



EN

Horizon 2020

Work Programme 2018-2020

20. Cross-cutting activities

IMPORTANT NOTICE ON THIS WORK PROGRAMME

This Work Programme covers 2018, 2019 and 2020. The parts of the Work Programme that relate to 2020 (topics, dates, budget) have, with this revised version, been updated. The changes relating to this revised part are explained on the Funding & Tenders Portal.

(European Commission Decision C(2020)6320 of 17 September 2020)

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Introduction

This work programme part contains the following cross-cutting calls:

- BUILDING A LOW-CARBON, CLIMATE RESILIENT FUTURE: NEXT-GENERATION BATTERIES
- COMPETITIVE, LOW CARBON AND CIRCULAR INDUSTRIES
- BUILDING A LOW-CARBON, CLIMATE RESILIENT FUTURE: GREEN DEAL CALL

SYNERGIES WITH OTHER FUNDS

Project proposers should consider and actively seek synergies with, and where appropriate possibilities for further funding from, other relevant EU, national or regional research and innovation programmes (including the EU-ETS Innovation Fund, ERDF/ESF+ or the Instrument for Pre-accession Assistance [IPA II]), private funds or financial instruments (including EFSI).

Examples of synergies are actions that build the research and innovation capacities of actors; mutually supportive funding from different Union instruments to achieve greater impact and efficiency; national/regional authorities actions that capitalise on on-going or completed Horizon 2020 actions aimed at market up-take/commercialisation.

In order to explore options for synergies, project proposers could seek contact with national/regional managing authorities and the authorities who developed the Research and Innovation Smart Specialisation Strategies (RIS3)¹. For this purpose the 'Guide on Enabling synergies between ESIF, H2020 and other research and innovation related Union programmes'² may be useful. Horizon 2020 project proposals should outline the scope for synergies and/or additional funding, in particular where this makes the projects more ambitious or increases their impact and expected results. Please note, however, that while the increase in the impact may lead to a higher score in the evaluation of the proposal, the reference to such additional or follow-up funding will not influence it automatically.

OPEN RESEARCH DATA

Grant beneficiaries under this work programme part will engage in research data sharing by default, as stipulated under Article 29.3 of the Horizon 2020 Model Grant Agreement (including the creation of a Data Management Plan). Participants may however opt out of these arrangements, both before and after the signature of the grant agreement. More information can be found under General Annex L of the work programme.

¹ 1.<http://s3platform.jrc.ec.europa.eu/map>

² http://ec.europa.eu/regional_policy/sources/docgener/guides/synergy/synergies_en.pdf

BUSINESS CASES AND EXPLOITATION STRATEGIES FOR INDUSTRIALISATION

This section applies only to the following topics, for which proposals should demonstrate the expected impact by including a business case and exploitation strategy for industrialisation.

- LC-BAT-1-2019: Strongly improved, highly performant and safe all solid state batteries for electric vehicles (RIA)
- LC-BAT-2-2019: Strengthening EU materials technologies for non-automotive battery storage (RIA)
- CE-NMBP-42-2020: Materials life cycle sustainability analysis (RIA)
- CE-SPIRE-01-2020: Tapping into the potential of Industrial Symbiosis (IA)
- CE-SPIRE-07-2020: Preserving fresh water: recycling industrial waters industry (IA)
- CE-SPIRE-09-2020: Alternative mineral resources for high volume production (IA)
- CE-SC5-07-2020: Raw materials innovation for the circular economy: sustainable processing, reuse, recycling and recovery schemes (IA)
- CE-SC5-08-2020: Raw materials policy support actions for the circular economy - Expert network on Critical Raw Materials (CSA)
- CE-SC5-31-2020: Develop, implement and assess a circular economy oriented product information management system for complex products from cradle to cradle (IA)
- LC-SC3-CC-9-2020: Industrial (Waste) Heat-to-Power conversion
- LC-SC3-NZE-5-2020: Low carbon industrial production using CCUS

The business case and exploitation strategy will be evaluated under the 'Impact' criterion:

The business case should demonstrate the expected impact of the proposal in terms of enhanced market opportunities for European enterprises and innovators and enhanced manufacturing capacities in Europe, and thus growth and jobs in Europe, in the short to medium term. It should describe the targeted market(s); estimated market size in Europe and globally; user and customer needs; and demonstrate that the solutions will match the market and user needs in a cost-effective manner; and describe the expected market position and competitive advantage.

The exploitation strategy should be realistic and identify obstacles, requirements and necessary actions involved in reaching higher TRLs, such as

1. Improved material/product robustness and reliability;
2. Matching European value chains;

3. Securing an industrial integrator to adapt the new technologies to industrial scale;
4. Availability of large-scale testing, pilot and manufacturing facilities;
5. Standardisation;
6. IPR and technology transfer;
7. Product approval by regulatory and/or relevant international bodies;
8. User acceptance and the needs of industrial users, including SMEs;
9. Sustainability of financing (after the EU funding).

For TRLs 6-7, a credible strategy to achieve future full-scale manufacturing in Europe is expected, indicating the commitments of the industrial partners after the end of the project (including financial commitments). In the case of demonstrators and pilot lines, the planned use and expected impact from using the final installation should be considered.

Exploitation plans, outline financial arrangements and any follow-up will be developed further during the project.

The results of these activities as well as the further activities envisaged in this respect should be covered by the final report (and intermediate deliverables) of the project.

Contribution to focus area(s)

Focus Area 'Building a low-carbon, climate resilient future' (LC): EUR 1275.00 million

Focus Area 'Connecting economic and environmental gains - the Circular Economy' (CE): EUR 201.50 million

Call - Building a Low-Carbon, Climate Resilient Future: Next-Generation Batteries

H2020-LC-BAT-2019-2020

In the wake of the Paris agreement (COP21), as well as the EU 2020 and EU 2050 targets, there is a need for significant reductions in CO₂ and greenhouse gas emissions in a short time span. Electric batteries are currently seen as important technological enablers to drive the transition towards a de-carbonised society, by integration of renewable and clean energy sources (such as wind energy and photovoltaics) in the electricity grid, and, in particular, by electrification of transport. Energy storage is the common denominator: it includes both electro-mobility and stationary applications despite the different constraints applying to each of these applications in real life.

Electric batteries have recently achieved considerable improvements in terms of their technical performance (such as energy density, power density, thermal stability and durability) and economic affordability. Such improvements are major contributors to the successful introduction of electric vehicles (which are becoming cheaper and have longer range) and of stationary energy storage systems. But for a successful mass introduction of electrified mobility and renewable and clean energy systems with market competitive performances and - in the case of electric vehicles - fast charging capability, substantial improvements of the electric battery technologies are required.

The competitiveness of new advanced energy storage systems or sustainable battery powered vehicles is strongly dependent on the performance and cost of the battery and battery cells and the materials used for the production of the cells. This is especially valid for the fast growing market of electrified vehicles. However, the world production of automotive battery cells is dominated by Asian companies which represent more than 90% of the present world capacity.

It will be very challenging for European companies to catch-up. Europe has to search for better performance, and strongly force the development of more price competitive and sustainable battery storage solutions. Beyond research on improved electrochemistry and new battery materials (e.g. advanced Li-ion, solid-state and post-Li-ion technologies), it is the complete electric batteries value chain and life-cycle that has to be considered, from access to raw material, over innovative advanced materials and nanotechnologies to modelling, production, recycling, second life, life cycle and environmental assessment and skills.

To face the challenge, Vice-President Maroš Šefčovič has initiated in October 2017 the EU Battery Alliance as a joint industry-led initiative to prevent a major technological dependence in batteries cells supply and ensure that European companies capture a significant share of the emerging electric battery market.

The selected topics proposed in this Call cover a relevant spectrum of activities in the field of electric batteries technology: short term research for advanced Li-ion electrochemistry and production processes, short to medium term research for solid-state electrochemistry,

modelling tools, new materials for stationary electric batteries, hybridisation of battery systems, next generation batteries for stationary energy storage, next generation and validation of battery packs and battery management systems, networking of pilot lines and skills development and training.

Large scale research initiative on Future Battery Technologies:

The last four topics in this Call (from LC-BAT-12-2020 to LC-BAT-15-2020) kick-start a large-scale research initiative on Future Battery Technologies that will ensure the European knowledge base in long term battery research. This new large-scale, long-term research initiative was announced in May 2018 as part of the Third Mobility package, with its research activities starting to receive support in 2020 from Horizon 2020³. Such a coordinated long-term effort is essential, given that at the dawn of a new, connected, green era - represented by autonomous vehicles, smart cities, smart grids based on renewable energy sources, drone aircraft, robotic devices, - reliable and safe batteries with ultra-high performance are becoming essential. Novel cross-disciplinary approaches empowered by digital technologies can accelerate research on the next generations of smart, safe and high-performing batteries.⁴ They will provide Europe with a competitive advantage in the fast growing market of electrochemical energy storage and will be key for the development of a world-class European industry capable of addressing the needs of many sectors, including e-mobility and renewable energy storage.

In addition to the COP 21 Paris Agreement and decarbonisation, all topics under this call are in line with the Energy Union policies as well as the SET-plan⁵ and STRIA⁶.

Proposals are invited against the following topic(s):

LC-BAT-1-2019: Strongly improved, highly performant and safe all solid state batteries for electric vehicles (RIA)

Specific Challenge: International developments towards less air pollution and CO2 production are pushing towards a rapid implementation of electrification of transport. In addition, according to market forecasts, a rapid growth of the sales and deployment of battery electric vehicles (BEV) is predicted. Considering the global competition, the rush for better technology implies also the need for a better traction battery technology as a key enabling technology. Europe has to regain its competitiveness in markets that nowadays are dominated by non-European countries. This could occur by developing a new European owned battery technology.

Furthermore, an international tendency of Original Equipment Manufacturers (OEM) is to consider more and more the solid state technology as a solution that could replace the current

³ See https://ec.europa.eu/transport/sites/transport/files/3rd-mobility-pack/com20180293-annex2_en.pdf.

⁴ See Manifesto for a long-term research initiative to create the batteries of our future: <http://battery2030.eu/>

⁵ See <https://setis.ec.europa.eu/>

⁶ See <https://ec.europa.eu/transport/sites/transport/files/swd20170223-transportresearchandinnovationtomobilitypackage.pdf>

Li-ion technology based on liquid electrolytes. The reason is the need of higher energy density, but also of inherently safe batteries.

New chemistries, materials and production technologies have to be developed to strengthen the European industrial base, in line with the EU initiatives as the Strategic Energy Technology Plan (SET Plan) Implementation Plan for Action 7 ('Batteries') and in support of the Šefčovič battery initiative “EU *Battery Alliance*”, to be ready for market deployment by 2026.

This challenge is based on the results of previous calls and stakeholder consultations⁷ and is supplementary to the topic published in the Sustainable Transport Challenge of 2019 on “Next generation of high energy density, fast chargeable lithium ion batteries”.

Scope:

Activities should develop further the current solid state battery technology and present solutions beyond the current state-of the art of solid state electrolytes that are suffering from various issues, e.g. a too high operating temperature, too low ion conductivity, too high impedance of the electrode electrolyte interface, short cycle life and lack of knowledge of suitable production technologies at a competitive cost. The ideal solid state battery and electrolyte would provide a solution for all these shortcomings.

Three dominant categories of electrolyte materials seem to emerge:

- Inorganic electrolyte materials :
 - Inorganic crystalline materials (e.g. perovskites, garnets, sulphides, Nasicon, e.g. suffering from high interfacial resistance and poor interface contacts, problems during cell assembly and/or cycling due to reactivity between solid electrolyte and electrodes);
 - Inorganic amorphous materials (e.g. LiPON, glass oxides).
- Solid polymers/polymeric materials (e.g. polyethylene oxide, PIL, single-ion, e.g. suffering from low ionic conductivity, electrochemical stability, not suitable working temperature, Li dendrites) ;
- All solid state hybrid systems (e.g. suffering from low polymer stability at high voltages, and/or knowledge on details and behaviour of the interface in the composite).

Solid state technology, according to a recent stakeholder proposal, has been classified in 2 sub-generations:

- So called generation 4a with conventional Li-ion materials (as NMC/Si to be developed by 2020-2022) and

⁷ "Innovative batteries for eVehicles Workshop", 12 May 2017, and
"European Battery Cell R&I Workshop", 11 - 12 January 2018, European Commission DG RTD

- So called generation 4b with Li-metal as anode (to be developed by 2025-2030)

This call addresses all three main categories of electrolyte materials mentioned above, and includes also solid state batteries of the so-called "post Lithium-ion" batteries (generation 4a and 4b), as e.g. solid state forms of Li-S or Li-air.

The work should include:

- Cell design;
- Identification of problems and proposals of solutions to overcome issues hampering an optimal function of the specifically proposed electrolyte material(s) at bulk, surface, interface and grain boundary levels;
- In depth interface optimization, characterization and integration, including multiscale modelling which should target in particular problems of the ion transport processes at the interfaces of the solid state battery system;
- Demonstration of suitability to work with high voltage electrode materials, where applicable;
- IP protection and know how creation. A solid analysis and description of the state of the art of specific R&I and the patent situation has to be included.

The developed cells should meet the typical EV operating conditions in a broad temperature range, i.e. 10 to 50 °C. Moreover, the cells should demonstrate negligible loss of charge during lengthy standby periods at sub-zero temperatures. Fast charging requirements of BEV should be met. Cyclability should be suitable for application in BEV.

The choice of the electrolyte to be developed should be duly justified in terms of chances of market success in the coming years. Validation of a pre-industrial prototype in relevant industrial environment should include an assessment of the scale-up potential in view of large scale manufacturability.

The TRL level of the project should start at TRL 3 and reach TRL 6 at the end of the project.

