

Programme of applied research, experimental development and innovation in the field of environment - Environment for Life

1. NAME OF THE PROGRAMME

Programme of applied research, experimental development and innovation in the field of environment - Environment for Life (hereinafter "the Programme").

2. LEGAL FRAMEWORK FOR THE PROGRAMME

The Programme shall be implemented pursuant to:

- Act No. 130/2002 Coll., on the Support of Research, Experimental Development and Innovation from Public Funds and on Amendments to Certain Related Acts (hereinafter also "the Act on the Support of Research, Experimental Development and Innovation" or "the Act"), as amended,
- Treaty on the Functioning of the European Union 2012/C 326/01, (in particular Article 107, and, as the case may be, also Articles 93 and 106),
- Commission Regulation (EU) No 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty– Official Journal of the European Union L 187/1 of 26 June 2014 (hereinafter also "the Regulation" or "GBER"), in particular Articles 25, 28 and 29, as amended by Commission Regulation No. 2017/1084 of 14 June 2017;
- Framework for State Aid for Research and Development and Innovation – Official Journal of the European Union C 198/1, 27 June 2014 (hereinafter "the Framework");
- and other related laws and regulations.

The Programme is exempt from the notification requirement of Article 108(3) of the Treaty on the Functioning of the European Union, as it meets the conditions of the Regulation.

This Programme excludes disbursement of individual aid to an enterprise:

- against which, following a decision of the European Commission under which the aid received from a provider from the Czech Republic was declared as illegal and incompatible with the internal market, a recovery order has been issued which is unpaid,
- meeting the definition of an "undertaking in difficulty" as laid down in Article 2(18) of the Regulation.

For enterprises awarded public aid exceeding EUR 500,000 under the Programme, the information on the beneficiary and the aid awarded (to the extent specified in Annex III of the Regulation) shall be published on a central website as provided in Article 9 of the Regulation.

The Programme is in accordance with the National Research, Development and Innovation Policy of the Czech Republic for the period of 2016 - 2020, approved by Resolution of the Government of the Czech Republic No. 135 of 17 February 2016, with the National Priorities of Oriented Research, Experimental Development and Innovation (hereinafter “RDI priorities”) adopted by Resolution of the Government of the Czech Republic No. 552 of 19 July 2012, and it reflects the updated National Research and Innovation Strategy for Smart Specialisation of the Czech Republic (RIS3 Strategy), adopted by Government Resolution No. 634 of 11 July 2016. The Programme is based on the updated State Environmental Policy 2012 – 2020 which was approved by Government Resolution No. 1026 of 23 November 2016, and the Research and Development Strategy of the Ministry of the Environment for the period 2016 – 2030, and other national and ministerial strategies (for more details see point 6 – Programme Focus).

3. PROVIDER

The provider of the funding is the Technology Agency of the Czech Republic.

4. PROGRAMME IDENTIFICATION CODE

For the purposes of registration in the R&D information system, the Programme was assigned a “SS” code.

5. PROGRAMME DURATION AND CALL ANNOUNCEMENT DATES

The programme is proposed to run from 2020 until 2026, i.e. for 7 years.

The call for proposals in applied research, experimental development and innovation (hereinafter “the call for proposals”) to select projects for the programme will be first announced in 2019 with funding starting in 2020. It is foreseen that subsequently calls for proposals will be announced annually from 2020 until 2024.

The maximum length of projects under this programme is set at 7 years (it is different for individual sub-programmes). On average, projects with a duration of 30 months can be expected.

The duration of projects may not exceed the duration of the programme.

6. PROGRAMME FOCUS

The focus of the programme is determined by the State Environmental Policy 2012 – 2020 (hereinafter “the SEP”) which was adopted by the Government in November 2016. To improve the quality of environmental protection in the Czech Republic and to meet the commitments that the Czech Republic has made in this area within the European Union and under international conventions, applied research, experimental development and innovation will focus on priority thematic areas of the SEP, namely protection and sustainable use of natural resources, climate protection and improvement of air quality, improvement of waste management and its utilisation, nature and landscape conservation, and safe and resilient environment, including prevention of natural and anthropogenic hazards and reduction of their consequences.

The focus of the programme reflects the research needs of public administration, including relevant contributory and other organizations, in the implementation of the state environmental policy, the Strategic Framework Czech Republic 2030 and other relevant strategies at the national, regional and local levels.

The programme is focused on the support of projects falling according to Article 25 (2) (b) and (c) of the Regulation and Article 1.3 (e) of the Framework under the category of applied research, the results of which have a high application potential in numerous areas of life of Czech society. The outputs, results and impacts of funded projects will in particular help in identifying real risks for the environment and in proposing effective measures for their prevention or rectification of their effects, thus improving the quality of life of the population in the Czech Republic.

The basis for the focus of this programme is also provided by departmental strategies for various environmental areas, adopted by the Czech government in recent years, namely, in particular, Climate Protection Policy of the Czech Republic adopted by Government Resolution No 207 of 22 March 2017, Strategy for Adaptation to Climate Change in the Czech Republic adopted by Government Resolution No 861 of 26 October 2015, Strategy for protection against the impacts of drought in the Czech Republic adopted by Government Resolution No 528 of 27 July 2017, Medium-term Strategy for Improving Air Quality in the Czech Republic, adopted by Government Resolution No 979 of 2 December 2015, Strategic concept for environmental security 2016-2020 with outlook to 2030, adopted by Resolution of the National Security Council No 11/2016, National Emission Reduction Programme adopted by Government Resolution No 978 of 2 December 2015, Waste Prevention Programme of the Czech Republic adopted by Government Resolution No 869 of 27 October 2014, Waste Management Plan of the Czech Republic for the period 2015 – 2024 adopted by Government Resolution No 1080 of 22 December 2014, State Nature Conservation and Landscape Protection Programme of the Czech Republic adopted in an updated version by Government Resolution No 1497 of 30 November 2009, National Biodiversity Strategy of the Czech Republic adopted by Government Resolution No 193 of 9 March 2016, National Action Plan for Clean Mobility adopted by the Government on 20 November 2015, National river basin management plans drawn up by the Ministry of Agriculture and the Ministry of the Environment in cooperation with the respective river basin management authorities and regional authorities, Plans for flood risk management and others, including the Strategic Framework for Economic Restructuring of the Ústí, Moravian-Silesian, and Karlovy Vary regions, and possibilities for joint funding of projects from European and national sources within calls under synergistic instruments.

With emphasis on the currently most pressing issues and those foreseen in the upcoming period in view of the state and evolution of the environment and relevant policies, the Programme focuses on the following main priorities:

1. Climate - measures for climate protection, mitigation and adaptation to increased extremes in precipitation and temperatures, both in settlements as well as in open countryside

This includes especially climate change scenarios, identification and monitoring of its impacts, research and development of new atmospheric modelling schemes to improve the description of the hydrological and energy cycle of the atmosphere in connection with the needs of the hydrometeorological forecasting and warning service, planning, preparation and implementation of adaptation measures, introduction of mitigation and adaptation measures in individual areas

of economic and social life of the Czech Republic, including research into synergies and antagonism of individual measures. The priority also includes the impact assessment and prognosis of related natural hazards and anthropogenic risks and the possibilities of their prevention in relation to climate dynamics.

The priority is focused mainly on drought, specifically on the so-called meteorological drought and hydrological drought and on the impacts of drought on the quality of human life, the aquatic environment (especially ensuring minimum residual flows rates) and the concentration of its pollution, the functioning of ecosystems and the state of endangered and specially protected habitats and organisms. Related to this is the protection and sustainable use of water resources, rainwater management, reuse of wastewater (especially grey water) and other care for the microclimate in settlements, various measures in urban planning, architecture and construction, use of research and modelling in the field of structure and method of use of agricultural landscape in terms of the effect on the extremeness of climatic parameters and efforts not only to retain water in the landscape but to optimize the overall landscape water regime with emphasis on the restoration of the small water cycle, including proposals for legislative and motivational measures for practical implementation of results of this research.

