processes within 3 years after the implementation of the project (pcs.)**	**6**	**13**
Measure 1.1. Joint science and business projects contributing to the implementation of smart specialization	2 430	-	-	Ministry of Education and Science	Number of projects jointly executed by business, science and education institutions (pcs.)	2	5
	422	-	382	Ministry of Economy	Number of certified products (pcs.)	2	4
Measure 1.2. Support for the creation or development of the company's RDI infrastructure and implementation of RDI activities ("Intelektas")	4 185	-	3 878				
Measure 1.3. Support for company RDI providing innovation vouchers ("Inovaciniai čekiai")							
Measure 1.4. Support for patenting inventions and design ("InoPatent LT")							
Measure 1.5. Support for precertification of new products and technologies and for conducting tests in laboratories under actual conditions ("Inosertifikavimas")							
Action 2. To encourage the creation of knowledge-intensive business and development of companies having large potential:	1 303	-	145		**New companies having received investments within 3 years after the implementation of the project (pcs.)**	**1**	**2**
Measure 2.1. Support for the provision of innovation consulting services ("Inogeb LT")					Number of companies receiving financial support in some other form than a subsidy (pcs.)	1	3

Measure 2.2. Support to companies engaged in RDI by financial tools (“Technostartas LT”, “Koinvest LT”)							
Action 3. To promote clusterization, integration into international value creation networks and investments in RDI:					**New cluster members within 3 years from the start of the implementation of the project (persons)**	**2**	**4**
					Attracted foreign investments into RDI area by areas of smart specialization within 3 years after the implementation of the project (thousand EUR)	**42 353***	**95 295***
Measure 3.1. Support for cluster operation (“InoKlaster LT”)	1 731	-	1 221		Number of legally binding agreements with international partners (pcs.)	4	10
Measure 3.2. Support for participating in international RDI initiatives (“InoConect LT”)							
Measure 3.3. Support for investments into a cluster (“InoKlaster LT+”)							
Measure 3.4. Support for attracting direct foreign investments in RDI area (“Smartinvest LT”)	5 792*	-	-				
Measure 3.5. Support for direct foreign investments in RDI area (“SmartInvest LT+”)	28 962*	-	32 011*				
Action 4. To promote science and business cooperation, transfer of knowledge and technologies in order to commercialize R&D results:				Ministry of Education and Science	**Business R&D orders executed by science and education institutions (thousand EUR)**	**90,7**	**117,9**
					Revenues of science and education institutions from intellectual activity results (thousand EUR)	**10,0**	**12,5**
Measure 4.1. Creation of the material base intended for the implementation of joint science and business projects and the development thereof in science and education institutions (creation and development of infrastructure of centres of excellence)	8 690*	-	-		Patent applications (pcs.) Doctoral studies conducted together with business entities (number of doctoral students)	2 1	5 2
Measure 4.2. Support for the implementation of R&D activities executed by centres of excellence	11 580*	-	-				
Measure 4.3. Implementation of market-oriented science and business projects through cross-border network	135	-	-				
Measure 4.4. Promotion of commercialization of R&D activity results in science and education institutions	407	504**	-				
Action 5. To enhance the potential of science and education institutions and their abilities to create and commercialize knowledge and to prepare specialists:					**External users from foreign science and education institutions, Lithuanian and foreign business companies having used the renewed open access research infrastructure**	**229,6**	**298,5**

					(funds received from these users (thousand EUR))		
					Number of publications in frequently cited periodicals (pcs.)	**20**	**25**
Measure 5.1. Renewal of RDI and education infrastructure in the areas of smart specialization	52 132*	-	-		Number of researchers working in improved research infrastructure base (full-time equivalents)	39	50
Measure 5.2. Creation and development of the European research infrastructures and Lithuania's integration into the European research infrastructures pursuant to Lithuanian research infrastructure signpost and ESFRI	26 066*	1008**	-		Number of spin-offs created in science and education institutions (units)	2	5
Measure 5.3. Renewal of equipment used in open-access centres by areas of smart specialization	116	-	-				
Measure5.4. R&D activities conducted by the Lithuanian science and education institutions	397	-	-				
Measure 5.5. Subscription of databases necessary for RDI activities	28 960*	-	-				
Measure 5.6. Creation of infrastructure of centres of excellence and parallel laboratories	26 640*	504**	-				
Measure 5.7. Development of information infrastructure for science and education (LITNET)	4 340*	-	-				
Measure 5.8. Attraction of foreign scientists and R&D activities	14 481*	-	-				
Measure 5.9. Promoting activities of innovation and technology transmission centres of science and education institutions	14 480*	-	-				
Measure 5.10. Ensurance of the doctoral study process; doctoral studies, trips, scholarship, R&D, transfer, funds for visits (including foreign doctoral students)	644	62 154**	-				
Measure 5.11. Employment of scientists and other researchers in knowledge-intensive enterprises	2 896*	-	-				
Measure 5.12. Attraction and reintegration of scholars	5 792*	-	-				
Measure 5.13. Student R&D activities	2 317*	-	-				
Measure 5.14. Promotion of post-doctoral internships	7 240*	-	-				
Measure 5.15. Preparation of specialists in smart specialization priority-related study programmes	116	-	-				
Measure 5.16. Development of science popularization system	12 000**						
Measure 5.17. Funding of undergraduate, graduate, integrated and non-degree studies	-	220 032**	-				

Measure 5.18. Support for mobility of Lithuanian and foreign students and teachers	-	3 438**	-				
Measure 5.19. Practical trainings for scientists and other researchers, participation of scientists and other researchers in targeted events of international programmes, participation of Lithuanian researchers in targeted meetings for the preparation of project applications, participation of representatives from Lithuania in the European Union and other international working groups, committees, commissions, related to research and experimental (socio-cultural) development. / Encouragement of participation in H2020	4 503**	258**	-				
Measure 5.20. To ensure funding for R&D activities relevant to the solution of top-level problems strategically important to the public and the state as well as economic development	-	94 314**	-				
Measure 5.21. To support cross-sectoral cooperation in R&D area	-	2 364**	-				
Measure 5.22. To allow researchers to use digital scientific data resources	-	450**	-				

* Funds unattributed to specific priority area of research and experimental (socio-cultural) development and innovation (smart specialization), their implementation results can contribute to the implementation of all or the majority of RDI priorities.