The Commission considers that proposals requesting a contribution from the EU between EUR 6 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- For generation 4a, an energy density >350 Wh/kg and >1000 Wh/l, for generation 4b a higher energy density >400 Wh/kg and >1200 Wh/l ;
- Fast charge rates above 10C with power density values >10000 W/kg as 2030 target;
- Proven safety;

- IPR protection guaranteed and demonstrated;
- Cost euro < 100euro/kWh;
- The European materials modelling capacity and ecosystem should be increased;
- The European battery value chain towards cell production in Europe should be strengthened.

Relevant indicators and metrics, with baseline values, should be clearly stated in the proposal.

The proposal has to do a thorough Life Cycle Analysis cradle to cradle and consider recycling as far as possible.

This work contributes to the work developed in the running EC-EGVIA agreement and to EGVIA related activities of the “Transport Challenges”.

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-BAT-2-2019: Strengthening EU materials technologies for non-automotive battery storage (RIA)

Specific Challenge: Driven by the needs for a cleaner environment and the transition towards a low-carbon competitive economy, deployment of solar and wind energy increases. The respective energy supply will be much more decentralised, resulting in enhanced needs for deployment of large to small scale industrial electricity grids, and in an increased share of electricity produced in private households. Also industry 4.0 with its new less centralised production methods will need a more delocalised energy supply. And more and more small robotised devices dedicated for industry or private households appear on the market that need energy. For all these new technologies and markets, the respective energy storage challenges have to be solved. This can be done by specific batteries, and Europe has to use its knowledge and competitive advantage in advanced materials and nanotechnologies to strengthen the related battery storage value chain and prepare European industry to be competitive in these new markets.

Scope: Proposals should cover the following:

- Develop more price competitive, better performant and highly safe battery storage solutions, with improved lifetime by lowering the cost and capital expenditure through development of less expensive and more performant materials (e.g. novel advanced electrode materials, including nanostructured and 2D materials and electrolytes), chemistries, packaging and cell design and battery component production processes. The progress should make use of the advantages of the existing EU value chain. Synergies with the electrified vehicle battery production sector could be explored;

- Duly consider safety aspects depending on the application, e.g. by consideration of polymer or solid electrolytes for solid-state batteries;
- Sustainable materials and environmental friendly production processes, possible second life applications, and materials that are easily available in Europe, in order to avoid market dependence. Recycling should be inherently possible on a large scale, permitting overall costs that will not hamper market acceptance;
- The new solution and respective output targets (such as cyclability, reliability, usage and lifetime) should be demonstrated and tested where possible in a relevant industrial environment; and developments in the European regulatory framework as well as the impact on industrial standards should be considered;
- To allow comparison with currently existing solutions, a full life cycle assessment covering environmental and economic aspects of the proposed alternatives should be included.

Activities should start at TRL 4 and achieve TRL 6 at the end of the project.

The Commission considers that proposals requesting a contribution from the EU between EUR 6 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: The performance levels of the proposed solution(s) should be in line with those specified in the relevant parts of the SET-Plan.⁸ The new developments should respond to all of the following requirements:

- Enhanced market success of the new more competitive and sustainable technologies, obtained by strong reduction of the cost for stationary applications, below 0.05 €/kWh/cycle; the reduction of cost should be at least 20% in all other cases;
- More competitive products due to increased life time, with a cycle life for stationary energy storage applications that should be clearly beyond the current standards, and reach at least 5000 cycles at 80% Depth of Discharge; and it should be significantly improved with respect to the state-of-the-art in all other cases;
- More sustainable products, with a recycling efficiency beyond currently legal obligations, as established in the Batteries Directive,⁹ ideally beyond 50%, and a demonstrated economic viability.

Relevant indicators and metrics, with baseline values, should be clearly stated in the proposal.

⁸ Action 7 of the SET Plan on "Batteries for e-mobility and stationary storage",
see: https://setis.ec.europa.eu/system/files/integrated_set-plan/action7_issues_paper.pdf

⁹ Batteries Directive, EC/2006/66,
<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02006L0066-20131230&qid=1420631813560&from=EN>

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-BAT-3-2019: Modelling and simulation for Redox Flow Battery development

Specific Challenge: Redox flow batteries (RFB) are considered prime candidates for grid-scale stationary energy storage due to their ability to store large amounts of electrical energy for extended periods and release it quickly when needed. Their extended lifetime and reasonable efficiency are additional benefits. The redox couples and the electrolytes are the most important component in redox flow batteries, as they largely determine system energy density and cost. Currently used RFB rely on metal-based redox pairs that are non-indigenous to Europe, and can be highly corrosive and sometimes toxic. In addition, these systems are mostly water-based, which can potentially result in water electrolysis at high voltage, and membrane cross-over. Mining and extraction of metals can have substantial social and environmental impact. These issues all affect the cell's efficiency, cost, safety and sustainability. The challenge is to identify suitable redox pairs and electrolyte chemistries for low-cost, high-efficiency and sustainable stationary RFB systems that are optimised in terms of redox potential, electrochemical reaction reversibility, chemical stability, solubility and material availability. Since extensive laboratory testing is both time consuming and costly, modelling and simulation is needed to prioritise promising redox species for further analysis and testing. This challenge is in line with the identified priorities in the context of the SET-Plan.

Scope: The objective is to develop mathematical models for numerical simulation and high-volume pre-selection of multi-species electrolyte flow and electrochemistry. Models should allow the characterisation of new chemicals and designs, the related charge, mass and heat transport mechanisms, identifying cell-limiting mechanisms, forecasting cell performance and optimising the design and scale-up. Of particular interest are performances in terms of cell voltage, energy and power density, reliability and cost.

The simulation models should be validated with experimental examples from known chemistries and representative prototypes, and show how new chemistries can be explored.

The Commission considers that proposals requesting a contribution from the EU of up to EUR 2 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: The proposed action should allow to significantly enhance research and engineering processes, and accelerating the search for new non-rare and non-toxic redox couples and electrolytes. These would allow reducing production costs in materials and component development, contributing to optimising the design and performance of full-scale low-cost and environmentally sustainable RFB systems for balancing intermittent renewables on a grid scale. Project results should in the medium to long-term contribute to reach the

targets set in the SET Plan and stimulate investment in the low-carbon energy sector, with the long term aim to boost innovation-driven growth and industrial competitiveness in stationary electrical energy storage.

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-BAT-4-2019: Advanced Redox Flow Batteries for stationary energy storage

Specific Challenge: Redox flow batteries (RFB) are considered prime candidates for grid-scale stationary energy storage due to their ability to store large amounts of electrical energy for extended periods and release it quickly when needed. Key features include their scalability, independent sizing of energy and power rating, room temperature operation and potential long cycle life. However, currently used RFB rely on redox couples that are non-indigenous to Europe, not widely available and therefore relatively costly. In addition, the voltage and energy density that can be achieved in aqueous flow batteries are constrained by undesired water electrolysis and the low solubility of the active species. This challenge is in line with the identified priorities in the context of the SET-Plan¹⁰.

Scope: The objective is to develop and validate RFB based on new redox couples and electrolytes (such as organic or earth-abundant substances) that are environmentally sustainable, have a high energy and power density, maximise lifetime and efficiency, while minimising their cost. Validation of new designs must include testing of full-size prototypes in pilot facilities.

Specific issues to be addressed include:

- Long-term stability of the redox couples under repetitive voltage swings, and their enhanced solubility and reversibility;
- Low membrane resistance (or even membrane-free systems);
- Improved electrode reaction kinetics;
- Upscaling (especially increasing the reaction surface);
- Improved battery control systems;
- Environmental sustainability; and
- Safety aspects (toxicity, flammability).

Since cost is the most important driver for grid scale electricity storage, targets for key performance indicators such as levelised cost of energy (€/MWh), cost per surface power

¹⁰ <https://setis.ec.europa.eu/implementing-integrated-set-plan/batteries-e-mobility-and-stationary-storage-ongoing-work>

density ($\text{€}/\text{Wm}^{-2}$) and capital cost ($\text{€}/\text{kWh}$ of capacity) should be set. "Balance of plant" components should be included in cost optimisation.

The activities are expected to bring the technology from TRL 3 to TRL 5 (please see part G of the General Annexes)¹¹.

The Commission considers that proposals requesting a contribution from the EU of between EUR 3 and 4 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: Project results should contribute to reach the targets set in the SET Plan, putting the energy storage cost on the path to fall below 0.05 $\text{€}/\text{kWh}/\text{cycle}$ by 2030. Overall, the results should stimulate investment in the low-carbon energy sector, with the long term aim to boost innovation-driven growth and industrial competitiveness in stationary electrical energy storage. The proposed action should contribute to accelerating the integration of large shares of intermittent renewables (in particular solar and wind) into the energy system by pushing the boundaries of stationary electrical energy storage.

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-BAT-5-2019: Research and innovation for advanced Li-ion cells (generation 3b)¹²

Specific Challenge: The high growth rate of electrified vehicles (xEV) with substantial unit forecasts is driving the demand for electrochemical battery cells. To achieve a significant market share for European suppliers, global competitiveness for xEV batteries has to be achieved.

For the future it is important that European industry and research have the system knowledge in next generation lithium ion battery technology (generation 3b) covering the full value chain and the capability to provide the most essential parts of them both at cell and at the system levels: the cells and their constituent components (anode and cathode materials, separators, electrolytes), the control and sensor systems and the assembly know how. At the same time competitiveness in terms of performance, safety, cycle and calendar life has to be achieved.

With the intended research the development of a strong European industrial base in this field has to be supported. In addition to this topic, topic LC-BAT-1-2019 of this call addresses solid state battery electrochemistry issues, in a longer term perspective..

¹¹ This topic is complementary to topic LC-NMBP-27-2019 (Strengthening EU materials technologies for non-automotive battery storage), which addresses TRL 4 to 6.

¹² More information regarding definitions (i.e., generation 3b, generation 4, etc) can be found in SET-Plan Action 7, Implementation Plan "Become competitive in the global battery sector to drive e-mobility and stationary storage forward" (page 20).

Scope: The activities will be based on a multidisciplinary approach that includes the system knowledge for the most promising electrochemistries to achieve possible production-readiness by two to three years after the end of the project. The whole system performance for batteries has to be addressed and related monitoring systems / smart management have to be developed (TRL 5-6 achievement at the project end). The advanced performance parameters critical to customer acceptance (low cost per unit of energy and power capacity, safety, resistance to high-power charging, durability), environmental sustainability (energy-efficient manufacturing, recyclability and 2nd life usage) and aspects for large scale manufacturing solutions have to be considered.

At least one of the following bullet points has to be addressed (although a full integration of the three bullet points would provide the best impact):

- Research in cell chemistry, cell morphology & cell architecture to:
 - a) maximise energy and power density;
 - b) reduce critical raw materials (in particular cobalt) use per unit stored energy;
 - c) develop and apply green production processes for cathode, anode and electrolyte materials and coating processes;
 - d) maintain or improve overall system capability (cell, pack and system levels) in terms of critical parameters such as safety, durability (including deeper understanding of degradation in normal and fast charging and discharging and better balancing of low temperature performance and high temperature life time), high power capability (for regenerative braking and fast charging);
 - e) environmental sustainability (energy for manufacturing, recyclability, 2nd life opportunities & design for manufacturing) of chemistries and processes achieve all the above while further reducing cost, particularly by pursuing cost reduction of electrode active materials;
- Development of smart micro-sensors and micro-circuits in/at cells or modules for monitoring and diagnosis of cell status thus enabling a wider operational range according to the requirements (usage profile, life time requirements cycles, temperature conditions) in xEV applications by advanced battery management.
- Development of advanced manufacturing methods and equipments capable of managing thinner material layers, increasing quality and its control and enhancing throughput, thus increasing density and reducing cost.

Any needed modelling can be included, provided that it does not need extensive development and can immediately support the needed design aspects. Longer term modelling efforts are developed in the topic LC-BAT-6-2019.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 to 12 million would allow this specific challenge to be addressed appropriately.

Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: Research and innovation activities will bring European industry to a stronger position on the world market having the technological knowledge and be prepared for a fast implementation to launch competitive next generation Li-ion cell based (3b) mass production in Europe.

The proposed solutions should demonstrate technological readiness and safety through prototypes in accordance to the required TRL levels (TRL 5-6), improving cell-level energy densities of at least 750 Wh/l, and costs lower than 90€/kWh at pack level, with at least 2,5C (preferably 3 or more) fast charging capability while keeping a useful life of at least 2000 deep cycles (with 10% fast charging) to 80% residual capacity.

At least 20% reduction of critical materials with respect to NMC¹³ 8-1-1 at the same energy density.

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-BAT-6-2019: Li-ion Cell Materials & Transport Modelling

Specific Challenge: Europe is strong in research capabilities, the ability to industrialize products and competences in terms of material research related to battery chemistry. However, the step towards large-scale mass production of competitive battery technology (mainly Li-ion / advanced Li-ion) has not been established so far and still requires fundamental research. Especially when moving to cell materials beyond conventional Li-Ion battery for mobility applications, it is no longer possible to rely on classic cell design methodology to achieve the ambitious goals set for cell technology after 2025 (both generation 3b and generation 4). As such, advanced modelling and simulation tools are required that specifically target the electrode and cell level and addressing the fundamental understanding of materials and cell behavior. These tools are vital to support future cell development, but require significant advancements in order to meet this challenge. Not only the material characterization must be considered, but in particular the validation of the models and simulation tools must be of utmost priority.

These efforts will require sufficient prototype manufacturing of cells to measure and validate, and is expected to result in a key cornerstone in the overall framework needed to improve European competitiveness in cell design and manufacture. Via a highly dynamical iterative exchange process between prototyping, simulation and newly developed analytical tools an accelerated development process can be established, leading to a significantly accelerated adoption of new battery technologies to the market.