2. Air protection

Air protection includes reduction of pollutant emissions and minimisation of the negative effects of air pollution on human health and ecosystems, assessment of the impacts of meteorological and anthropogenic processes on emissions and ground-level concentrations of pollutants, and development of pollutant transport models to obtain more detailed spatial information on air pollution distribution as part of air quality assessment and forecasting.

Attention should also be paid to synergies between reducing greenhouse gas emissions and emissions of air pollutants, which means research and development of measures, technologies and practices leading to strengthening of mutual synergies and minimisation of compromises. Development of emission projections and scenarios based on them is also important for the formulation of strategies, policies, programmes and plans, especially with regard to small, fugitive and mobile sources of air pollution.

3. Waste management and circular economy

The priority is the prevention and minimization of waste generation and its negative effects on the environment, increasing the material and energy use of waste while minimizing the environmental impacts, reuse of waste as a substitute for natural raw materials or primary resources, namely through the development and application of new recycling technologies producing outputs of quality comparable with primary raw materials, the development of new efficient energy recovery processes while minimizing adverse environmental impacts, reducing anthropogenic risks in remediation and control of hazardous waste management, fulfilling the principles of circular economy through support of the production phase, eco-design and reparability of products, consumption phase, green public procurement, waste management, market in secondary raw materials, support of eco-innovation, reduction of waste production using the latest techniques, support of waste reuse within the production process and support for waste-free technologies.

4. Protection of water, soil, rock environment and other natural resources

Regarding the **improvement of the state of waters**, it involves mainly the retention of water in the landscape, securing the replenishment of groundwater resources and optimizing the outflow of surface water from the territory of the Czech Republic and achieving good ecological and chemical status of surface waters and good chemical and quantitative status of groundwater, which creates stable conditions for aquatic and water-related ecosystems, while ensuring sufficiently abundant sources of quality water for the sustainable development of society. There is a great need for expert support for groundwater and surface water planning, development and improvement of methodologies for monitoring and evaluation of the quantitative and qualitative status of surface and groundwater bodies, with emphasis on large rivers and dams, reduction of pollution of water resources by agriculture and prevention of new environmental pressures due to non-compliance with the requirements of European directives, such as Directive 2009/128/EC of the European Parliament and of the Council establishing a framework for Community action to achieve the sustainable use of pesticides or Council Directive 91/271/ EEC concerning urban waste-water treatment.

In the field of **protection of soils and rock environment**, priorities include sustainable provision of non-productive functions of soils, mitigation of negative impacts of human activity on soil, comprehensive protection of soil quality and quantity with emphasis on organic matter content, functional diversity of soil organisms and retention capacity, optimization of the availability of nitrogen and phosphorus in ecosystems as a condition for long-term carbon sequestration in soils for sustainable development of agriculture and forestry while improving soil and water quality, quantity of groundwater resources, efficient use of the Czech Republic's raw material resources, development of environmentally friendly technologies for mining, transport and processing of raw materials, and assessment of the risks of radon and geological instability, including the search for new techniques for their detection and elimination.

Technologies related (not only) to energy are also supported, especially with regard to air quality and climate change, but only in those areas that are not yet funded under other programmes supporting applied research, development and innovation. This area includes efficient and environmentally friendly use of renewable energy sources, increasing energy efficiency, efficient use of living organisms in the production of raw materials and energy while maintaining the quality of natural resources and the environment, development of best available techniques and emerging techniques of industrial activities providing a higher level of environmental protection and greater cost savings, development and application of new technologies, materials and products that will reduce the negative impacts of current production processes and that will contribute to improving the environment and the culture of the society's life.

5. Biodiversity, nature and landscape conservation means in particular protection and strengthening of ecological stability of landscape and sustainable management, preservation of natural and landscape values, especially preservation of natural properties (functions) of landscape (ecological stability, soil formation processes, landscape permeability for migration), conceptual landscape planning, restoration of disturbed landscape and creation of cultural (artificial) landscape, conservation of diversity and reduction of landscape fragmentation, protection of biodiversity at the level of communities, species and genetic variability of individuals, increasing the efficiency of nature and landscape conservation targeting particular species and territory, increasing the quality and expertise of the management of special protection areas and Natura 2000 sites in the Czech Republic, prevention of extinction of endangered species, conservation of natural, close-to-nature and valuable human-influenced habitats with characteristic communities, even against the impacts of biological invasions,

development of modern methods and procedures for monitoring and evaluating the state of nature and landscape, including research of gene pool, its protection and recovery, or forensic methods that can be used to combat the illegal trade in endangered species of animals and plants, etc.

6. Environmentally friendly society, safe and resilient environment, specific tools for environmental protection and sustainable development

Support through research is required to improve the quality of the environment not only within settlements, among others by reducing the noise pressure and light pollution, and by a responsible application of the smart cities concept or a sustainable development of regions and municipalities. New methods and solutions are also needed to increase the resilience of cities and communities to the impacts of emergencies (disasters) of anthropogenic and natural origin, to reduce the release of hazardous substances into the environment and minimize the harmful effects of these substances on human health and ecosystems (based on monitoring of biogeochemical and hydrological cycles), for remediation of contaminated sites, stabilization of contaminated areas, and reduction of the contamination by hazardous substances. Further needs include a mix of tools for environmentally and economically effective regulation, increasing the effectiveness of environmental education, training and awareness raising, eco-labelling, certification and other voluntary tools and support for eco-innovation, transition to sustainable consumption patterns, improvement of ecosystem services, improving and creating new applications for the Integrated Warning Services System (IWSS) and the Smog Warning and Regulation System (SWRS), development and verification of technical, methodological and legislative tools for the assessment of anthropogenic impacts on the state of the environment.

It is clear from the above that environmental protection is not a simple sectoral area, but part of the society's life which requires dynamic multidisciplinary applied research, development and innovation so that through a number of partial solutions it becomes possible to achieve the main objective of the Programme as well as the main objectives of both the EU 7th Environment Action Programme (see below) and the State Environmental Policy (SEP).

Projects funded under this Programme will contribute to meeting the objectives of the National RDI Priorities, especially in priority area No 3 Environment for Quality Life, and horizontally also in other priority areas.

Given that environmental protection has not only local effects, but in numerous areas also transboundary and global impacts, it is of utmost importance to acquire new knowledge concerning causes of changes in the environment, as well as their impacts and consequences. The Programme will contribute to ensuring that investment of public funds in applied research, experimental development and innovation in this area will bring economic and societal benefits, lead to new knowledge, procedures and technologies which could be applied in the Czech Republic, and with an important export potential, bearing in mind the global needs of environmental protection.

The Programme constitutes a follow-up to other national programmes devoted to applied research, development and innovation, especially the ending TA CR programmes Epsilon and Competence Centre or the Competence Centre 1, and the TA CR Théta and Kappa programmes, the Země (Earth) programme of the Ministry of Agriculture, the security research and IMPAKT1 programme of the Ministry of Interior and the NAKI II programme of the Ministry of Culture.

It will be possible to use the Programme for synergistic and complementary effects in EU and

other international or bilateral programmes that will be in line with its focus, especially in Horizon 2020 and Horizon Europe.

7. PROGRAMME OBJECTIVE

The objective of the Programme is to bring new solutions in the field of environment, stabilize and expand the knowledge base, which will significantly contribute to ensuring a healthy and quality environment in the Czech Republic and to sustainable use of its resources, will minimize negative impacts of human activities on the environment, including transboundary impacts, thus contributing to improving the quality of life in Europe as well as in the global context.