** Funds for measures, which are relevant to the entire RDI system and are unattributed to specific RDI priorities, their implementation results will also contribute to the implementation of the Priority.

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Annex 2 to the Action Plan of the Priority "Smart Systems for Energy Efficiency, Diagnostic, Monitoring, Metering and Management of Generators, Grids and Customers" of the priority area of research and environmental (socio-cultural) development and innovation (smart specialization) "Energy and Sustainable Environment"

A SET OF EDUCATION AND RDI POLICY MEASURES

<table>
<tr><th>Generation of science potential critical mass</th><th>Search for new ideas and their solutions</th><th>Creation of technologies and their prototypes</th><th>Introduction into the market</th><th>Generation of business potential critical mass</th></tr>
<tr><td>Measure 5.1. Renewal of RDI and education infrastructure in the areas of smart specialization</td><td colspan="3">Measure 1.1. Joint science and business projects contributing to the implementation of smart specialization</td><td>Measure 3.1. Support for cluster operation ("InoKlaster LT")</td></tr>
<tr><td>Measure 5.2. Creation and development of the European research infrastructures and Lithuania's integration into the European research infrastructures pursuant to Lithuanian research infrastructure signpost and ESFRI</td><td colspan="2">Measure 1.2. Support for the creation or development of the company's RDI infrastructure and implementation of RDI activities ("Intelektas LT")</td><td></td><td>Measure 3.2. Support for participating in international RDI initiatives ("InoConect LT")</td></tr>
<tr><td>Measure 5.3. Renewal of equipment used in open-access centres by areas of smart specialization</td><td>Measure 5.4. R&D activities conducted by Lithuanian science and education institutions</td><td colspan="2">Measure 1.5. Support for precertification of new products and technologies and for conducting tests in laboratories under actual conditions ("Inosertifikavimas")</td><td>Measure 5.11. Employment of scientists and other researchers in knowledge-intensive enterprises</td></tr>
<tr><td>Measure 5.5. Subscription of databases necessary for RDI activities</td><td colspan="4">Measure 2.1. Support for the provision of innovation consulting services ("Inogeb LT")</td></tr>
<tr><td>Measure 5.6. Creation of infrastructure of centres of excellence and parallel laboratories</td><td colspan="4">Measure 2.2. Support to companies engaged in RDI by financial tools ("Technostartas LT", "Koinvest LT")</td></tr>
<tr><td>Measure 5.7. Development of information infrastructure for science and education (LITNET)</td><td colspan="4">Measure 3.4. Support for attracting direct foreign investments in RDI area ("Smartinvest LT")</td></tr>
<tr><td>Measure 5.9. Promoting activities of innovation and technology transmission centres of science and education institutions</td><td colspan="4">Measure 3.5. Support for direct foreign investments in RDI area ("SmartInvest LT+")</td></tr>
</table>

Measure 5.10. Ensurance of the doctoral study process; doctoral studies, trips, scholarship, R&D, transfer, funds for visits (including foreign doctoral students)	Measure 4.4. Promotion of commercialization of R&D activity results in science and education institutions			
Measure 5.12. Attracting and reintegrating scholars	Measure 5.20. To ensure funding for R&D activities relevant to the solution of top-level problems strategically important to the public and the state as well as economic development	Measure 1.3. Support for company RDI by providing innovation vouchers ("Inovaciniai čekiai")	-	Measure 3.3. Support for investments into a cluster ("InoKlaster LT+")
Measure 5.14. Promotion of internships after doctoral studies	Measure 3.2. Support for participating in international RDI initiatives ("InoConnect LT")			-
Measure 5.15. Preparation of specialists in smart specialization priority-related study programmes	Measure 5.13. Student R&D activities			
Measure 5.8. Attraction of foreign scientists and R&D activities		Measure 1.4. Support for patenting inventions and design ("InoPatentas LT")		
Measure 5.16. Development of science popularization system	-	Measure 4.3. Implementation of market-oriented research and business projects through the cross-border network		
Measure 5.17. Funding of undergraduate, graduate, integrated and non-degree studies		-		
Measure 5.18. Support for mobility of Lithuanian and foreign students and teachers				
Measure 5.19. Practical trainings for scientists and other researchers, participation of scientists and other researchers in targeted events of international programmes, participation of Lithuanian researchers in targeted meetings for the preparation of project applications, participation of representatives from Lithuania in the European Union and other international working groups, committees, commissions, related to research and experimental (socio-cultural) development. / Encouragement of participation in *H2020*				
Measure 5.21: To support cross-sectoral cooperation in R&D area				
Measure 5.22. To allow researchers to use digital scientific data resources				
Measure 4.1. Creation of the material base intended for the implementation of joint science and business projects and the development thereof in science and				

education institutions (creation and development of infrastructure of centres of excellence)				
Measure 4.2. Support for the implementation of RDI activities executed by centres of excellence				