¹³

Nickel Manganese Cobalt

Scope: Proposals should address all of the following items:

- Advanced modelling approaches based on different physical domains correctly describing the behaviour of micro-structures in advanced Li-ion cell chemistries and 3D structure, but also considering packing conditions under arbitrary usage scenarios. The new model approaches should be able to take into account the behavior, performance and both homogeneous and inhomogeneous/heterogeneous ageing
- Systematic measurements of basic input parameters for modelling (like heat coefficients, diffusion coefficients, conductivity etc.) to establish a reliable data base for these parameters. This may require measurement techniques and methodologies that may not even currently exist, in order to sufficiently confirm that the simulation data, results and predictions to match the actual cell behavior observed (this could also include new measurement tools to monitor changes in electrode structure or cells, for example mechanical stresses, changes in porosity, microstructure) including complete cell behavior (with respect to formation and cycling) needed for the simulation models and future progress with new advanced modelling approaches.
- Manufacture of prototype cells or cell components with distinctive features to allow 1) generating input parameters to initialize the model, and 2) validating the usability of the simulation models and, at the same time, being clearly conform with future industrialization efforts. Cooperation with projects in LC-BAT-5-2019 can provide support to design, manufacturing and sensitization aspects.
- Demonstrate sufficient correlation between cell measurements and simulation, especially for all relevant cell design needs, as well as the validity and robustness of the models for multiple test variations which account for the relatively big state-space of electrochemical systems. (models should not be just optimized for one particular test case, but also show good correlation with valid test variations).

Additionally some specific aspects can be also considered, such as:

- Sensitivity analysis on model parameters to assess governing parameters and model robustness can also be performed to allow an efficient calibration method and experimentation.
- Investigation of tolerances for cell production by means of simulation, study and prediction failure propagation and consequences on ageing and safety.
- Assessment of EOL properties of newly high optimized (>300Wh/kg) developed cell chemistries based on combined simulation / experimental validation approach, referring to automotive standards & requirements.
- Investigation of new methodologies and procedures to shorten the endurance validation of cells, in terms of functionalities, ageing and safety.

For future battery industry collaborative round-table approaches would achieve a considerable gain, bringing together the whole value chain from academia to the OEM. Furthermore, this can bring together representatives from experimental & simulation fields of expertise, exchanging their knowledge via a structured approach.

The activities should thus focus on a multidisciplinary approach from fields of expertise in simulation and experimental field, investigating battery chemistries most relevant for the automotive field in the next 5-10 years and oriented on the specific ERTRAC energy density targets for advanced Li-ion technologies (generation 3b). By means of such a round table approach; at least TRL 5 level or above is aspired. The synergetic development approach by combining simulation and rapid prototyping on the experimental side is expected to speed up the development processes of battery technologies relevant for cell production in Europe, targeting the automotive market.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 to 6 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: The final simulation solution should not increase significantly computing costs and should be compatible with available computing resources in modern engineering workplace, while providing the following benefits:

- Reduce the development time and cost for battery cell up to 30% each.
- Get a better optimum of the design thanks to the analysis based on different physical domains.
- Demonstrate the potential for reduction of number of experiments by factor 3, for the overall development process.
- Reduce battery R&I cost by 20%

It is expected that progress in the area of new and innovative measurement technologies would lead, at some point, to standardized measurement procedures.

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-BAT-7-2019: Network of Li-ion cell pilot lines

Specific Challenge: Awareness of the need for a competitive European knowledge base in Li-ion cell technology and manufacturing processes has led to the establishment of a multitude of non-industrial pilot lines all around the EU, recently. Many of these activities are focussed on highly specific systems or processes, and can each alone hardly keep up with the immense advancements of battery cell production, particularly in Asia. In order to maximize the

benefits of the related investments, mutual exchange of data, expertise, and access rights between these pilot lines would be desirable. Therefore, a network of Li-ion pilot lines shall be built, which should include industrial stakeholders, thus establishing the competencies, value chains, and unique selling propositions of the arising European innovation and production ecosystem for li-ion cell technologies. It will be of particular relevance to jointly develop strategies for scaling up the impact of the network and to support the market access of European cell production companies in view of international competition and standardization. Availability of industrial scale or pilot scale production lines can be challenging within Europe. Li-ion battery is an emerging technology established on know-how of the specific companies. There will be difficulties to having a common approach on pilot production facilities due to information security reasons.

Scope: Proposals should address all the following issues:

- Determine the competence profiles of EU Li-ion battery cell pilot lines regarding technologies, production scale, testing & validation, expertise and specialisation;
- Analyse skill and equipment gaps the pilot lines are suffering from in view of arising technology paradigms and worldwide competition;
- Outline a standardized data exchange platform to further the Li-ion cell production know-how in Europe;
- Develop models for the shared access to the pilot lines and for the collaboration of academia and industry including the access of observers as well as for solutions regarding IPR-management ensuring the ownership of IP within the collaboration;
- Develop a common type of contract for ensuring information security of the pilot lines beneficiaries;
- Identify opportunities for the network to exchange results and to work on energy- and resource efficient production processes;
- Following establishment of the above points, a round-robin of parameter measurements in European Li-ion cell pilot lines who allow external access to compare qualification method and match results and to analyse sensitivity of cell properties to production effects;
- Organize joint workshops and conferences within the network and create platforms for mutual learning and focussed training;
- Develop a roadmap of joint strategies for the network to scale up pilot processes from small batch testing towards processes of industrial dimension. This shall outline recommendations and harmonize actions regarding funding, accelerated technology transfer, IPR, roles and responsibilities as well as for business models;

- Carry out dissemination actions to build the network incorporating public and private stakeholders along the value chain and conceptualize formats to increase visibility of the network.

The Commission considers that proposals requesting a contribution from the EU between EUR 1 to 2 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: The established network of Li-ion cell pilot lines should lead to:

- Further the production of Li-ion cells towards industrial scale in Europe
- Better utilize synergies of mutual collaboration of pilot lines
- Increase the basis of trained Li-ion battery cell experts in Europe
- Ensure fair competition, open source and access within the network and stakeholders
- Establish a Unique selling proposition (USP) for efficiency in Li-ion cell production
- Create visibility of the network
- Accelerate the advancement of innovation in the field.

Type of Action: Coordination and support action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-BAT-8-2020: Next-generation batteries for stationary energy storage

Specific Challenge: Stationary applications such as utility grids and industrial sites require storage applications that have the ability to combine high power and heavy use, going through multiple deep cycles per day, with a long lifetime and maximum safety. In addition, future battery systems should have optimal sustainability throughout the entire supply chain, including the substitution of critical raw materials, second-life, and recycling. Current generation Li-ion batteries, despite their success in e-mobility, may not be the ultimate solution for stationary storage; in addition, the growth of Li-Ion battery market is not enough to meet the demand for stationary and e-mobility applications. Interest in next-generation Li-ion and non-Li-ion batteries (for example molten salt, metal-air, lithium-sulphur, sodium, flow batteries, solid state, new ion-based systems) for these applications is growing, but many fundamental and technological obstacles remain to be overcome. This challenge is in line with the identified priorities in the context of the SET-Plan.

Scope: The objective is to develop and validate or demonstrate innovative next-generation battery technologies for stationary energy storage that have a low cost, high safety, high depth of discharge, and high cycle life and efficiency. Development must include the integration of

sensors and/or battery management electronics in the cell, and the potential for upscaling the battery systems. The battery systems should have optimal sustainability throughout the entire supply chain, including the substitution of critical raw materials. A key issue is the design of an efficient production process with minimal environmental impacts across the whole life-cycle, including recycling. Solutions must be validated or demonstrated in a relevant environment. Since cost is the most important driver for grid scale electricity storage, targets for key performance indicators such as capital cost, storage cost and end-of-life cost should be set. "Balance of plant" components should be included in cost estimates.

The activities are expected to bring the technology from TRL 3 to TRL 5 (please see part G of the General Annexes).

The Commission considers that proposals requesting a contribution from the EU of between EUR 6 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: Project results are expected to contribute to:

- Assure best possible performance and lifecycle for the next-generation battery technologies for stationary energy storage at lowest cost, in particular by putting the energy storage cost on the path to fall below 0.05 €/kWh/cycle by 2030;
- Reduce the pressure on limited natural resources due to longer battery lifespan, improved recyclability and the use of more abundant and less harmful materials;
- Speeding up development and subsequent deployment of batteries for energy storage applications.

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-BAT-9-2020: Hybridisation of battery systems for stationary energy storage

Specific Challenge: Advanced batteries are expected to play a major role in electricity grid management in systems with a high share of renewable electricity. The need for simultaneously providing multiple services (e.g. artificial inertia, frequency regulation, renewables balancing, load levelling, backup power and longer-term energy storage) requires compromises between power needs and energy needs. Hybrid battery systems can provide the ability to optimise power/energy performances by the combination of different technologies. Such hybrid systems would reach better business cases by mixing the contribution to different services and/or products. This challenge is in line with the identified priorities in the context of the SET-Plan¹⁴.

¹⁴

https://setis.ec.europa.eu/sites/default/files/set_plan_batteries_implementation_plan.pdf

Scope: The objective is to develop and demonstrate optimised innovative battery storage systems based on hybridisation. The resulting storage system can be engineered either by the twinning of distinct systems, or internal hybridisation of cells and control systems. Focus should be on cell and stack design, on advanced battery management systems and on high-level, hybrid storage control systems. The hybrid storage systems may for example be optimised for one or more of the following applications:

- Stand-alone provision of services to the interconnected pan-European grid
- Provision of services to island grids
- Provision of services in weak distribution grids
- Provision of services in private grids such as industrial parks
- Provision of load levelling for EV charging service stations.

The activities are expected to bring the technologies from TRL 4 to TRL 6 (please see part G of the General Annexes). The battery systems should have optimal sustainability throughout the entire supply chain, including the substitution of critical raw materials. The systems should be demonstrated in a relevant environment and at a scale that allows future business cases to be developed.

The Commission considers that proposals requesting a contribution from the EU of EUR 3 to 4 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: Increased competitiveness of electrical energy storage by balancing power needs with energy needs, providing a more efficient system with a longer and better performing lifespan, and by optimising balance-of-plant and installation costs. Project results should put the energy storage cost on the path to fall below 0.05 €/kWh/cycle by 2030.

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-BAT-10-2020: Next generation and realisation of battery packs for BEV and PHEV

Specific Challenge: To accelerate the mass market take-up of battery electric vehicles (BEV) and plug-in hybrids (PHEV), it will be necessary to increase the density of battery packs in terms of weight and package space in order to improve range and decrease weight. Moreover, shorter charging times for BEVs through high-power charging will enable travelling over longer distances, imposing further challenges on cooling needs. Higher performance of battery pack raises safety issues which require more robust and flexible advanced Battery Management Systems (BMS).

Besides research on advanced electro-chemistries and cell manufacturing, which are not part of this topic, the integration of battery rechargeable cells into battery packs plays an important role. However, the manufacturing of battery primary cells and their electrochemistry influences their shape and thermal behaviour and hence also the way how they can be integrated into modules and battery packs.

Advanced concepts of BMS relating to hardware and software enabling cell/module/pack communication need to be developed in order to maximise the performance of the final battery system used in vehicles. When aiming at large-scale production of high-density battery packs, manufacturing processes of modules, and their easy and efficient integration into packs need to take into consideration the choice of materials and requirements related to safety, quality, and fast and cost efficient fabrication.

Scope: Proposals will have to address all of the following technical areas for passenger car applications (developed module concept scalability to delivery vans, heavy duty vehicles or busses would be beneficial, but not obligatory. Same applies to concept transfer between BEV and PHEVs):

- Design of advanced battery packs and systems satisfying lightweighting, crashworthiness, electrical and thermal requirements using advanced lightweight materials improved packaging, integration and modularity while considering aspects of ecodesign for manufacturing and dismantling (including their automation), reuse (second life) and recycling/sustainability, leading to a global LCA improvement.
- Development of specific solutions and processes for the sustainable dismantling and recycling of battery pack/modules and their materials, components and sub-systems taking into account safety and automation.
- Flexible advanced battery management systems capable of being used on different types of packs and mid-sized vehicles with different use patterns, and underlying provision to be used in second life applications.
- Advanced functionalities of battery management systems to enable control of modules and packs and their remote maintenance and troubleshooting, software updating and other functions. Safety and modularity aspects must be taken into account when increasing battery pack energy density. In addition, health and environmental aspects of advanced battery pack materials shall be considered over the lifecycle including cases of failure, and reuse/recycling.
- Development of high voltage systems compatible with high-power ultra-fast charging and related implications, including high and low temperature charging, insulation, advanced models (including for instance data mining and big data on existing databases) for monitoring thermal state and estimation of application-dependant State of Health (i.e. in first and second use).

- Development and qualification of future performance-related test procedures of developed functionalities under real-world conditions, incl. extreme environmental conditions.
- Concept validation of battery performance functionalities at full scale should be demonstrated through pack integration into an existing vehicle (no vehicle development can be included in claimed costs) which should also serve as a benchmark of achieved performance.
- Development and qualification of future safety related test procedures e.g. venting/management of gases, battery failure warning signals, thermal propagation.

The combination of achieved improvements with new components and functionalities on the vehicle and infrastructure sides coming from topics LC-GV-01-2018, LC-GV-02-2018 and LC-GV-03-2019) should allow the development of new concepts for affordable FEVs which enable long duration trips (e.g. 700-1000km day trips across different Member States) with not more than respectively 60-90 minutes additional travel time in comparison with ICE vehicles and without additional degradation impact on the FEV powertrain including the battery when used for max 10% of the charging events.