These solutions will contribute to reducing the impacts of climate change on nature and society, in particular mitigating and preventing the effects of drought, to a reduction of the impact of other meteorological extremes (wind, floods, extreme temperatures), improvement of air and water quality, development of waste management, circular economy and efficient use of raw materials, the protection of natural resources, water, soil and rock environment, the preservation of biodiversity and the improvement of nature and landscape conservation, the development of an environmentally friendly and environmentally resilient and secure society.

Priority will be given to activities that contribute to the achievement of more objectives and that will have a synergistic impact on other desirable activities. Applying this concept of "one activity-more benefits" will maximize synergies and minimize trade-offs, which will have a financial or non-financial expression.

The objective will be achieved through the support of research, development and innovation in the field of environmental protection, focusing on the following three areas:

- support of projects in public interest (see sub-programme 1, chapter 18.1),
- new practices, environmental technologies and eco-innovation with high potential for rapid application in practice (see sub-programme 2, chapter 18.2),
- support for more time- and knowledge-intensive solutions based on longer-term monitoring of social, natural and climate changes (see sub-programme 3, chapter 18.3)

Note: This division corresponds to the structure of the sectoral Théta programme for energy where TA CR is the provider and it follows the same intervention logic.

Projects should cover the needs of environmental protection in the short, medium and longer term, so that research can address more complex topics for which it is not possible to achieve final results in the short term. All types of actors and beneficiaries will be involved - research organizations, public administration, entrepreneurs, non-governmental and other organizations financed from public funds (e.g. schools, social and health services).

The resulting solutions will reduce regulatory complexity and administrative burden of environmental protection, increase the economic efficiency of the protection of environmental components (search for the so-called optimal pollution), increase the competitiveness of companies focused on the development and production of environmental protection equipment and services and expand their export potential. The qualification of the actors of the conducted research and their involvement in international cooperation will increase, the number of young researchers involved in projects will increase, and cooperation will be expanded between the research and the application sphere, which besides the business sphere includes also the public sphere.

Specific objectives of the Programme are as follows:

- 1. Contribute to adaptation to climate change and to the introduction of economically efficient mitigation measures**
- 2. Contribute to improvement of the components of the environment and support the introduction of the principles of circular economy**
- 3. Support resilient and safe society and nature**

Note: Given that environmental solutions bring an effect in the longer term and a "final state" cannot be reached in the given short period of time, the objectives are formulated in the above manner (contribute, support). However, the change in the state will be measurable over time, so it will be possible to assess the success of the programme according to the set indicators.

Specific objective 1, i.e. contribute to adaptation to climate change and to the introduction of economically efficient mitigation measures is focused mainly on the issues of drought, mitigation of its effects on human settlements and nature, water retention in the landscape by methods close to nature, and water supply to the population.

Within the first sub-programme focusing on projects in public interest, the objective is to contribute to the development of a comprehensive, multi-disciplinary approach to climate change issues ("climate package of the Czech Republic") which will include:

- Analytical and prediction tools (including software tools) providing more accurate identification and monitoring of climate change and its impacts as well as the formulation of development scenarios (in the field of inventories and projections of greenhouse gas emissions as well as the impacts of their increased concentration in the atmosphere)
- Development of effective adaptation measures at a local, regional and national scale with emphasis on solutions that are in line with or directly support the principles of nature and landscape protection, including advanced methods for their cost optimization and regulatory impact assessment (RIA). An example is increased infiltration to replenish groundwater supplies or slowing down of surface runoff.

Within the second sub-programme, research will focus on new processes and technologies with emphasis on:

- Research and development of energy efficient technologies and energy saving methods/processes (synergy with specific objective 2)
- Research and development of low emission or zero emission technologies (in terms of greenhouse gas emissions) (synergy with specific objective 2)
- Research and development of technologies with low water use and technologies/processes for water recycling (synergy with specific objective 2)
- Research and development of technologies/processes for water retention in landscape (synergy with specific objective 2)
- Research and development of technologies and processes to optimise microclimate in human settlements (synergy with specific objective 3)
- Research and development of processes for landscape utilisation
- Research and development of new materials and products resistant to expected impacts

of climate change

Under the third sub-programme, research will focus on long-term monitoring and finding of solutions for the protection of climate and air, water, soil, biodiversity and natural habitats. Based on the longer-term research, more comprehensive solutions will be obtained for nature conservation, landscape development, water retention on the territory of the Czech Republic, soil improvement, and reduction of Czech Republic's contribution to climate change.

The desired outcome will be a significant increase in the amount and quality of data and information related to climate change, increased availability of economically viable, administratively practicable and politically feasible procedures to adapt to climate change impacts and increased commercial availability of technologies with minimal climate change impacts.

Specific objective 2 is to contribute to improvement of the components of the environment and support the introduction of the principles of circular economy. This means reducing the impact of environmental pollution on human health and on nature, increasing the efficiency of use of natural resources, and supporting the emergence of a "zero-emission society" with the minimization of energy and material demands.

Under the first and third sub-programmes, attention will be focused on the creation of an integrated system for assessing and managing the quality of environmental components (air, water, soil, landscape, forest, biodiversity, rock environment) and waste. Research will be conducted and methods will be developed especially in the following areas:

- Analytical and prediction tools providing more accurate identification and monitoring of the state of individual environmental components (including impacts of environmental pollution and deteriorated quality of the environment on human health and ecosystems) as well as the formulation of development scenarios in the areas of:
 - balance and projections of emissions of air pollutants and the effects of their increased concentration in the atmosphere and their transfer to other components of the environment, especially to water
 - balance and projections of groundwater and surface water quantity and quality
 - quantitative and qualitative parameters of the state and predicted development of forests and other habitats, soil, landscape, biodiversity and rock environment
 - balance of waste quantity and composition, possibilities of waste prevention, reuse and prediction of further development
- Research and development of effective measures to reduce the pressure on individual components of the environment, to transition to the principles of circular economy, to prevent and reduce waste, as well as to promote its reuse and recycling at local, regional and national scale, including advanced methods of cost optimization and regulatory impact assessment (RIA)
- Research and development of effective measures to reduce the material and energy intensity of national economy, including advanced method for their cost optimization and regulatory impact assessment (RIA), promotion of the principles of circular economy
- Methods for the use of geo-information, remote sensing of the Earth, protection of the rock environment.

Under the second sub-programme, attention will focus on:

- Research and development of technologies with low energy and material intensity, and energy and material saving methods/processes (synergy with specific objective 1)
- Research and development of low emission or zero emission technologies (in terms of emissions of air pollutants); synergy with specific objective 1)
- Research and development of technologies with low water use and technologies/processes for water recycling (synergy with specific objective 1)
- Research and development of technologies with low material intensity and with emphasis on raw materials available in the Czech Republic
- Research and development of zero waste technologies or technologies significantly reducing waste production
- Research and development of new materials and products which will be durable, resistant, repairable and fully recyclable
- Research and development of new recycling technologies and products with high added value and the highest possible share of materials allowing reuse or recycling
- Research and development of innovative technologies increasing the use of secondary raw materials
- Research and development of technologies/processes for water retention in landscape (synergy with specific objective 1)
- Research and development of processes for landscape use

The desired outcome will be a significant increase in the amount and quality of data and information related to the assessment and management of the quality of environmental components, increased availability of economically viable, administratively practicable and politically feasible procedures to achieve adequate quality of environmental components and circular economy objectives, increased commercial availability of technologies and products with minimal impact on the state of the environment and their increased export potential.

Specific objective 3 is focused on supporting resilient and safe society and nature.