The Commission considers that proposals requesting a contribution from the EU of between EUR 8 and 10 million would allow the specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Considerably improved performance of the EV through reduced battery system weight by 20% at constant electric vehicle range for mid-size battery electric car.
- Overcome the uncertainty of range by achieving 25% shorter recharging time with a 150kW charger compared to best in class electric car available on the market in 2018. The demonstrator must have the same battery capacity as the reference car and meet the useful battery life mentioned below.
- Improved attractiveness of the EV through achieving extended useful battery life to 300 000 km in real driving¹⁵ referring to a mid-size passenger car using improved battery management, balancing and thermal management during high-power charging/discharging.
- Contribution to Circular Economy goals through a minimum 20% Life Cycle Analysis improvement compared to existing products.

¹⁵

A realistic driving cycle like WLTC can be used, adding simulated heating, defrosting and cooling consumption along the year and slow-medium charging for normal use plus a group of two consecutive fast charges to 80% every 6.000 km and one fast charge to 80% every 2000km.

- Considerably improved knowledge on module and pack sensorisation and thermal management.

Type of Action: Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-BAT-11-2020: Reducing the cost of large batteries for waterborne transport

Specific Challenge: Large battery packs are increasingly deployed to improve the efficiency and to eliminate emissions from waterborne transport. However waterborne transport batteries can be up to ten times more expensive than an automotive battery of equivalent capacity and their high cost is an important barrier to increasing the deployment of both hybrid and fully battery electric shipping. Unlike for other transport modes, the space, weight and consequently power density of waterborne transport batteries is usually of secondary importance within the systems total life cycle cost. Several factors contribute to the cost difference including production processes, safety certification, fire suppression, lower economies of scale and higher assembly costs. The challenge is to substantially reduce the cost of large waterborne transport battery systems and cells for both marine and inland waterway transport applications.

Scope: Proposals can address either the battery cell or the battery system (racks, battery management system, fault detection and any integrated fire suppression) or both the cell and battery system.

All of the following aspects should be addressed:

- With respect to waterborne transport, research and develop a large battery system and/or specific battery cells that are substantially cheaper on a total cost basis with respect to existing system.
- Work should be applicable to battery systems of at least 1 MWh capacity.
- Prove the technology and manufacturing processes through system trials and testing.
- Address production process efficiency.
- Address the requirements for type approval from relevant authorities including a comprehensive risk based safety assessment.
- Development of a marine battery certification methodology with the objective of: validating and verifying safety (with consideration of air, liquid or passive cooling), including the standardisation of test methods and tools for certification cost reduction.
- Considering of different vessel types, address the integration of battery systems into Energy/Power management system of vessel.

- Undertake a cost benefit analysis to convincingly demonstrate the cost savings in comparison to current state of the art waterborne battery technology.
- Assess end of life and disposal strategies.
- Develop a convincing business case and consider potential financing models.

The Commission considers that proposals requesting a contribution from the EU of between EUR 8 and 12 million would allow the specific challenge to be addressed appropriately.

Expected Impact: The principal impact should be to substantially reduce the lifetime cost of large waterborne battery systems and to enhance the competitiveness of European industry within the waterborne battery market. Cut greenhouse gas emissions from waterborne transport. Increase the European skills base in large battery technology and manufacturing processes. Support European jobs and growth. Increase confidence in waterborne battery technology investment. Speed up the transition of most short range freight and ferry services towards zero emission.

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

A large-scale research initiative on Future Battery Technologies

The last four topics in this Call (from LC-BAT-12-2020 to LC-BAT-15-2020) implement a large-scale research initiative on Future Battery Technologies, as announced in May 2018 as part of the Third Mobility Package¹⁶. It aims to ensure the European knowledge base in long term battery research. The topics tackle long-term research challenges expected to result in 'game changing' impacts on future battery technologies paving the way for providing a technological competitive advantage to the European battery industry. Because of their ambition, their scale and their interdisciplinary nature, these challenges can only be realised through a long-term, coordinated and sustained effort at European level, by building on large scale research cooperation across academia and industry and with other research initiatives at regional, national and European level, and by mobilising Europe's best researchers around an ambitious research agenda¹⁷. Note that a further topic in this work programme part, CE-NMBP-41-2020, calls for an ERANET Cofund action, including for fostering synergy between European, national and regional initiatives and promoting broader partnerships between the European stakeholders in future battery technologies.

Proposals are invited against the following topic(s):

¹⁶ See https://ec.europa.eu/transport/sites/transport/files/3rd-mobility-pack/com20180293-annex2_en.pdf

¹⁷ See Manifesto for a long-term research initiative to create the batteries of our future: <http://battery2030.eu/>

LC-BAT-12-2020: Novel methodologies for autonomous discovery of advanced battery chemistries

Specific Challenge: The performance and durability of existing batteries are limited due to insufficient knowledge in managing the complex and dynamic processes taking place in the materials and in particular at the interfaces/interphases within the battery cell. The long-term challenge is to integrate advanced multi-scale computational modelling, materials synthesis, characterization and testing to perform closed-loop autonomous materials findings and interphase engineering that would accelerate by at least a factor of 5 the discovery of new battery chemistries with ultra-high performances.

Scope: The target is to develop a pilot materials platform for computational and experimental material characterization that would pave the way towards the development of a full-scale autonomous battery Material Acceleration Platform (MAP) enabling closed-loop materials discovery, automated characterization, device-level testing and addressing aspects related to manufacturability and recyclability. The pilot MAP should deliver a blueprint of the targeted autonomous material discovery platform that could demonstrate key features such as: the ability to use modeling, simulation and machine learning techniques to determine optimal materials composition, the ability to autonomously direct an automated material synthesis robot in optimizing selected battery materials and the ability to perform autonomous analysis and interpretation of experimental data and of deriving previously unknown structures and compositions. The pilot MAP should demonstrate the potential of this novel approach on a specific test case targeting the optimization of specific advanced or emerging battery chemistries. It should be sufficiently flexible to be adaptable for future disruptive battery chemistries, concepts and technologies and for integrating aspects like manufacturability, ageing, degradation and recycling of importance to the entire battery lifecycle. Proposals should be specifically targeting battery interfaces such as the Solid Electrolyte Interphase and the Cathode Electrolyte Interphase that are critical for the battery functionality, as well as controlling their formation, composition and morphology.

The Commission considers that proposals for Research and Innovation Actions of a 3-year duration and requesting a contribution from the EU up to EUR 20 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals of another duration and/or requesting other amounts.

The project partners shall make provisions to actively participate in the common activities of the large scale research initiative on Future Battery Technologies and in particular: coordinate technical work with the other selected projects under topics LC-BAT-13-2020 and LC-BAT-14-2020; and contribute to the activities of the Coordination and Support Action defined under the topic LC-BAT-15-2020. In particular, the project partners will need to conclude a written collaboration agreement with the other projects selected from these topics as indicated in the Grant Conditions.

Note that special Grant Conditions will apply for projects granted under this topic. Please see under Call Conditions.

Expected Impact:

- Demonstrate a fundamental paradigm shift in the materials discovery process for clean energy materials, yielding to a significant acceleration in the development cycle for future battery materials and technologies, which cannot be achieved using conventional Edisonian type trial-and-error approaches.
- Demonstrate the potential to achieve a 5-10 fold acceleration in the materials discovery process, e.g. through a reduction in the number of required experimental trials.
- Demonstrate the ability to improve the performance of the selected battery interfaces with the developed methodologies.

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-BAT-13-2020: Sensing functionalities for smart battery cell chemistries

Specific Challenge: Today, battery performance monitoring and control basically takes place only at the module or battery pack level via a battery management system (BMS). To gain a full supervision and thus control of the battery system and to increase their quality, reliability and life (QRL), it is necessary to monitor in operando the battery performance and control of their state of health (SoH), state of charge (SoC), state of energy (SoE), state of power (SoP) and state of safety (SoS). The challenge is to incorporate smart functionalities into the battery cell for following in time and space different relevant cell component parameters such as temperature variations, interface and interphase dynamics, structural changes by the integration and development of various sensing technologies so as to facilitate control of individual cells within the battery system.

Scope: The target is to develop a proof of concept for the establishment of successful sensing technologies capable of monitoring changes within a battery cell under various operation conditions, including their use under extreme weather conditions, as a first step towards the development of a wider range of sensing technologies capable of monitoring of cells from various emerging battery chemistries. The proof of concept should focus on the sensing technologies and the integration of sensors in liquid electrolyte cell technologies since it is deemed to be the technology of choice for short to medium term. Proposals should aim at smart functionalities incorporated into the battery cell and relying on the integration and development of various sensing technologies to transmit information out of the cell, in order to facilitate control of individual cells within the battery system. Sensors could be used to simultaneously measure with high sensitivity and resolution changes in multiple parameters, such as chemical composition, strain, temperature, pressure, and concentration of dissolved cations, and this at various locations and for diverse components within the cell, under different use cases, especially during high power charging. They must consider the adaptability of sensors to the targeted cell environment in terms of chemical and

electrochemical reactivity, thermal design and foresee boundary manufacturing constraints. Additional constraints such as cost and recyclability of the battery with embedded sensor technology should also be tackled. Data processing within an advanced battery management system (BMS) and the synchronization with sensor data coming from the module and the pack level, incl. provisions for conflicting data management, is another essential aspect. Advancements towards standardisation of the BMS could also be included. With this regard, collaboration shall be ensured with the topic LC-BAT-10-2020: Next generation and realisation of battery packs for BEV and HEV.

All results shall be validated and demonstrate significant improvements compared to the state-of-the art technologies, incl. benchmarking to initiatives or projects supported under national funding schemes.

The Commission considers that proposals for Research and Innovation Actions of a 3-year duration and requesting a contribution from the EU of between EUR 2 and 4 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals of another duration and/or requesting other amounts.

The project partners shall make provisions to actively participate in the common activities of the large scale research initiative on Future Battery Technologies and in particular: coordinate technical work with the other selected projects of the call under topics LC-BAT-12-2020 and LC-BAT-14-2020; and contribute to the activities of the Coordination and Support Action defined under the topic LC-BAT-15-2020. In particular, the project partners will need to conclude a written collaboration agreement with the other projects selected from these topics as indicated in the Grant Conditions.

Note that special Grant Conditions will apply for projects granted under this topic. Please see under Call Conditions.

Expected Impact:

- Increased quality, reliability and life (QRL) of the battery system by maximizing the performance and safety of the complete battery system over its lifetime, including forecasting the remaining lifetime under different use cases, especially the suitability for possible "second life" usage.
- Assured best possible performance and lifecycle for a range of applied cell types at lowest cost
- Industrial opportunities for exploiting new concepts and technologies for integrating multifunctional sensor capabilities in the battery cells and for optimizing the performance of the complete battery systems
- Better identification of defective cell components, allowing replacement of components or introduction of local targeted repair mechanisms, such as self-healing, in future cell design and chemistry generations.

- Improved knowledge on different factor (use patterns, ambient temperature etc.) impact on battery performance and characteristics.
- Provide the foundations for collecting large amounts of data that can be used for autonomous discovery of future battery chemistries and for development of advanced modelling approaches to improve current chemistries with a view of optimizing cell performance for mobility applications (linking with topic LC-BAT-6-2019)

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-BAT-14-2020: Self-healing functionalities for long lasting battery cell chemistries

Specific Challenge: Increasing our daily dependence on batteries calls for increased efforts in ensuring their quality, reliability and life (QRL). While sensing is the natural instrument to monitor and control QRL, it can also serve to identify defective components and local spots in the cell that need to be repaired by injection or addition of self-healing functions.

Scope: The target is to deliver a proof-of-concept for the realization of battery cells with the proper repairing additives and to elucidate the modus operandi of the specific self-healing functionality by advanced analytical tools. Proposals should aim at developing innovative auto-repairing approaches for cell components such as mechanisms for on-demand administration of molecules that can solubilize a resistive deposit or at injecting self-repairing polymers to restore a defective electrode within the battery. They should lay the foundation for a sound scientific platform on battery self-healing relying on chemical/physical tooling. Whatever the pursued approach, it will have to comply with the electrochemical environment of the targeted cell environment, be readily adaptable to battery cell mass production processes and not hinder subsequent recycling process. The competitive advantage over alternative approaches like replacement or recycling or second-use should be demonstrated.

The Commission considers that proposals for Research and Innovation Actions of a 3-year duration and requesting a contribution from the EU of between EUR 2 and 4 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals of another duration and/or requesting other amounts.

The project partners shall make provisions to actively participate in the common activities of the large scale research initiative on Future Battery Technologies and in particular: coordinate technical work with the other selected projects under topics LC-BAT-12-2020 and LC-BAT-13-2020; and contribute to the activities of the Coordination and Support Action defined under the topic LC-BAT-15-2020. In particular, the project partners will need to conclude a written collaboration agreement with the other projects selected from these topics as indicated in the Grant Conditions.

Note that special Grant Conditions will apply for projects granted under this topic. Please see under Call Conditions.

Expected Impact:

- Increased quality, reliability and life (QRL) of the battery system by extending the lifetime of the battery cells and maximizing their performance
- Industrial opportunities for exploiting new concepts and technologies for integrating self-healing capabilities in the battery cell.

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-BAT-15-2020: Coordinate and support the large scale research initiative on Future Battery Technologies

Specific Challenge: To network and coordinate the large scale research initiative on Future Battery Technologies and its contribution to the broader efforts of the European research and innovation stakeholders in battery technologies foreseen at European level and in the Strategic Energy Technology (SET) Plan¹⁸

Scope: Proposals are expected to coordinate the research activities and the stakeholders participating in the initiative; to facilitate communication, dialogue and cooperation on cross-cutting topics; to monitor the initiative's progress and maintain its roadmap; to provide support for its governance; to promote and communicate the objectives of the initiative¹⁹ and its achievements, including by ensuring media presence and public visibility, by engaging with industry and society and by participating or organising outreach events; to identify training and education needs and promote European curricula in future battery technologies. In particular, proposals should identify and coordinate relevant efforts for modelling and data sharing, standardisation, IPR actions in cooperation with other relevant initiatives at European level. They should also help networking and collaboration with other relevant national and international activities in the field. They should cooperate with the ETIP on battery announced in the EU Strategic Action Plan on Batteries²⁰.