This means creating such conditions for the lives of citizens and society that will increase the quality of life of the population and reduce the pressure on the environment. Support will be provided for the concept of smart cities or healthy cities, use of digitization opportunities, and the development of the landscape as a broader context of human settlements. The resilience of nature and landscape to accidental natural phenomena and human failures will be strengthened as well as the use of their services.

The first and third sub-programmes will focus on creating a comprehensive multidisciplinary approach to increase the resilience of human settlements and the landscape to negative effects directly or indirectly related to the state of the environment (including crisis situations), which will include:

- Analytical and prediction tools (including software tools) providing more accurate identification and monitoring of climate change, state of environmental components and negative factors (noise pressure, growing intensity of electromagnetic field) as well as the formulation of scenarios for the development of human settlements and landscape (optimization of traffic within settlements, reduction of air pollution from traffic, new processes and models of behaviour – e.g. car sharing)
- Research and development of effective concepts for the development of human settlements - based on the concepts of "green city", "smart city", "healthy cities",

"regions of the future", including advanced methods for their cost optimization and regulatory impact assessment (RIA)

- Research and development of effective procedures to minimise impacts of extraordinary or emergency events (floods, long-term drought, extreme meteorological phenomena), with the exception of the non-transferable tasks of the security system services involved in the protection of the population, as defined in the Concept of the protection of the population until 2020 with outlook until 2030, and further of calamities linked with forest pests and the spread of invasive animal and plant species
- Research of the links between biodiversity and the natural state of habitats and their resistance to extreme phenomena threatening their use, development and verification of model schemes / land use systems based on the use of natural biodiversity and natural processes
- Research into the genetic composition and variability of species populations and design of procedures for the use of findings in the field of genetics for more effective protection of species biodiversity
- Research and development of procedures against illegal traffic in endangered species of animals and plants, including proposals for their application

Under the second sub-programme, attention will focus on:

- Research and development of environmentally friendly infrastructure systems in human settlements (energy, water, waste, transport, public space), including intelligent management systems
- Research and development of technologies, devices and control systems for application in infrastructure systems of human settlements and in the landscape
- Research and development of products and services with favourable properties which could be applied in human settlements, in the landscape and in nature

The desired outcome will be a significant increase in the amount and quality of data and information related to living conditions in human settlements, landscape formation and use, to the prediction, prevention and mitigation of impacts of extraordinary and emergency events, increased availability of economically viable, administratively practicable and politically feasible procedures to increase the resilience of human settlements (to climate change, environmental pollution and exhaustion of natural resources), and the efficiency of the protection of nature, landscape and biodiversity as sources of human life quality, and increased commercial availability of procedures, technologies and products with minimal adverse effects on the quality of life in human settlements, and the quality of landscape and nature.

8. JUSTIFICATION OF THE OBJECTIVE OF THE PROGRAMME

As mentioned above, in 2016 the government approved an updated SEP, which contains four basic environmentally important areas. Applied research is necessary for their long-term development and financially efficient administration, which is also included in the individual priority areas of the SEP and the corresponding instruments.

Environmental protection, like energy, is a shared responsibility of the European Union and the Member States, which is why the focus of European policy in this area is extremely important for national policy. The orientation of the European policy is currently represented primarily by the 7th Environment Action Programme which should serve to achieve a long-term aim

oriented until 2050 which is a good life of EU inhabitants within the planet's ecological limits, prosperity and healthy environment stemming from an innovative, circular economy, where natural resources are managed sustainably, and biodiversity is protected and restored in ways that enhance our society's resilience, and economic growth is tied to a low-carbon economy. The main aim is supported by three specific objectives, namely sustainable use of EU natural resources, conversion of the EU to a competitive low-carbon economy, and protection of the environment so that its condition and evolution do not endanger the health and well-being of Europeans.

The programme will also make a significant contribution to ensuring the Czech Republic's share in the implementation of the EU Bioeconomy Strategy, updated in October 2018.

The search for completely new or innovated solutions should lead not only to the improvement of the environmental protection and the health of the population, but also to the most economically efficient regulation or to such innovations that will make it possible to avoid regulation in the given area. Within this search, preference will be given to solutions based on electronic communications or digitization, the use of Earth remote sensing and spatial data in general, which will reduce the carbon footprint and environmental impact throughout the life cycle of products, buildings, technologies and techniques.

As mentioned above, the Programme is in accordance with the National RDI Priorities and the National RIS3 Strategy.

9. CRITERIA TO EVALUATE THE ACHIEVEMENT OF PROGRAMME OBJECTIVES

The achievement of the Programme objectives will be evaluated in accordance with the Methodology for evaluating the results of research organizations and evaluation of targeted support programmes for research, development, and innovation valid at the time of the programme evaluation, on the basis of a set of indicators designed to monitor the progress of the programme and evaluate its overall performance and success, or other conditions.

The evaluation will use indicators designed to monitor the programme's progress, performance and success.

Indicator	Value
a) number of supported projects	220
b) share of successfully completed projects	80%
c) number of achieved results/exploitable outputs	520
share of non-public sources for the whole programme	10%

Other indicators will include number and type of beneficiaries and other project partners, number of results, type and number of users of the results:

Indicator	Expected minimum number
Beneficiaries – research organisations	132
Beneficiaries – enterprises	53
Beneficiaries – other natural and legal persons – in sub-programmes 1 and 3	35
Other project partners – research organisations	110
Other project partners – enterprises	85
Other project partners – other natural and legal persons	75
Results H, N, O	370
Results F, G, R, S, P, Z	150
Users of results – public administration bodies	300
Users of results – organisations in public sector (schools, social services, hospitals, cultural institutions, NGOs)	300
Users of results - enterprises	200

10. EXPECTED RESULTS AND BENEFITS OF THE PROGRAMME

The Programme will support especially those projects that are expected to achieve outputs of applied research that will meet the objective of the programme and will be directly applicable to environmental protection, as well as publication results and others with a positive social impact. In view of the different nature of projects in individual sub-programmes and the different time required for their completion, the main types of expected results will also differ, which will be defined according to the Methodology and the Information Register of R&D results (RIV) at the time of announcing the relevant call.

At least one of the results listed below must be achieved no later than in the third year of the project, for shorter projects in the last year of the project and at least one result must be achieved exclusively within the project supported by this Programme. It will be entered into RIV as a separate result of this project. The result of the “O” type is an exception: together with it must be achieved as least one result of the “V” or „V_{summary}“ type, i.e. research report or summary research report.

Other results of applied research, experimental development and innovation will also be welcomed as complementary to the results relevant under the sub-programme.

Results relevant for sub-programme 1:

- P – patent
- G – technically achieved results – prototype, functional sample;

- R – software
- N_{metS}, N_{metC}, N_{metA} – methodology
- N_{map} – specialised map
- H_{neleg} – results projected into guidelines and other non-legislative regulations that are mandatory within the remit of the Ministry of the Environment
- V, V_{summary} – research report
- Z_{polop}, Z_{tech} – pilot plant, verified technology
- S – specialized public database
- H_{leg} – results reflected in legislation and standards
- J_{imp}, J_{SC}, J_{ost} – peer-reviewed expert article
- B – specialised book
- C – chapter in a specialised book
- E_{krit} – organisation of an exhibition with a critical catalogue
- M – organisation of a conference
- O – other results

Results relevant for sub-programme 2:

- P – patent
- G – technically achieved results – prototype, functional sample;
- Z – pilot plant, verified technology
- F – industrial design and utility model
- R – software
- S – specialized public database
- N_{map} – specialised map
- V, V_{summary} – research report
- O – other results

Results relevant for sub-programme 3:

All results of applied research according to the evaluation system approved by the government and valid at the time when the results are submitted to the Information Register of R&D results (RIV) are considered relevant. Exceptionally, a result including the necessary oriented basic research will also be recognized.

In individual calls for proposals, relevant types of results may be further specified (restricted).

Expected benefits of the Programme include increasing the quality and number of results of applied research in the field of the environment so as to increase the international competitiveness of Czech research institutions dealing with environmental issues and improve the usability of research findings for society. The new techniques are expected to contribute to increased competitiveness of businesses and provide them with export opportunities, there will be an increase in the quality of products and services in the environmental field and a reduction in the impact of the use of products and services on the environment.

The expected benefit in sub-programme 1 is mainly an improvement of public administration in the area of environmental protection. Expected benefits of sub-programme 2 include introduction of eco-innovation, new and innovative techniques into environmental protection, or introduction of such technologies, procedures and services that will prevent environmental pollution or will minimize environmental impacts. Sub-programme 3 is mainly expected to bring a more fundamental shift in research and development of promising technologies, techniques

and processes, especially in the areas of biodiversity, protection of natural resources and adaptation to climate change.

Practical application of the research results obtained under this Programme should lead to a reduction in public expenditures on environmental protection or to their better use, and reduce the financial and administrative demands on companies that arise for them as a result of regulations to protect the environment.

Benefits of specific objective 1 (contribute to adaptation to climate change and to the introduction of economically efficient mitigation measures) will include a significant increase in the amount and quality of data and information related to climate change and the decline in biodiversity, increased availability of economically viable, administratively practicable, close-to-nature and politically feasible procedures to adapt to climate change impacts, and increased commercial availability of technologies with minimal climate change impacts. The first two benefits are specifically useful for the Ministry of the Environment

Benefits of specific objective 2 (contribute to improvement of the components of the environment and support the introduction of the principles of circular economy) will be in particular:

- development of an integrated system for the assessment and management of the quality of environmental components (air, water, soil, landscape, forest, biodiversity, rock environment, waste)
- significant increase in the amount and quality of data and information related to the assessment and management of the quality of environmental components
- increased availability of economically viable, administratively practicable, close-to-nature and politically feasible procedures to achieve adequate quality of environmental components and circular economy objectives, and
- increased commercial availability of technologies and products with minimal impact on the state of environmental components and their increased export potential.

The first three benefits are specifically useful for the Ministry of the Environment.

Benefits of specific objective 3 (support resilient and safe society and nature) will be in particular

- comprehensive multidisciplinary approach to increase the resilience of human settlements and the landscape to negative effects directly or indirectly related to the state of the environment (including crisis situations),
- significant increase in the amount and quality of data and information related to living conditions in human settlements, landscape formation and use, to the prediction, prevention and mitigation of impacts of extraordinary and emergency events,
- increased availability of economically viable, administratively practicable and politically feasible procedures to increase the resilience of human settlements (to climate change, environmental pollution and exhaustion of natural resources), and the efficiency of the protection of nature, landscape and biodiversity,
- increased commercial availability of procedures, technologies and products with minimal adverse effects on the quality of life in human settlements, and the quality of landscape and nature.

The first three benefits are specifically useful for the Ministry of the Environment.

11. APPLICANTS AND DEMONSTRATION OF THEIR ELIGIBILITY

Pursuant to the Act, Framework and Regulation, applicants for or beneficiaries of the project funding can be

Enterprises – entities meeting the conditions of Article 2 (2) and (24) of the Regulation, i.e. legal as well as natural persons engaged in an economic activity, irrespective of their legal form which implement the project individually or in cooperation with other partners and which demonstrate the ability to co-finance the project from non-public sources

Research and knowledge-dissemination organisations (ROs) – legal persons meeting the definition pursuant to Article 2(83) of the Regulation and pursuant to the Act which implement the project individually or in cooperation with other partners.

The following are further relevant as main applicants for sub-programmes 1 and 3 (as other applicants for sub-programme 2):

Other natural and legal persons (ONLP) governed by public as well as private law, irrespective of their legal form or method of financing which will carry out activities in the project for which funding is provided outside of the state aid regime, i.e. they are not enterprises.

Potential cooperation between enterprises and research organizations, or other natural and legal persons, may not provide indirect benefits to enterprises through the research organization.

The funding for a project implemented under this Programme may be obtained only by the applicants meeting the eligibility conditions laid down by § 18 of the Act on the Support of Research, Experimental Development and Innovation and by the Regulation. Where several applicants apply jointly for a project, the obligation to demonstrate eligibility applies to all those applicants. Applicants demonstrate their eligibility by documents pursuant to the Act on the Support of Research, Experimental Development and Innovation and in a manner specified by the provider in the call documentation. Compliance with the eligibility conditions will be assessed by the committee for admission of project proposals before evaluation of project proposals. Failure to meet any of the eligibility conditions is the reason for not admitting the project proposal to the call.

12. EXPENDITURE ON THE PROGRAMME

Total expenditure on the programme is expected to amount to CZK 4 460 000 000, of which CZK 3 800 000 000 should come from state budget expenditure on research, development and innovation. This estimated expenditure was determined on the basis of an analysis of absorption capacity and evaluation of existing expenditures on topics in the field of environmental protection and is distributed in accordance with the expected announcement of calls under individual sub-programmes. These expenditures will be allocated within the budget of Chapter 377 - Technology Agency of the Czech Republic within the limits approved to support research and development and innovation for the relevant periods. The share of the Ministry of the Environment in the implementation of the Programme will be provided under Chapter 315 - the Ministry of the Environment without increased demands on the state budget.

At least 50% of the total expenditure of the Programme will be dedicated to research related to climate change (priority 1).

Total expenditure per individual project and enterprise is in accordance with Article 4 of Commission Regulation (EU) No 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty, i.e. GBER.

The allocation (according to state budget expenditure) is divided to individual sub-programmes approximately as follows: sub-programme 1 - 22.5%, sub-programme 2 - 34.1%, sub-programme 3 - 43.4%.

Expenditure on the programme in CZK million:

	2020	2021	2022	2023	2024	2025	2026	Total
State budget expenditure for R&D&I	222.0	422.0	557.0	647.0	707.0	710.0	535.0	3 800.0
Non-public sources (co-funding)	34.0	66.0	90.9	113.4	128.4	128.5	98.8	660.0
Total expenditure	256.0	488.0	647.9	760.4	835.4	838.5	633.8	4 460.0

13. FUNDING RATE

The average funding rate for the whole programme is 85%. The maximum allowable funding rate per project in sub-programmes 1 and 3 is 100%. In sub-programme 2, it is at most 90% if the project is carried out by a research organization independently.

For individual projects, the limits set by the Regulation and the Framework will be followed, with the funding rate, determined as a percentage of project eligible costs, being calculated separately for each project as well as for each beneficiary and other project partner. For enterprises participating in the projects, the conditions are set out in Article 25 (5) and (6) of the GBER. For research organizations, the maximum funding rate is 100%.

The following table shows the maximum allowable funding rates for industrial research, experimental development and innovation by category of beneficiaries.

Beneficiaries	small enterprise*	medium-sized enterprise*	large enterprise*	research organisation**
Category of activity				
Industrial research	70%	60%	50%	100%
Industrial research with effective collaboration or subject to condition of public dissemination of results	80%	75%	65%	100%
Experimental development	45%	35%	25%	100%

Experimental development with effective collaboration or subject to condition of public dissemination of results	60%	50%	40%	100%
Innovation intended for SMEs	50%	50%	0	0
Process and organisational innovation	50%	50%	15%***	100%

Note:

* Small and medium-sized enterprises are defined in Article 2 (2) of the Regulation and in Annex 1 thereto and large enterprise is defined in Article 2 (24) of the Regulation.