It is expected that such an activity is driven by representatives of the relevant actors of the field (e.g., from academia, RTOs and industry).

The Commission considers that proposals for Coordination and Support Actions of a 3-year duration and requesting a contribution from the EU of up to EUR 2 million would allow this

¹⁸ See <https://ec.europa.eu/en/topics/technology-and-innovation/strategic-energy-technology-plan>
¹⁹ encompassing the overall strategy and all activities funded under topics LC-BAT-12-2020, LC-BAT-13-2020 and LC-BAT-14-2020

²⁰ See https://ec.europa.eu/transport/sites/transport/files/3rd-mobility-pack/com20180293-annex2_en.pdf

specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals of another duration and/or requesting other amounts.

Note that special Grant Conditions will apply for projects granted under this topic. In particular, the project partners will need to conclude a collaboration agreement with the other projects selected from the topics LC-BAT-12-2020, LC-BAT-13-2020 and LC-BAT-14-2020 as indicated in the Grant Conditions.

Please see under Call Conditions.

Expected Impact:

- Fostering the technological, economic and societal impact of the initiative and paving the way to industrial exploitation of future battery technologies in key energy or transport application domains
- Well-coordinated European initiative on future battery technologies, involving all relevant stakeholders and linked with relevant international, national and regional programmes.
- Spreading of excellence in future battery technologies across Europe, increased awareness of European activities and availability of European curricula in the field.
- Increased synergies and collaboration between the relevant research and innovation stakeholders in Europe as well as with major initiatives that already exist or are under preparation.

Type of Action: Coordination and support action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Conditions for the Call - Building a Low-Carbon, Climate Resilient Future: Next-Generation Batteries

Opening date(s), deadline(s), indicative budget(s):²¹

Topics (Type of Action)	Budgets (EUR million)		Deadlines
	2019	2020	
Opening: 24 Jan 2019			

²¹ The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.

The Director-General responsible may delay the deadline(s) by up to two months.

All deadlines are at 17.00.00 Brussels local time.

The implementation is subject to the availability of the appropriations provided for in the general budget of the Union for years 2019 and 2020.

Horizon 2020 - Work Programme 2018-2020
Cross-cutting activities

LC-BAT-1-2019 (RIA)	25.00 ²²		25 Apr 2019
LC-BAT-2-2019 (RIA)	24.00 ²³		
LC-BAT-3-2019 (RIA)	5.00 ²⁴		
LC-BAT-4-2019 (RIA)	15.00 ²⁵		
LC-BAT-5-2019 (RIA)	30.00 ²⁶		
LC-BAT-6-2019 (RIA)	13.00 ²⁷		
LC-BAT-7-2019 (CSA)	2.00 ²⁸		
Opening: 09 Jul 2019			
LC-BAT-12-2020 (RIA)		20.00 ²⁹	16 Jan 2020
LC-BAT-13-2020 (RIA)		10.00 ³⁰	
LC-BAT-14-2020 (RIA)		10.00 ³¹	
LC-BAT-15-2020 (CSA)		2.00 ³²	
Opening: 03 Dec 2019			
LC-BAT-10-2020 (IA)		40.00 ³³	28 Apr 2020
LC-BAT-11-2020 (RIA)		20.00 ³⁴	
LC-BAT-8-2020 (RIA)		20.00 ³⁵	
LC-BAT-9-2020 (RIA)		10.00 ³⁶	
Overall indicative budget	114.00	132.00	

Indicative timetable for evaluation and grant agreement signature:

²² of which EUR 25.00 million from the 'Smart, green and integrated transport' WP part.

²³ of which EUR 24.00 million from the 'Secure, clean and efficient energy' WP part.

²⁴ of which EUR 5.00 million from the 'Secure, clean and efficient energy' WP part.

²⁵ of which EUR 15.00 million from the 'Secure, clean and efficient energy' WP part.

²⁶ of which EUR 30.00 million from the 'Smart, green and integrated transport' WP part.

²⁷ of which EUR 13.00 million from the 'Smart, green and integrated transport' WP part.

²⁸ of which EUR 2.00 million from the 'Smart, green and integrated transport' WP part.

²⁹ of which EUR 20.00 million from the 'Future and Emerging Technologies' WP part.

³⁰ of which EUR 10.00 million from the 'Future and Emerging Technologies' WP part.

³¹ of which EUR 10.00 million from the 'Future and Emerging Technologies' WP part.

³² of which EUR 2.00 million from the 'Future and Emerging Technologies' WP part.

³³ of which EUR 40.00 million from the 'Smart, green and integrated transport' WP part.

³⁴ of which EUR 20.00 million from the 'Smart, green and integrated transport' WP part.

³⁵ of which EUR 20.00 million from the 'Secure, clean and efficient energy' WP part.

³⁶ of which EUR 10.00 million from the 'Secure, clean and efficient energy' WP part.

For single stage procedure:

- Information on the outcome of the evaluation: Maximum 5 months from the final date for submission; and
- Indicative date for the signing of grant agreements: Maximum 8 months from the final date for submission.

Eligibility and admissibility conditions: The conditions are described in General Annexes B and C of the work programme.

Evaluation criteria, scoring and threshold: The criteria, scoring and threshold are described in General Annex H of the work programme.

Evaluation Procedure: The procedure for setting a priority order for proposals with the same score is given in General Annex H of the work programme.

The full evaluation procedure is described in the relevant [guide](#) published on the Funding & Tenders Portal.

Grant Conditions:

LC-BAT-12-2020, LC-BAT-13-2020, LC-BAT-14-2020, LC-BAT-15-2020	Grants awarded under this topic shall be implemented as a programme through the use of complementary grants to those awarded under topics LC-BAT-12-2020, LC-BAT-13-2020, LC-BAT-14-2020 and LC-BAT-15-2020, and the respective options of Article 2, Article 31.6 and Article 41.4 2 of the Model Grant Agreement will be applied. In particular the projects are required to conclude a collaboration agreement, in principle prior to the signature of the grant agreement.
LC-BAT-12-2020, LC-BAT-13-2020, LC-BAT-14-2020	For grants awarded under this topic for Research and Innovation Actions the Commission or Agency may object to a transfer of ownership or the licensing of results to a third party established in a third country not associated to Horizon 2020. The respective option of Article 30.3 of the Model Grant Agreement will be applied.

Consortium agreement:

All topics of this call	Members of consortium are required to conclude a consortium agreement, in principle prior to the signature of the grant agreement.
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Call - COMPETITIVE, LOW CARBON AND CIRCULAR INDUSTRIES

H2020-LOW-CARBON-CIRCULAR-INDUSTRIES-2020

This call addresses research challenges related to the Circular Economy – a priority since the 2015 Circular Economy Action Plan – as well as to reaching carbon neutral industries as set out in the November 2018 Commission Communication "A Clean Planet for all– A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy".

Research and Innovation implementing these two priorities will significantly contribute to the modernisation of industrial processes and to new ways designing products and business models. Results coming out of the project portfolio under this call should demonstrate the economic, environmental, climate and social added-value of decarbonised and circular production systems.

The cross-cutting nature of this call should lead to an improved cooperation and integration between sectors and value chains, and to making circular economy practices more mainstreamed and widespread and contributing to a carbon neutral industry in the medium term.

This call supports the development of innovative production systems and business models, in which resource efficiencies, waste management and system thinking should be incorporated in the initial design, across sectors that are traditionally resource and energy intensive and/or with significant environmental footprints. The objective is the design and demonstration of profitable and sustainable (circular) value chains of materials, products and services, and of transactions for novel sourcing of required inputs and value-added destinations for non-product outputs between industrial facilities (industrial symbiosis). The environmental, climate, economic and social gains should be assessed from a comprehensive full life cycle perspective, including production and recycling processes, materials, and products (cradle-to-cradle).

Portfolio approach as to the envisaged impact

In order to strengthen the impact of the activities under the call, clustering of projects around certain activities into portfolios will be facilitated. This portfolio approach will be pursued to establish regular exchange of information between all projects under this call and to clarify thematic links across topics. Where relevant, clusters will be created to ensure optimal coordination between relevant projects, to promote continuous dialogue and exchange of good practices between all actors involved, improve communication and transfer of knowledge and to identify technological and non-technological barriers. Proposals are therefore encouraged to contribute to such clustering activities, including coordinated deliverables and joint dissemination or exploitation activities, with other projects selected under this call and under

previous relevant ones. A workshop at the beginning of the projects will be organised to explain and put into practice this portfolio approach.³⁷.

Proposals are invited against the following topic(s):

CE-NMBP-41-2020: ERA-NET on materials, supporting the circular economy and Sustainable Development Goals

Specific Challenge: Maintaining Europe's position in research related to materials science and engineering requires concentrated action on common European research priorities in view of implementing joint initiatives.

The M-ERA.NET 2 network has successfully targeted the Low Carbon Energy Technologies addressed by the SET Plan. Now the scope should on one hand guarantee some continuation, and on the other hand become more ambitious and underline the commitment of the EU regarding the circular economy and Sustainable Development Goals.

The European Commission has adopted an ambitious new Circular Economy Package to help European businesses and consumers to make the transition to a stronger and more circular economy. Moreover, in 2016, the 17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development came into force. They aim to end poverty, protect the planet, ensure prosperity and tackle climate change. The EU is fully committed to be a frontrunner in implementing the 2030 Agenda and SDGs. Finally, the Commission launched the Battery Alliance initiative in 2017.

Materials research is a relevant field for addressing these overall challenges and for making substantial contributions to achieving the specific objectives.

Global challenges call for co-operation on a global scale to build capacity in science, technology and innovation (STI) at both national and international levels. A strategic and industrially relevant approach is needed that cover the entire research and innovation chain by pooling national research and innovation capacities, thereby mobilising European infrastructure networks as well as promoting education and training in materials research and innovation.

Scope: The proposed ERA-NET aims at coordinating the research efforts of the participating Member States, Associated States and Regions in the field of materials, continuing the activities started by M-ERA.NET, for materials research and innovation, especially targeting the circular economy and Sustainable Development Goals (such as Goal 7 – “Affordable and clean energy”, by enabling electromobility through sustainable energy storage technology or Goal 9 “Industrial innovation and infrastructure”, by enhancing scientific research and upgrading the technological capabilities of industrial sectors). Proposals should pool the necessary financial resources from participating national or regional research programmes by implementing a joint transnational call for proposals (resulting mainly in grants to third parties) with EU co-funding to fund multinational innovative research initiatives in this

³⁷ SPIRE-13-2017, CIRC-01-2016-2017, SC5-04-2019

domain, including support to the large scale research initiative on future battery technologies launched under the H2020-LC-BAT-2019-2020 Call³⁸.

Proposers are also requested to implement other joint activities and, additional joint calls without EU co-funding. The proposal should demonstrate that these additional joint calls exclude any overlaps with related on-going actions co-funded by the EU under NMBP.

Proposals should demonstrate the expected impact on national and transnational programmes as well as the leverage effect on European research and competitiveness, and should plan the development of key indicators for supporting this.

Participation of legal entities from third countries, and/or regions including those not automatically eligible for funding in accordance with General Annex A is encouraged in the joint call as well as in other joint activities including additional joint calls without EU co-funding. Participants from countries not listed in General Annex A are eligible for EU funding under this topic and may request a Union contribution (on the basis of the ERA-NET unit cost) only for the coordination costs of additional activities.

The Commission considers that proposals requesting a contribution from the EU of EUR 15 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. EUR 5 million of the requested contribution from the EU should be used as support to transnational projects, co-funded by the Commission, on future battery technologies, fostering synergy between European, national and regional initiatives and promoting broader partnerships between the European stakeholders in future battery technologies.

Expected Impact:

- synergies with international, national and regional programmes that support research and innovation;
- synergies but no overlap with the topics of Horizon 2020 and with related European Partnership initiatives and be open to adapt to future coming initiatives of Horizon Europe;
- leverage of national, regional and European funding;
- contribution to meeting Global Challenges through Better Governance: International Co-operation in Science, Technology and Innovation;
- relevant contribution to the SDGs, including sustainable battery based energy storage technology;
- relevant contribution towards a circular economy.

Type of Action: ERA-NET Cofund

³⁸ http://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-cc-activities_en.pdf

The conditions related to this topic are provided at the end of this call and in the General Annexes.

CE-NMBP-42-2020: Materials life cycle sustainability analysis

Specific Challenge: The main purpose of the Circular Economy (CE) is to develop material/product business models that are economically and environmental sustainable, with actions supporting each stage of the value chain (from production to consumption, from design to recycling and upcycling of waste-materials) while promoting industrial and social innovation. In line with this, the challenge is to evaluate product improvement, taking into consideration, all relevant subsystem interactions (environmental, economic and social) and all the life cycle stages of the product. However, although environmental indicators and methodologies for product level assessment are well advanced and harmonised (LCA-PEF³⁹) this is not yet the case as regards the social and economic pillars of sustainability assessment. Life cycle sustainability analysis (LCSA) is needed, integrating social and economic benefits with environmental burdens, which fit these causal interrelations into an holistic approach understandable to different stakeholders.