** Research organisation is defined pursuant to Article 2 (83) of the Regulation. The stated funding rate is intended for non-economic activities of research organisations pursuant to point 19 and following points of the Framework.

*** Funding for large enterprises for process and organisational innovations is compatible only under the conditions laid down in Article 29 (2) of the Regulation.

Source: Regulation

The typical project holder in sub-programme 1 is a research organisation or other natural and legal persons which are not enterprises. In sub-programme 2, project holders will be enterprises or research organisations. In sub-programme 3, it is foreseen that project holders will be research organisations, with all types of entities (research organisations, enterprises, other natural and legal persons) being other project partners.

14. ELIGIBLE COSTS

Funding will be provided for eligible project costs, i.e. for those eligible costs which are approved by the provider, which are justified and their scale is necessary for the purposes of the project. An applicant may propose as eligible costs only the costs defined in accordance with the Act on the Support of Research, Experimental Development and Innovation, and in accordance with Article 25 (3) (a) (b) (d) and (e) of the Regulation:

- *Personnel costs*: researchers, technicians and other supporting staff to the extent employed on the project; these are personnel costs for
 - Applicant's/beneficiary's employees allocated to the project, i.e. researchers, technicians and other supporting staff to the extent necessary for the purposes of the project;
 - Workers with which the applicant/beneficiary concluded work activity agreement or work performance agreement directly connected with the project;
 - Scholarships of students participating in the project.
- *Costs of instruments and equipment* to the extent and for the period used for the project. Where such instruments and equipment are not used for their full life for the project, only the depreciation costs corresponding to the life of the project are considered as

eligible.

- *Costs of contractual research*, technical knowledge and patents bought or licensed from outside sources under normal market conditions and provided that the transaction took place under conditions of free competition and no irregularity occurred, as well as costs of consultancy and equivalent services used exclusively for the research activity under the given research project.
- *Additional overheads and other operating expenses*, including costs of materials, supplies and similar products, incurred directly as a result of the project.

In the case of innovation aid for small and medium-sized enterprises, the following costs are also eligible under sub-programme 2, subject to compliance with the conditions set out in Article 28 (3) and (4) of the Regulation:

- *costs for obtaining, validating and defending patents* and other intangible assets;
- *costs for secondment of highly qualified personnel* from a research organization or a large enterprise, working on research, development and innovation activities in a newly created function within the beneficiary and not replacing other personnel;
- *costs for innovation advisory and support services*;

Pursuant to Article 29 (3) of the Regulation, in the case of aid for process and organisational innovation, the following costs are eligible under sub-programme 2, subject to compliance with Article 29 (2) and (4) of the Regulation:

- *personnel costs*
- *costs of instruments, equipment, buildings and land* to the extent and for the period used for the project;
- *costs of contractual research, knowledge and patents* bought or licensed from outside sources under normal market conditions;
- *additional overheads and other operating expenses*, including costs of materials, supplies and similar products, incurred directly as a result of the project.

Eligible costs must be proportionate to their purpose and must be incurred in accordance with the principles of economy, usefulness and effectiveness. Any further specification of eligible costs within the above will be part of the call documentation for the given call.

15. INCENTIVE EFFECT

In order to meet the objectives of the programme and the conditions of the Regulation, the provider will assess the presence of the incentive effect of the aid pursuant to Article 6 of the Regulation within the process of evaluation of project proposals. To meet the incentive effect pursuant to Article 6 of the Regulation, works on the project or activity may not start before submission of the application for the aid.

16. METHOD AND GENERAL CRITERIA FOR EVALUATION OF PROJECT PROPOSALS

Project proposals will be comprehensively evaluated by the provider in accordance with the Act. Each project proposal will be evaluated by at least three independent experts. For the evaluation of project proposals received under a call, the provider will set up an expert advisory body.

Proposed general evaluation criteria:

- compliance with the conditions of the call
- the need for the project and its contribution to meeting the objectives of the programme
- expected benefit and quality of project results
- the feasibility and process of project implementation

A detailed method for project proposal evaluation, the scores and threshold values for individual evaluation criteria will be set out in the call documentation for the given call which will be prepared by the provider in cooperation with the Ministry of the Environment. The principles or parameters of cooperation between the Ministry of the Environment and the TA CR are laid down in an annex to the Programme.

A risk of overlaps between programmes of applied research and thus of an inefficient spending of public funds will be prevented by appropriate coordination of programmes within the working group of ministries – providers of funding for applied research and developers of TA CR programmes. The decisive criterion will be the goal (purpose) of the supported research activity and the competence of the ministry in the given area.

In addition to cooperation with other providers, the provider will use data and analytical tools to assess possible duplications, links, complementarities and synergies between different completed projects, including those carried out under the programmes of different providers. Conflicts of interest in the evaluation of projects will be addressed by selecting suitable candidates for the TA CR expert bodies and by the consent of the participants with the TA CR code of ethics.

17. METHOD OF PROGRAMME MONITORING AND EVALUATION

The Programme will be monitored on a continuous basis through collection of information on projects, their implementation and results. The Programme will be subject to a continuous and final evaluation by means of implementation evaluation reports or a report of the programme completion and its results. Three years after the end of financing of projects, an evaluation report will be drawn up on the impacts and usefulness of the funded research.

In the middle of the programme's duration, i.e. in 2023, a mid-term evaluation of the programme will be carried out to evaluate the achievement of the above indicators and the likelihood of achieving the programme objectives.

Projects will be systematically monitored and regularly evaluated. The evaluation will be performed by the provider in cooperation with the expert guarantor of the project on the basis of a report submitted by the beneficiary, or based on a check of the project's progress. The interim evaluation of the achieved results of the project will determine whether the project will continue to be funded, will be limited or stopped. Based on this interim evaluation, a monitoring and evaluation report on the state of implementation will be prepared in cooperation with the Ministry of the Environment. The monitoring and evaluation report will be published on the website of the provider and the Ministry of the Environment.

In view of the nature of the funded projects, special attention will be paid to compliance with the priority needs of environmental protection. The interim evaluation of projects will also assess compliance with obligations and the transfer of information to the R & D Information System (according to § 31 of the Act). During the implementation of projects, the beneficiaries will be inspected in accordance with § 13 of the Act.

An evaluation of project results will be made in the final project report.

Based on its evaluation, the project may fall into one of the following categories:

Category A: the project met the set objectives

Category B: the project has not met the set objectives for reasons that neither the provider nor the beneficiary could have foreseen

Category C: the project failed to meet the set objectives.

In order to close a project, the compliance of the project with the Act will be assessed. Given that the Programme supports applied research projects in terms of their diverse use for environmental protection needs, an evaluation of the possible practical impacts of their implementation will also be an integral part of the evaluation. To this end, before the end of the project the beneficiaries shall submit proposals for the appropriate use of the results according to the nature of individual calls, a plan of possible implementation of the achieved results into practice.

The final project report, as well as the results of interim inspections and proposals for the appropriate use of the results will be used to evaluate the project objectives. The expected societal benefits of the project in the coming years after its completion will be described. Within three years from the end of the project, the project holder will be obliged to provide the TA CR with information on the use of the research result and economic and non-economic impacts on the individual company or society.

The evaluation of the Programme will be carried out after its completion. It will include the evaluation of the results of the projects and their use in practice, if they were completed three years before the end of the Programme. For projects completed in 2025 and 2026, the results achieved will be evaluated, with the impact on society being monitored for three years from the end of the Programme, as described above. The evaluation will cover the specific use of the achieved results, economic and non-financial benefits, impact on economic, social and environmental parameters at the local, regional, national and international level. This information will then be used to comprehensively evaluate the benefits of the public funding.

The evaluation of the Programme will correspond to the requirements of the methodology for the evaluation of targeted support valid at the time of the end of the Programme.

The achievement of change in environmental protection based on research support will be based on indicators that are used to evaluate the State Environmental Policy and are published annually in the State of the Environment Report. If it is not possible to use quantitative indicators, the change will be described qualitatively.

The following are identified as potential risks for the achievement of the Programme's objectives:

- a) Selection and evaluation of projects within the Programme
- b) Lack of interest of the final beneficiary in the results of the projects
- c) Programme's absorption capacity
- d) Changes in legislation
- e) Outages in project financing (e.g. due to provisional budget)

18. SUB-PROGRAMMES

In order to achieve its objectives, the Programme is divided into three sub-programmes, which support and complement each other. A more detailed specification of the focus of individual sub-programmes is set out in the call documentation for the given call.

18.1 Sub-programme 1 – Operational research in public interest

Objective and focus of sub-programme 1

The objective of the sub-programme is to simplify, improve and streamline public administration, improve the management and regulation in the field of the environment, focusing on all three specific objectives of the Programme. For this reason, sub-programme 1 focuses on addressing issues with local, regional and societal impacts, the results of which can be used mainly in public administration (eGovernment, digitization, regulatory optimization, reduction of administrative burdens) and for the creation of strategic and conceptual documents. Sub-programme 1 will therefore support research and development projects in the public interest. Individual calls will be focused on a more narrowly and in a greater detail defined range of topics depending on the urgency of their solution. The Ministry of the Environment will be the exploitation guarantor of the projects.

The first sub-objective in sub-programme 1 is **to increase the efficiency of resource use and reduce environmental pollution**. This encompasses mainly the topics of circular economy, quality and sufficient volume of surface and groundwater, protection and use of soil and rock environment, improvement of air quality, conservation and promotion of biodiversity as a source of ecosystem services.

The second sub-objective of sub-programme 1 is **to reduce the risks arising from insufficient or extensive environmental protection, insufficient adaptation to climate change and its consequences**. The research will deal with the assessment of the impacts of economic activities on the environment, prevention of risks arising from both climate change and economic activities for human health and the environment, adaptation measures in connection with climate change, and reduction of pressures resulting from economic activities on the environment and especially nature.

The third sub-objective of sub-programme 1 is **to increase the quality of life of the population of the Czech Republic, to introduce the prevention of environmental pollution instead of eliminating the consequences of pollution**. This will be mainly about the use of tools for digitization of public administration, creation of environmental knowledge, access of citizens to environmental information, awareness raising in the field of waste prevention, support of educational activities in the field of circular economy, education, tools for development of standards, in particular improving the quality of development of environmental legislation, both at national and European level.

It is expected that 6 calls for proposals will be announced under sub-programme 1, with the first one taking place in 2019 and the last one in 2024. The projects will usually last for 1-3 years, with the projects from the last call lasting not more than 2 years.

Budget of sub-programme 1

The expected funding rate in sub-programme 1 is 95%. The maximum allowable funding rate is 100% of the total eligible project costs. The budget below is shown in CZK million.

	2020	2021	2022	2023	2024	2025	2026	Total
State budget expenditure for R&D&I	42.0	107.0	152.0	152.0	152.0	155.0	95.0	855.0
Non-public sources (co-funding)	2.2	5.6	8.0	8.0	8.0	8.2	5.0	45.0
Total expenditure	44.2	112.6	160.0	160.0	160.0	163.2	100.0	900.0

18.2 Sub-programme 2 – Eco-innovations, technologies and processes for environmental protection

The objective of sub-programme 2 is to contribute, through applied research, experimental development and innovation in the medium and longer term, to such technological changes and changes in techniques (meaning techniques in the sense of best available techniques - BAT – and techniques in nature and landscape conservation) that will serve to fulfil the strategic goals in the environmental sector according to its strategic documents listed in the introduction of the Programme and to meet the three specific objectives of the Programme. Depending on the needs and other circumstances, the exploitation guarantors will be both enterprises and other private entities as well as public administration bodies in the broadest sense of the word.

The projects will focus on environmental technologies and eco-innovations, on innovative approaches which could be applied to mitigate the impacts of climate change, will reflect the protection of natural resources, and will be oriented on current environmental challenges.

The first sub-objective is to support **eco-innovations and technologies in technical protection of the environment**, transfer of technologies, experience and knowledge base from research organisations to companies, especially to small and medium-sized enterprises. The projects will be focused on energy savings, low-emission technologies, efficient use of raw materials and materials in general, new (digital) solutions in construction, transport and in areas where the development of best available techniques (BAT) is expected. In the field of waste management and circular economy, support will be provided for innovative processes introducing circular economy, and in the field of waste prevention, support will go to innovative processes in waste reuse, food waste reduction and waste recycling. Projects contributing to this sub-objective are expected to bring specific improvements of the environment in the area of air protection, water protection, waste management and circular economy, new solutions for climate change adaptation and mitigation, and more efficient treatment of old contaminated sites.

The second sub-objective is to provide **procedures to minimize the risks arising from a poor quality of the environment for people's health, their environment and nature**. To this end, support will be provided to projects aimed at conceptual solutions in municipalities and regions (e.g. healthy cities, smart cities, digitization of public services with a view to

reducing the pressure on the environment), methods for measuring and standardizing procedures in the field of technical protection of the environment, climate and for the conservation of biodiversity.

The projects in sub-programme 2 will serve as one of the inputs for the national programme Environment of the Ministry of the Environment, aimed at supporting eco-innovations.

It is expected that five calls for proposals will be announced under this sub-programme, with the first one taking place in 2019 and the last one in 2023. The projects will usually last for four years, with the projects from the last call lasting not more than three years.

Budget of sub-programme 2

The expected funding rate in sub-programme 2 is 80%. The maximum allowable funding rate is 90% of the total eligible project costs, which will apply in the case of projects implemented independently by research organisations. The budget below is shown in CZK million.

	2020	2021	2022	2023	2024	2025	2026	Total
State budget expenditure for R&D&I	50.0	135.0	220.0	277.0	277.0	222.0	114.0	1 295.0
Non-public sources (co-funding)	12.5	33.75	55.0	69.25	69.25	55.5	28.5	323.8
Total expenditure	62.5	168.75	275	346.25	346.25	277.5	142.5	1 618.8

18.3 Sub-programme 3 – Long-term environmental and climatic prospects

The objective of sub-programme 3 is to support holistic approaches and long-term close-to-nature solutions and technological perspectives in environmental protection in order to meet all three specific objectives of the Programme. Problems will be researched, examined and elaborated in particular through activities of research organizations. There will be among others (usually long-term) projects of applied research (including necessary activities of oriented basic research) where immediate application is not expected and which will support systemic and comprehensive environmental solutions. The exploitation guarantor will in principle be the Ministry of the Environment, or other public administration bodies, and only for some sub-projects potentially also enterprises.

Sub-programme 3 is focused on research topics that in a decisive manner bring a new quality in environmental protection and in the orientation towards long-term stability of society's living conditions and its increased resilience. The topics will be selected in cooperation with the most important partners active in economic sectors, in environmental protection and in public administration or in public sphere, taking into account among others the Czech Republic's commitments resulting from relevant European and global strategies. At present, they include mainly the problems of drought, floods and other impacts of climate change (extreme meteorological phenomena), efficient use of resources or circular economy, waste management, water management, air quality, biodiversity and the social context of environmental protection.

In view of the length of the projects in this sub-programme, significant effects are also expected in the involvement of young researchers (the possibility of involving mainly graduate students and their orientation on issues of environmental protection) and the internationalization of environmental research.