Scope:

- Develop approaches/methodologies to incorporate social and economic indicators in sustainability evaluations;
- Develop approaches and select indicators that allow formalising connections between subsystems. Existing standard methods⁴⁰ should be used in this project for assessing environmental impacts. As regards, social life cycle assessment it is suggested to build on the work done by the Life Cycle Initiative⁴¹;
- Develop a quantitative approach that allows assessment of the sustainability multi-criteria trade-offs of circularity (cradle to cradle) dynamically in real cases. The approach needs to facilitate the incorporation of existing product LCSA harmonised approaches;
- Develop a public demonstration of the LCSA approach, which can contribute towards effective uptake of LCSA within different sectors;
- Work with industrial associations and clusters to engage with industry and especially SMEs but also with consumer organisations, as well as governmental and standardisation bodies;
- Stimulate the use of existing ontologies developed under Horizon 2020.

Clustering and cooperation with other selected projects under this cross-cutting call and other relevant projects is strongly encouraged.

³⁹ http://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR_en.htm

⁴⁰ <https://www.lifecycleinitiative.org/resources/reports/>,

⁴¹ <https://product-social-impact-assessment.com/handbook/>

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the Introduction of this part of the Work Programme.

Activities should start at TRL 3 and achieve TRL 6 at the end of the project.

The Commission considers that proposals requesting a contribution from the EU around EUR 6 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- More robust early-stage evaluations and increase consistency across sectors and through value chains through improved sustainability evaluation tools;
- Better informed investment decision-making for future products and processes through improved visualisation and communication of potential sustainability trade-offs with stakeholders
- Support the implementation of EU policies, including the transition to a more circular economy at different scales of economic and social conditions.
- Creation of new business opportunities and increased competitiveness of EU industries and supporting SMEs in the transition to the circular and sustainable economy;
- Improved product investment decisions for industry;
- Contribution to a future LCSA at European Union level linked to the certification of final products.

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

CE-SPIRE-01-2020: Tapping into the potential of Industrial Symbiosis

Specific Challenge: Industrial Symbiosis holds significant potential to provide major improvements in resource and energy efficiency for all energy intensive industries. Exploiting this potential could accelerate the transition to a circular economy and to renewable energy systems, reduce waste heat energy and lead to significant reduction of GHG emissions. However, Industrial Symbiosis is currently not yet widely implemented. The challenge is to tackle all technological and non-technological barriers. The full potential of industrial symbiosis could only unfold if the consequences for energy grids and adjacent infrastructures (e.g. waste heat recovery through district heating or heat integration in chemical processes, waste to energy, or waste and gaseous effluents management), as well as the regional dimension are taken into account.

Scope: Technology based innovations should prove the potential for novel symbiotic value chains in demonstrators involving multiple industrial sectors in real industrial settings. Proposals are expected to address e.g.:

- Broader symbiosis, from local and regional perspectives, with infrastructures (e.g. waste and water management infrastructure, gas networks), communities and energy grids (e.g. smart operations scheduling, district heat integration), including distributed generation and the role that symbiosis can play in fluctuating energy grids (i.e. grid services, seasonal storage, biomass or heat pumps integration);
- Management of side/waste streams (through e.g. capturing, purification, concentrating, sorting, collecting, exchanging or preparation) specifically for the use as resource for other plants and companies across sectors and/or across value chains;
- Process (re-)design and implementation to integrate and adapt existing processes to enhance industrial symbiosis (energy and material flow coupling, infrastructure and logistics).
- Integration of information technology, including artificial intelligence, and operational technology; appropriate ICT tools (e.g. aggregation technologies) for multi-criteria decision making, for the design and the operation management of exchange streams in a dynamic production environment, advanced modelling to design and establish novel symbiotic interactions; data sharing and preservation of data confidentiality;
- Assessment methodologies and KPIs to measure the performance of symbiosis, including environmental, economic and social impacts. Life cycle assessment and life cycle cost analysis should take into account existing sustainability standards (e.g. ISO 10410) and existing best practices;

Creation of an inventory of successful symbiotic relations and solutions, as well as best practices. Non-technological aspects, which may include regulatory issues, the need for redefining standards, and new business models, covering ownership, management and fair sharing of benefits, should be considered. This may entail devising collaboration strategies via contracts and platforms for cross-sectorial sharing of resources and benefits in industrial parks, clusters or distributed plants.

Clustering and cooperation with other selected projects under this cross-cutting call and other relevant projects is strongly encouraged.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the Introduction of this part of the Work Programme.

Activities should start at TRL 6 and achieve TRL 7 at the end of the project.

The Commission considers that proposals requesting a contribution of EUR between EUR 12 and 20 million would allow this specific challenge to be addressed appropriately.

Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: Several of the following impacts are expected:

- Step change towards closing circular loops;
- Improvement of at least 15% in energy efficiency of the targeted industrial processes, compared to the non-symbiotic scenario;
- Reduction of at least 30% in total energy intensity, on the basis of full life cycle considerations;
- Overall reductions in CO₂ emissions of 40% compared to the non-symbiotic scenario;
- Reduction in primary raw material intensity of up to 20%;
- Reduction of waste generation by at least 25%;
- Better understanding of relevant barriers (e.g. end of waste criteria);
- Effective dissemination of major innovation outcomes to the current and next generation of employees, through the development of learning resources with flexible usability. These should be easy to integrate in existing curricula and modules for undergraduate level and lifelong learning programmes;
- The environmental gains in absolute figures, and weighted against EU and global environmental footprints, should be demonstrated;
- In addition, the replication potential should also be assessed.

Relevant indicators and metrics, with baseline values, should be stated clearly in the proposal.

Type of Action: Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

CE-SPIRE-07-2020: Preserving fresh water: recycling industrial waters industry

Specific Challenge: Energy-intensive industries are major users of fresh water, for e.g. processing, washing, diluting, heating, cooling, and transporting products. Since fresh water is a scarce resource, breakthrough innovations are needed in energy-intensive industries to recycle water and create closed loops in industrial processes. Such closed loops would significantly reduce the use of fresh water and improve water availability in the relevant EU water catchment areas, as outlined in the Water Framework Directive, for other purposes (adjacent communities, farming and bio-based industries). Industrial symbiosis offers the potential for energy, water and other resource efficiency at a scale beyond energy intensive industries.

Scope: Proposals should aim at near-zero discharge using closed-loop systems in combination with recovery of energy and/or substances (resources) through the development of integrated water-smart strategies for industrial processes.

Strategies should take into account:

- Better characterising the water usage and production in the industrial processes;
- Defining recycling options with a combined water, waste and energy approach in an integrative system design method considering investment and optimal operations;
- Future production demand through design, control options, and technologies integration that reduce water consumption, recycle water, and reduce the use of fresh water resources in closed-loop industrial processes including cascading use of different kinds of water in industrial settlements or for compatible re-use in urban and rural areas.

Reprogramming of water resources and optimisation of water management in industrial processes should apply the principles of waste - water - energy design in a circular context.

Proposals should develop new technologies and approaches at a large scale. It is anticipated to combine:

- Real time smart monitoring and management systems with innovative digital solutions for sensors and actuators (e.g. modelling and artificial intelligence) and;
- Recycling technologies such as highly selective separation or extraction processes and new solutions for water treatment to prevent fouling and corrosion.

Integrated Water Management should consider different qualities and sources of water, including desalination, re-use of treated wastewater, rainwater harvesting and gas humidity condensation (e.g., cooling tower blowdown). Development of 'tailor-made' system solutions with demand orientation and scale-up testing to robust industrial processes will be required. Water re-use will subsequently lead to accumulation of pollutants. In-line monitoring should include these water quality control parameters linked to the process.

Clustering and cooperation with other selected projects under this cross-cutting call, and with other relevant projects, in particular those selected under SC5-04-2019 "[Building a water-smart economy and society](#)", is strongly encouraged.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the Introduction of this part of the Work Programme.

Activities should start at TRL 5 and achieve TRL 7 at the end of the project.

The Commission considers that proposals requesting a contribution from the EU between EUR 8 and 12 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: Several of the following impacts are expected:

- Significant reduction of the current use of fresh water resources;
- Significant steps towards near-zero discharge using closed-loop systems in industrial processes;
- Significant increase of the recovery of water, energy and/or substances and materials;
- Increase of resource and water efficiency by 30% compared to the state-of-the-art;
- Effective dissemination of major innovation outcomes to the current and next generation of employees, through the development of learning resources with flexible usability. These should be easy to integrate in existing curricula and modules for undergraduate level and lifelong learning programmes;
- The environmental gains in absolute figures, and weighted against EU and global environmental footprints, should be demonstrated;
- In addition, the replication potential should also be assessed.

Relevant indicators and metrics, with baseline values, should be stated clearly in the proposal.

Type of Action: Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

CE-SPIRE-09-2020: Alternative mineral resources for high volume production (IA)

Specific Challenge: Energy intensive industries in Europe depend on the one hand on very large volumes of minerals and other raw materials (e.g. 70% of process manufacturing depends on minerals and metals). On the other hand, they heavily rely on imports from third countries (extraction in Europe covers only 29% of the demand). The environmental footprint of high-volume products is also too high. The challenge is to develop technologies for the uptake of secondary raw materials based on industrial symbiosis, waste collection, or water treatment systems, and leading to new value chains or even value loops (i.e. reusing waste, by-products and recycled materials repeatedly) instead of just further optimising existing processes. Such new technologies should enable overcoming barriers such as low costs of primary raw materials or differences in taxes across countries and regions (e.g. landfilling taxes for primary and secondary raw materials).

Scope: Proposals should address the development of new high volume value loops and integrated supply chains through industrial processes enabling the cross-sectorial, symbiotic, use of mineral waste, by-products and end-of-life materials from other industry sectors. The secondary materials can be used either as raw material for the production process or can be introduced in a subsequent process step to an intermediate product where they become a constituent of the final product. Composition variability of wastes or by-products can be

addressed either by purification processes prior to production, or within the production process.

The following aspects should also be considered:

- Product specifications according to customer expectations (e.g. durability, versatility, quality, traceability), clearly shown by involving relevant actors in the value chain;
- Economic viability of the proposed processes together with potential new business concepts and simplified methodologies;
- Regulatory aspects such as transport and use of secondary material in new products put on the market.

Information guides should be provided before the end of the project. These should address elements covering the quality of information from product manufacturers, for the efficient use of secondary materials (beneficiation, quality concepts, test procedures, applications and training) and facilitate decision making.

Proof of concept should be delivered at pilot or demo scale (excluding commercially usable prototypes) to demonstrate convincingly scalability towards industrial applications. Projects are encouraged to develop advanced modelling tools or to use them to build dedicated pilot installations.

Clustering and cooperation with other selected projects under this cross-cutting call and other relevant projects is strongly encouraged.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the Introduction of this part of the Work Programme.

Activities should start at TRL 5 and achieve TRL 7 at the end of the project.

The Commission considers that proposals requesting a contribution from the EU between EUR 8 and 12 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: Several of the following impacts are expected:

- Reduction potential of at least 30% of primary raw material use per ton of main high volume final product;
- Reduction of waste generation by at least 25%;
- Significant energy savings and reductions in CO₂ emissions (including through a higher share of renewable energy) in the overall sustainable production lines in which the technology is fully integrated;

- Secure and sustainable provision of secondary resources at total cost lower than existing solutions;
- Contribution to new standards for the use of secondary materials for new products;
- Effective dissemination of major innovation outcomes to the current and next generation of employees, through the development of learning resources with flexible usability. These should be easily integrable in existing curricula and modules for undergraduate level and lifelong learning programmes;
- The environmental gains in absolute figures, and weighted against EU and global environmental footprints, should be demonstrated;
- In addition, the replication potential should also be assessed.

Relevant indicators and metrics, with baseline values, should be stated clearly in the proposal.

Type of Action: Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

CE-SC5-07-2020: Raw materials innovation for the circular economy: sustainable processing, reuse, recycling and recovery schemes

Specific Challenge: Securing the sustainable access to raw materials, including metals, industrial minerals, wood- and rubber-based, construction and forest-based raw materials, and particularly Critical Raw Materials (CRM), is of high importance for the EU economy. Complex primary and secondary resources contain many different raw materials. Their processing, reuse, recycling and recovery schemes are complex and imply different steps, ranging from collection, logistics, sorting and separation to cleaning, refining and purification of materials.

The challenge for industry is to scale up promising raw materials production technologies and to demonstrate that raw materials can be produced in an innovative and sustainable way in order to make sure that research and innovation end up on the market, to strengthen the competitiveness of the European raw materials industries, meet ambitious energy and climate targets for 2030, minimise environmental impacts and risks, and gain the trust of EU citizens in the raw materials sector.

This specific challenge addresses the development of "innovative pilot actions"⁴², which is one of the major targets of the European Innovation Partnership (EIP) on Raw Materials.

Scope: Actions should develop and demonstrate innovative pilots for the clean and sustainable production of non-energy, non-agricultural raw materials in the EU from primary and/or secondary sources finishing at Technology Readiness Levels (TRL) 6-7.

⁴²

https://ec.europa.eu/growth/sectors/raw-materials/eip/strategic-implementation-plan_en

All actions should contribute to achieving the targets of the EIP on Raw Materials, particularly in terms of innovative pilot actions on processing, refining and/or recycling for the innovative production of raw materials, and to building the EU knowledge base of primary and secondary raw materials by feeding into the EC Raw Materials Information System – RMIS⁴³. Actions should also contribute to improving the awareness of relevant external stakeholders and the general public across the EU about the importance of raw materials for society, the challenges related to their supply within the EU and about proposed solutions which could help to improve society's acceptance of and trust in sustainable raw materials production in the EU, duly taking into account the applicable EU environmental legislation.

All actions should facilitate the market uptake of solutions developed through industrially- and user-driven multidisciplinary consortia covering the relevant value chain and should consider standardisation aspects when relevant.

All actions should justify the relevance of selected pilot demonstrations in different locations within the EU (and also outside if there is a clear added value for the EU economy, industry and society).