The sub-programme will also make it possible to respond to new environmental challenges that may arise in the course of the programme's duration. Two calls for proposals are expected in this sub-programme, with the projects having the form of “centres of competence” according to a previous TA CR programme, but taking into account the specifics of environmental protection. Projects will run for 6 – 7 years. The first call for proposals will be announced in 2019, and the second in 2020.

Budget of sub-programme 3

The expected funding rate in sub-programme 3 is 85%. The maximum allowable funding rate is 100% of the total eligible project costs. The budget below is shown in CZK million.

	2020	2021	2022	2023	2024	2025	2026	Total
State budget expenditure for R&D&I	180.0	250.0	250.0	250.0	250.0	250.0	220.0	1 650.0
Non-public sources (co-funding)	31.8	44.1	44.1	44.1	44.1	44.1	38.8	291.2
Total expenditure	211.8	294.1	294.1	294.1	294.1	294.1	258.8	1 941.2

19. COMPARISON OF THE CURRENT SITUATION IN THE CZECH REPUBLIC WITH THE SITUATION ABROAD

The research in the area of technical protection of the environment, especially as regards marketable new technologies and their innovations had been supported from 2010 under the Alfa programme and currently it is supported under the finishing Epsilon programme of the Technology Agency of the Czech Republic. Environmental protection themes for social sciences and humanities were addressed in a number of projects under the Omega programme and they are supported also under the TA CR Éta programme. Research needs of public administration in the environmental area were addressed under the Beta programme and are being addressed by the TA CR Beta2 programme. The issues of biodiversity are partly covered by research carried out in the Země (Earth) programme of the Ministry of Agriculture. Other aspects of environmental protection may be covered by a programme of the Ministry of Industry and Trade, and marginally also in programmes of the Ministry of Culture and the Ministry of Interior.

It follows from the above that individual aspects of environmental protection are attached to other themes in projects where the main objective is other than environmental protection. Thus, a holistic approach is missing where quality environment is supported in all its aspects, and where **environmental protection is the objective of the programme, and not an accompanying phenomenon or side effect.**

The synergy and complementarity of the above programmes and the Environment for Life programme will be ensured and potential risks of programme overlaps will be eliminated by the work of a coordinating working group. Relevant ministries and organisations will be asked to participate in this group, i.e. TA CR, Ministry of Industry and Trade, Ministry of Transport, Ministry of Agriculture, with Ministries of Interior and Culture in an advisory capacity. The working group will deal with coordination of thematic areas for calls for proposals in individual programmes so as to avoid overlaps, will propose participants representing their respective ministries in expert groups for the given programmes, and will deal with ambiguities which may arise in TA CR in connection with the implementation of the sectoral programmes. In the event that the members of the working group will not be able to agree among themselves, the issue will be moved to the level of deputy ministers of the relevant ministries (Ministry of Industry and Trade, Ministry of the Environment, Ministry of Agriculture and Ministry of Transport).

In the global context, environmental protection is considered to be one of the three main pillars of sustainable development, together with the economic and social pillars. At present, its decisive expression is the 2030 Agenda for Sustainable Development (SDG - Sustainable Development Goals), adopted by the UN General Assembly in September 2015. The Agenda sets out 17 goals to be achieved by 2030, with environmental issues focusing mainly on human health, resource protection and water use, climate change, resource efficiency and sustainable production and consumption.

In the current EU Framework programme for research and innovation Horizon 2020 (H2020), research for environmental protection is formulated primarily under the societal challenge "Climate action, environment, resource efficiency and raw materials" with a budget of EUR 3.081 billion. SDGs will be addressed in the calls in 2019 – 2020. This area of H2020 has the objective of achieving a resource efficient and climate change resilient economy and society, protecting and sustainably managing natural resources and ecosystems and ensuring a sustainable supply and use of raw materials, in order to meet the needs of a growing global population within the sustainable limits of the planet's natural resources and ecosystems.

H2020 activities are focused on

- climate protection activities – to achieve a resilient society based on low-carbon economy,
- preservation of the natural cultural heritage as a prerequisite for economic growth,
- the use of remote sensing to obtain essential information on climate, energy, natural hazards and other societal challenges,
- close-to-nature solutions to support natural ecosystems and for the use of ecosystem services
- systemic eco-innovations which have economic as well as environmental positive effects

Within the societal challenge “Climate action, environment, resource efficiency and raw materials” in Horizon 2020, there are 24 projects with Czech participation. The research organisations from the Czech Republic which take part in those projects are well known for their long-term work on the issues addressed.

Among the most important are the following projects:

1. GeoERA - Establishing the European Geological Surveys Research Area to deliver a Geological Service for Europe and ProSUM - Prospecting Secondary raw materials in the Urban mine and Mining waste, both projects with the participation of the Czech Geological Survey
2. HiTechAlCarb - New geomodels to explore deeper for High-Technology critical raw materials in Alkaline rocks and Carbonites – with the participation of the Mendel University in Brno
3. UNALAB - Urban Nature Lab, with the participation of the Prague Institute of Planning and Development
4. SIM4NEXUS - Sustainable Integrated Management FOR the NEXUS of water-land-food-energy-climate for a resource-efficient Europe, with the participation of ENKI, o.p.s., a research organisation which was the holder of a similar project from the Centre of Competence programme of TA CR
5. ESMERALDA - Enhancing ecoSystem sERvices mApping for poLicy and Decision mAKing, ERA - PLANET, The European network for observing our changing planet, and ERA - CS, European Research Area for CLimate Services, three projects with the participation of the Global Change Research Institute of the Czech Academy of Sciences
6. ReCiPSS - Resource-efficient Circular Product-Service Systems, with the participation of Masaryk University in Brno
7. MinFUTURE - Global material flows and demand-supply forecasting for mineral strategies, with the participation of Charles University

An informal platform Environment Knowledge Community was set up in 2015 to share new knowledge in the field of environmental protection. The European Environment Agency, based in Copenhagen, is a professional institution that uses the findings of environmental research for their application in EU strategic documents. A long-term tool for supporting innovation, innovative techniques and methods is the LIFE programme. Its budget for 2021-2027 is to be increased by

60% compared to the current situation, mainly to address climate protection. Since 2015, the LIFE programme has supported 15 projects from the Czech Republic, mainly in the field of biodiversity, nature conservation, social tools and impacts of environmental protection.

Given that climate protection ranks among the key themes of EU policy, it is addressed not only in the context of H2020, but also in the research programmes of most EU Member States. It is strongly related to energy, but environmental aspects are also crucial in the management of chemicals, material-efficient production, sustainable farming, etc. As stated at the beginning of this document, environmental protection is a shared responsibility of the EU and the Member States, and at the same time it belongs to the areas with the highest degree of regulation and thus to the greatest sources of incentives for innovations which are not primarily driven by market needs. Environmental protection is a crucial area in which market failures are addressed (market without regulation does not address environmental improvement). This also implies an extensive focus of national research programmes on this area. All countries neighbouring the Czech Republic also have corresponding programmes in various forms. The national programmes always address specific environmental problems of their countries. In the Czech Republic, it is necessary to address both the issue of environmental protection in the Czech Republic and the Czech Republic's contribution to meeting the EU environmental objectives, and the obligations resulting from international conventions.

In the upcoming EU research support programme Horizon Europe, emphasis will be placed on so-called missions, i.e. comprehensive societal challenges translated to a limited number of clusters on which research support should focus. The clusters are based on the UN Sustainable Development Goals (SDGs – 17 goals until 2030) for the fulfilment of which the Ministry of the Environment has a coordinating role in the Czech Republic (see Mazzucato report 2018: Mission-Oriented Research and Innovation in the European Union and analytical report from public consultation on the report from June 2018).