All actions should include an outline of the initial exploitation and business plans, as outlined in the Introduction of this part of the Work Programme (with indicated CAPEX, OPEX, IRR and NPV⁴⁴), with clarified management of intellectual property rights, and commitment to the first exploitation.

Clustering and cooperation with other selected projects under this cross-cutting call and other relevant projects supporting the EIP on Raw Materials is strongly encouraged..

In line with the strategy for EU international cooperation in research and innovation (COM(2012)497), international cooperation is encouraged.

The Commission considers that proposals requesting a contribution from the EU of between EUR 8 million and EUR 13 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Applying a circular economy approach throughout the entire value chain, actions for this topic should address only one of the following sub-topics:

a) Sustainable processing and refining of primary and/or secondary raw materials: Actions should demonstrate new or improved systems integrating relevant processing and refining technologies for better recovery of minerals and metals at increased efficiency in terms of better yield and process selectivity as well as better utilisation of resources (hence reducing wastes). This would include processing of and recovery from low grade and/or complex ores and/or from industrial or mining wastes or landfills, and/or the reduction of the content of toxic elements or compounds in the resulting materials. The importance of the

⁴³ <https://ec.europa.eu/jrc/en/scientific-tool/raw-materials-information-system>

⁴⁴ Capital expenditures (CAPEX), operational expenditure (OPEX), internal rate of return (IRR), and net present value (NPV)

targeted raw materials and their sources for the EU should be demonstrated in the proposal. The solution proposed should be flexible enough to adapt to different or variable ore/secondary raw material grades and should be supported by efficient and robust process control. Where relevant, any solution proposed for the reduction of the content of toxic elements or compounds in the resulting materials should also include the appropriate management of the hazardous substances removed. Recycling of end-of-life products is excluded from this option.

- b) Recycling of raw materials from end-of-life products:** Actions should develop and demonstrate novel and environmentally sound solutions for a higher recycling and recovery of secondary raw materials from end-of-life products such as waste electrical and electronic equipment (WEEE), batteries, wood-based panels, multi-material paper packaging, end-of-life tyres, etc. These products can contain different minerals, metals, wood and wood-fibre, rubber, etc. (including critical raw materials and other technology metals).
- c) Recycling of raw materials from buildings and infrastructures:** Actions should develop and demonstrate novel solutions for a high-value recovery of raw materials from buildings and infrastructures. Actions should also benchmark against a series of comparative case studies of construction and demolition waste (C&DW) management in deconstruction of buildings and infrastructure of representative size categories in countries with different types of end-of-life building and infrastructure stocks, showcasing the appropriate use of the following: the EU C&DW Management Protocol⁴⁵, pre-demolition audit, smart demolition practices, using appropriate technical equipment, and sorting/processing and quality management of waste fractions such as metals, aggregates, concrete, bricks, plasterboard, glass, polymers and plastics and wood.
- d) Advanced sorting systems for high-performance recycling of complex end-of-life products:** Actions should develop and demonstrate innovative dismantling and sorting systems enabling functional recycling of critical raw materials, or other types of highly efficient recovery of metals, minerals or construction materials, from complex end-of-life products and scrap thereof. The advanced sorting systems should achieve very high throughput rates in order to allow their economically viable operation on the European market.
- e) Sustainable metallurgical processes:** Actions should develop and demonstrate innovative metallurgical systems integrating pyro-, hydro-, bio-, and/or electro-metallurgical and/or electrochemical technologies, in order to enhance the production efficiency in terms of increased yield and selectivity, higher grade and purity of the produced metals from primary and/or secondary raw materials as well as the environmental performance throughout the whole life cycle.

Expected Impact: The project results are expected to contribute to:

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<http://ec.europa.eu/DocsRoom/documents/20509/attachments/1/translations/en/renditions/native>

- pushing the EU to the forefront in the area of raw materials processing and/or recycling technologies and solutions through generated know-how (planned patents, publications in high impact journals and joint public-private publications etc.), and promoting socially innovative solutions;
- improving significantly the economic viability and market potential that will be gained through the pilot, leading to expanding the business across the EU after the project is finished, as well as creating added value and new jobs in raw materials producing, equipment manufacturing and/or downstream industries;
- unlocking a significant volume of various primary/secondary raw materials currently unexploited/underexploited within the EU, hence improving their 'circularity' in the economy and ultimately closing the material cycles for a circular economy;
- improving significantly the health, safety and environmental performance throughout the whole life cycle considered, including better energy and water efficiency, a reduction in emissions of greenhouse gases and pollutants, a reduction in waste generation and wastewater and a better recovery of resources from generated waste or a better recovery and recycling of resources from complex end-of-life products;
- additionally, only for sub-topic b) 'Recycling of raw materials from end-of-life products', in the shorter term, increasing measurably the efficiency and effectiveness (range, yield, quality and selectivity of recovered materials) of the exploitation of complex and heterogeneous secondary raw materials deposits ('urban mines') when compared to the state of the art;
- additionally, only for sub-topic c) 'Recycling of raw materials from buildings and infrastructure', lead to wider application of smart demolition techniques, C&DW processing, quality assurance practices, traceability and standardization for secondary raw materials in the construction sector, thus improving the material and value recovery rate.

Type of Action: Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

CE-SC5-08-2020: Raw materials policy support actions for the circular economy - Expert network on Critical Raw Materials

Specific Challenge: In order to secure the sustainable access to primary and secondary raw materials, including metals, industrial minerals, construction raw materials, wood, and particularly Critical Raw Materials (CRMs) for the EU economy, there is a need to tackle a number of specific non-technological challenges at local, regional, national, EU and global levels.

The supply of CRMs to the EU is at risk as they are often mined as by-products and usually still have recycling rates below 1% after decades of use. There is a need for an expert advice in support of decision-making at the EU level covering all the raw materials and their value chains screened in the CRMs assessment⁴⁶.

Scope: All actions should contribute to improving EU official statistics and to building the EU knowledge base of primary and secondary raw materials (EC Raw Materials Information System – RMIS⁴⁷).

Clustering and cooperation with other selected projects under this cross-cutting call and other relevant projects supporting the EIP on Raw Materials is strongly encouraged.

Actions should strengthen an EU expert network and community covering all raw materials screened in the CRM assessment of 2017⁴⁸, and once available also the raw materials of 2020 assessment. The consortium should organise the expert community across the EU covering expertise on primary and secondary resources; production, including exploration, mining, processing, recycling and refining; substitution of CRM; raw materials markets; future demand and supply; materials flows; socio-economic analysis, and strategic value chains and end-use sectors, including batteries, e-mobility, renewable energy, electronics, defence and aerospace.

The actions should improve data and knowledge on all screened raw materials; flexibly support the Commission in policy making related to CRM in general or linked to specific applications or sectors; as well in the relevant events organised by the Commission. The actions should also support the Commission in the analysis of the future supply and demand of raw materials, policy and technology gaps and innovation potential along the raw materials value chains.

The Commission considers that proposals requesting a contribution from the EU of up to EUR 3 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: The project results are expected to contribute to:

- achieving the objectives and the implementation of both the Raw Materials Initiative and the EIP on Raw Materials, in particular in terms of securing the supply of critical raw materials (CRMs);
- better informed and more effective decision-making by the EU and Member States policy makers and the producers and users of raw materials regarding the supply and demand of raw materials and the associated environmental and social aspects;

⁴⁶ https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_en

⁴⁷ <https://ec.europa.eu/jrc/en/scientific-tool/raw-materials-information-system>

⁴⁸ https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_en

- improved awareness of society across the EU about importance of the critical raw materials and other relevant materials for strategic value chains in support of the implementation of the Sustainable Development Goals (SDGs) in the EU;
- in the longer term improved diversification of CRMs supply to the EU.

Type of Action: Coordination and support action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

CE-SC5-31-2020: Develop, implement and assess a circular economy oriented product information management system for complex products from cradle to cradle

Specific Challenge: The transition to a circular economy requires that the value in products is retained as long as possible. To achieve this, reliable information about the composition of components and materials is needed for health and safety in repair and recycling enterprises and for improved user integration in sustainable product design and in new business models.

Other aspects such as recyclability, dismantlability, recycled content, the sustainability of sourcing of raw materials, security of supply, and ultimately the overall environmental and social performance along the life cycle, are also related to the composition and design of products. If the downstream actors in the value chain, such as consumers, retailers or end-product manufacturers demand this information, it needs to be collected in the whole supply chain upstream. The implementation of resource efficiency benchmarks in products e.g. via Ecodesign or the EU Ecolabel also requires product composition and environmental performance data. The information needs of consumers are of course different from those of manufacturers and recyclers, and suppliers and manufacturers are traditionally worried about excessive transparency and possible violations of proprietary data rights. All this needs to be considered in the design of the information flow in the economic value chain.

Although some manufacturers and suppliers use specific software for internal communication, upstream aggregation and compliance documentation for sectoral product legislation, this does not cover the critical information needs with regard to circularity or the overall life cycle performance. Some SMEs, start-ups, and social and municipal enterprises outside the supply chain would benefit from access to such information management systems, but they have too limited resources to invest in complex and expensive software solutions.

There is thus a need for designing and piloting an information system for raw materials and components in products and their environmental performance that is linked to the material and value flows in an ideally circular system.

The design should be flexible and smart with regard to data volume and conversions and should include the whole flow for a specific business, from raw materials supply via components to the finished product, including customers, repair business, refurbishers, and recyclers.

In addition, the flexibility should allow actors to use the data for compliance reasons, such as REACH or the (future) ECHA database on the presence of hazardous chemicals in articles (ECHA, 2018). It should also allow aggregation and extrapolation with a view to the analysis and mapping of raw material flows and needs in Europe. The concept, the data flow and the specific needs of each actor should be studied in a pilot with operators that are interested in making their business sustainable and future-proof.

Scope: Proposals are expected to bring together all relevant actors along product related value chains – product designers, producers, consumers, businesses providing repair or refurbishment, data provider and manager, sorters and recyclers. The selected products should have a major environmental impact, offer a high potential for circularity, have a complex supply chain, and be linked at both ends of the lifecycle to critical resource issues, e.g. the manufacturing industry, which includes amongst others textiles and plastics, construction and sectors with products that may contain critical raw materials. Where applicable, official nomenclature, such as used in Prodcod⁴⁹, should be used for all products and materials. Ideally, a fully functional system should be set up in a value chain with high internal quality standards and an established refurbishment business. The knowledge gained in this set-up should be comprehensive and systemic enough to be easily transferable to less complex sectors and business models. All information flows should be designed with a view to increased circularity, traceability and minimisation of the overall environmental footprint. Proposals should explore, develop and test integrated information flows that take into account the diverse information needs throughout and beyond the original lifecycle of the product.

To facilitate open innovation and transferability, open solutions such as open source software, open hardware design, and open access to data are encouraged. Results from the supported projects might play a central role in the further development of the policies for the transition to a circular economy. The ambition to grant open access to the underlying architecture such as databases, encryption and access rights management should therefore be a central element of the proposals, while adequately addressing possible data protection, user privacy and liability issues. Beneficiaries are encouraged to build value-added services based on the established architecture.

In order to facilitate project management, the development of respective technologies should be decentralised. Proposals are expected to provide quantitative information on the potential for transferring the implemented solution to the wider sector and to other relevant sectors. Based on the pilot data, environmental benefits should be assessed from a lifecycle perspective and quantified using the Product Environmental Footprint (PEF) method⁵⁰, which has already been elaborated for certain product categories in cooperation with industrial partners⁵¹. The social assessment part shall build on the work done in the context of the life

⁴⁹ <https://ec.europa.eu/eurostat/web/prodcom>

⁵⁰ http://ec.europa.eu/environment/eussd/smfp/PEFCR_OEFSR_en.htm

⁵¹ http://ec.europa.eu/environment/eussd/smfp/ef_pilots.htm#pef

cycle initiative and the Platform for Life Cycle Assessment⁵². Economic benefits should also be assessed and quantified under a life cycle perspective.

Participation of actors across the value chain, e.g. material and product producers, end-user organisations, civil society organisations, repair and recycling businesses, etc. is considered essential. Specific information needs at each point in the value chain should be addressed in a satisfactory way, systemised, and the respective data generated out of the integrated information flow. An additional aim of this testing is to obtain a better understanding of the mutual dependencies between the several operators in the system.

Clustering and cooperation with other selected projects under this cross-cutting call and other relevant projects is strongly encouraged.

Activities are expected to focus on Technology Readiness Levels (TRLs) 5-7.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the Introduction of this part of the Work Programme.

The Commission considers that proposals requesting a contribution from the EU in the range of EUR 7-8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: The project results are expected to contribute to:

- the development of new businesses related to the transition to a circular economy, and related value-adding consulting services;
- effective use of both primary and secondary resources in Europe, strengthening geopolitical resource independency, facilitating the market for secondary raw materials, closing material cycles, and reducing waste generation, environmental pollution and greenhouse gas emissions;
- achieving the targets of the EIP on Raw Materials, particularly in terms of feeding secondary raw materials knowledge into the EC Raw Materials Information System (RMIS);
- better insights into the material composition of products and the amount of secondary raw materials in circulation, increasing circularity of relevant material streams, and strengthening the use of PEF as the standard means for the assessment of the material efficiency and overall environmental performance of products;
- streamlined social life cycle assessment ensuring comparability and validity, allowing to critically review green claim and enabling consumers to take environmentally informed

⁵² <https://www.lifecycleinitiative.org/resources/reports/>;
<https://product-social-impact-assessment.com/handbook/>

purchasing decisions, as well as allowing product designers and developers to take environmentally informed design decisions at an early stage;

- better insights on how to transfer successful information management approaches to other businesses and sectors.

Type of Action: Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-SC3-CC-9-2020: Industrial (Waste) Heat-to-Power conversion

Specific Challenge: Better use of process excess/waste heat represents a significant source of energy savings for industries. In a context of reducing greenhouse gas emissions and introducing the concept of circular economy in heat management in view of industrial process electrification, European industries have a clear interest in finding new ways to capture the heat produced by their process and to reuse it or to produce electricity. The conversion of excess heat back to electricity would also improve energy efficiency, mitigate the increase of electricity consumption due to industrial electrification and thereby reduce the load on the power grids. This will also facilitate balancing the grid due to intermittent supply of electricity from renewables.

Innovative heat to (mechanical or electrical) power conversion cycles using either organic fluid or supercritical CO₂ fluid, present several benefits compared to conventional steam cycles. Organic cycles have the potential to recover waste heat sources as low as 150 °C, whereas steam systems are limited to heat sources above 260 °C. The supercritical CO₂ cycle covers medium and high temperatures with drastically reduced footprint, higher efficiency, reduced or eliminated water requirement, reduced operational costs, compared to steam cycles.

These technologies are also transferable to renewable and conventional power generation with higher efficiency and reduced footprint than established technologies.

Scope: Accounting for the results of previous research⁵³, proposals will integrate an industrial waste heat-to-power conversion system using one type of fluid (supercritical CO₂ or organic) and demonstrate the system operation in industrial environment at an output power level of at least 2 MW, with improved cost efficiency compared to existing solutions. Proposals are expected to bring the technologies to TRL 6 or 7 (please see part G of the General Annexes)

In order to reach this goal all the following development areas need to be covered:

- Optimisation of thermal cycles for different temperature levels of recovered heat and constrained industrial environment, in terms of efficiency and economics (capex, opex);

⁵³ EU co-funded projects I-Therm (680599), sCO₂-flex (764690), sCO₂-HeRo (662116), TASIO (637189)

- Development/improvement of design tools at components and system levels;
- Development/improvement of materials and components: heat exchangers, turbomachinery, waste heat recovery unit, power generator and electronics, etc.
- Integration and demonstration of the system in industrial environment;
- Technical, and economical life cycle assessment of heat-to-power systems adapted for at least 4 energy intensive industrial sectors, to demonstrate economic viability, define business cases and exploitation strategy;
- Dissemination of the technical and economic benefits.

Given the transversal nature of the technology, the potential for transferring the technology to the generation of electrical power from conventional and renewable energy sources should be assessed and disseminated.

In the case of supercritical CO₂ technology, the potential for international cooperation⁵⁴ to facilitate technology development and market uptake should also be explored, notably to: establish mechanisms for exchange of R&D results (e.g. on materials performance); establish forum on safety issues, on standardisation of performance models; establish standards for instrumentation performance and calibration.

This topic contributes to the roadmap of the Sustainable Process Industry through Resource and Energy Efficiency (SPIRE) cPPP. Clustering and cooperation with other selected projects under this cross-cutting call and other relevant projects is strongly encouraged.

The proposals should demonstrate cycles, components and systems designs that are particularly suitable for industrial use with proven contributions in terms of industrial excess/waste heat use and impact on power distribution networks.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the Introduction of this part of the Work Programme.

The Commission considers that optimizing cycles, components and systems and demonstrating the solution in an industrial setting would require an EU contribution of EUR 12 to 14 million. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: Actions are expected to make substantial contributions in terms of industrial excess/waste heat use and impact on power distribution networks:

- Improved cycles to achieve scalability to higher power levels, higher cost effectiveness, wider input temperature ranges, significantly reduced system size compared to steam turbines, allowing wider take up of heat recovery from more industrial processes;

⁵⁴ The US-DoE is supporting activities on supercritical CO₂ turbine system, for example the STEP project

- Primary energy savings (GWh/year) in industry (heat recovery) and potential primary energy savings in the power generation sector, assuming full deployment in EU Member States and (as far as data are available for the calculation of the impact) in Associated Countries.

Type of Action: Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-SC3-NZE-5-2020: Low carbon industrial production using CCUS

Specific Challenge: CCUS in industrial applications faces significant challenges due to its high cost and the fierce international competition in the sectors concerned. However, these sectors currently account for 20% of global CO₂ emissions, and in the 2 degree scenario, should represent half of the stored CO₂ by 2050. Relevant sectors with high CO₂ emissions are for example steel, iron and cement making, oil refining, gas processing, hydrogen production, biofuel production and waste incineration plants.

Scope: Projects will focus on integrating CO₂ capture in industrial installations, whilst addressing the full CCUS chain. Projects will elaborate a detailed plan on how to use the results, i.e. the subsequent transport, utilisation and/or underground storage of the captured CO₂. Important aspects to address are of technical (e.g. the optimised integration of capture plant with industrial processes; scalability; CO₂ purity), safety (e.g. during transportation and storage), financial (e.g. cost of capture; cost of integration) and strategic nature (e.g. business models; operation and logistics of industrial clusters and networks).

Projects are expected to bring technologies to TRL 6-7 (please see part G of the General Annexes). Technology development has to be balanced by an assessment of the societal readiness towards the proposed innovations. Relevant end users and societal stakeholders will be identified in the proposal, and their concerns and needs will be analysed during the project using appropriate techniques and methods from the social sciences and humanities, in order to create awareness, gain feedback on societal impact and advancing society's readiness for the proposed solutions. Projects should also explore the socio-economic and political barriers to acceptance and awareness with a view to regulatory or policy initiatives.

In line with the strategy for EU international cooperation in research and innovation (COM(2012)497), international cooperation is encouraged, in particular with relevant Mission Innovation⁵⁵ countries such as China⁵⁶.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the Introduction of this part of the Work Programme.

⁵⁵ <http://mission-innovation.net/our-work/innovation-challenges/>

⁵⁶ A Co-funding mechanism is in place in China; see <https://ec.europa.eu/programmes/horizon2020/en/news/eu-china-research-and-innovation-co-funding-mechanism-first-call-launched-china>

The Commission considers that proposals requesting a contribution from the EU of up to EUR 15 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: Successful, safe and economic demonstration of integrated-chain CCUS from relevant industrial sources such as mentioned in the specific challenge will accelerate the learning, drive down the cost and thus help break the link between economic growth and the demand for industrial output on one hand, and increasing CO₂ emissions on the other hand. The impact of projects under this call will to a large extent be determined by the extent to which the results will be exploited, i.e. the plan on how the captured CO₂ will be actually utilised and/or stored, either in the project or planned as a future phase. This will be evaluated based on the maturity and quality of the proposed post-capture solutions. Projects under this call that are carried out in areas where there is both a high concentration of CO₂ emitting industries and a nearby capacity for geological storage are considered prime sites for hub and cluster developments, and will generate the highest impact on full-scale deployment in the medium to longer term.

Type of Action: Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Conditions for the Call - COMPETITIVE, LOW CARBON AND CIRCULAR INDUSTRIES

Opening date(s), deadline(s), indicative budget(s):⁵⁷

Topics (Type of Action)	Budgets (EUR million)	Deadlines
	2020	
Opening: 03 Jul 2019		
CE-NMBP-41-2020 (ERA-NET-Cofund)	15.00 ⁵⁸	05 Feb 2020
CE-NMBP-42-2020 (RIA)	6.00 ⁵⁹	

⁵⁷ The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.

The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.

The implementation is subject to the availability of the appropriations provided for in the general budget of the Union for years 2019 and 2020.

⁵⁸ of which EUR 15.00 million from the 'Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing' WP part.

⁵⁹ of which EUR 6.00 million from the 'Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing' WP part.

CE-SC5-08-2020 (CSA)	3.00 ⁶⁰	
CE-SPIRE-01-2020 (IA)	97.50 ⁶¹	
CE-SPIRE-07-2020 (IA)		
CE-SPIRE-09-2020 (IA)		
CE-SC5-07-2020 (IA)	65.00 ⁶²	05 Feb 2020 (First Stage)
CE-SC5-31-2020 (IA)	15.00 ⁶³	03 Sep 2020 (Second Stage)
Opening: 05 May 2020		
LC-SC3-CC-9-2020 (IA)	14.00 ⁶⁴	01 Sep 2020
LC-SC3-NZE-5-2020 (IA)	15.00 ⁶⁵	
Overall indicative budget	230.50	

Indicative timetable for evaluation and grant agreement signature:

For single stage procedure:

- Information on the outcome of the evaluation: Maximum 5 months from the final date for submission; and
- Indicative date for the signing of grant agreements: Maximum 8 months from the final date for submission.

For two stage procedure:

- Information on the outcome of the evaluation: Maximum 3 months from the final date for submission for the first stage and maximum 5 months from the final date for submission for the second stage; and
- Indicative date for the signing of grant agreements: Maximum 8 months from the final date for submission of the second stage.

Eligibility and admissibility conditions: The conditions are described in General Annexes B and C of the work programme.

⁶⁰ of which EUR 3.00 million from the 'Climate action, environment, resource efficiency and raw materials' WP part.

⁶¹ of which EUR 97.50 million from the 'Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing' WP part.

⁶² of which EUR 65.00 million from the 'Climate action, environment, resource efficiency and raw materials' WP part.

⁶³ of which EUR 15.00 million from the 'Climate action, environment, resource efficiency and raw materials' WP part.

⁶⁴ of which EUR 14.00 million from the 'Secure, clean and efficient energy' WP part.

⁶⁵ of which EUR 15.00 million from the 'Secure, clean and efficient energy' WP part.

Evaluation criteria, scoring and threshold: The criteria, scoring and threshold are described in General Annex H of the work programme. The following exceptions apply:

CE-NMBP-42-2020, CE-SC5-07-2020, CE- SC5-31-2020, CE- SPIRE-01-2020, CE- SPIRE-07-2020, CE- SPIRE-09-2020, LC- SC3-CC-9-2020, LC- SC3-NZE-5-2020	The threshold for the criteria Excellence and Impact will be 4. The overall threshold, applying to the sum of the three individual scores, will be 12.
CE-NMBP-42-2020, CE-SC5-07-2020, CE- SC5-31-2020, CE- SPIRE-01-2020, CE- SPIRE-07-2020, CE- SPIRE-09-2020, LC- SC3-CC-9-2020, LC- SC3-NZE-5-2020	Proposals submitted under these topics should include a business case and exploitation strategy, as outlined in the Introduction of this part of the Work Programme.

Evaluation Procedure: The procedure for setting a priority order for proposals with the same score is given in General Annex H of the work programme. The following exceptions apply:

All topics of this call	<p>Under 3 (a) Proposals are first ranked in separate lists according to the topics against which they were submitted ('topic ranked lists'). When comparing ex aequo proposals from different topics, proposals having a higher position in their respective 'topic ranked list' will be considered to have a higher priority in the overall ranked list.</p> <p>Under 3 (b) For all topics and types of action, the prioritisation will be done first on the basis of the score for Impact, and then on that for Excellence.</p>
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The full evaluation procedure is described in the relevant [guide](#) published on the Funding & Tenders Portal.

Consortium agreement:

All topics of this call	Members of consortium are required to conclude a consortium agreement, in principle prior to the signature of the grant agreement.
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Call - Building a low-carbon, climate resilient future: Research and innovation in support of the European Green Deal

H2020-LC-GD-2020

This call for proposals is a direct contribution to the European Commission's European Green Deal Communication⁶⁶, which sets out the path for a fundamental transformation of Europe's economies and societies. The call responds to the pressing need to confront the climate crisis and provide greater protection for the continent's unique environment and biodiversity. At the same time, the call addresses the equally urgent challenge of aiding Europe's recovery in the wake of the Covid-19 crisis, contributing directly to the EU's Recovery Plan for Europe⁶⁷.

The call's ambition matches the magnitude of the task: its goal is to use research and innovation to kick-start the environmental, social and economic transformations required to tackle the climate challenge, while helping the EU recover from the Covid-19 crisis, and increasing its resilience and capacity to respond to such novel threats in the future. Science, knowledge and evidence – not short-term crisis contingencies – provide the compass for charting the path towards more resilient economies, societies and governance systems, and for designing a new, green growth strategy for the EU, embracing digitisation and enhancing Europe's competitiveness.

The challenge is not just technical: it requires profound adaptations in life-styles and behaviour. Research and innovation offers unique opportunities to reach out and engage with Europe's citizens in novel ways, identifying and addressing specific vulnerabilities with a view to ensuring that no one is left behind by the transition. Mainstreamed throughout this call, these aspects are also covered via specific actions, aiming for improved societal relevance and impact.

In addition, this call underlines the need to continue building Europe's knowledge systems and infrastructures. It stresses the importance of international cooperation, addressing the needs of less-developed nations, particularly in Africa, in the context of the Paris Agreement as well as the Sustainable Development Goals (SDGs).

This last call under Horizon 2020 differs in important respects from previous ones. Given the immediacy of the twin challenges it addresses, it aims for clear, discernible results in the short- to medium-term, embedding them in a perspective of long-term change. Interventions are more targeted, resulting in fewer, but at the same time larger and more visible, actions, with a focus on rapid scalability, dissemination and uptake.

⁶⁶ *The European Green Deal, EC COM (2019) 640 final, Brussels, 11 December 2019.*

⁶⁷ *Europe's moment: Repair and Prepare for the Next Generation, EC COM (2020) 456 final, Brussels, 27 May 2020*

Demonstrating the feasibility of new technologies and solutions, and paving the way to their commercialization, is key but experimentation, social innovation and citizen engagement are just as critical.

Electric batteries are important technological enablers to drive the transition towards a de-carbonised society and a climate-neutral Europe, by integration of renewable and clean energy sources (such as wind energy and photovoltaics) in the electricity grid, and, in particular, by electrification of transport. Supporting the development of price competitive and sustainable battery storage solutions considering the whole electric batteries value chain and life cycle is a direct contribution to the objectives of the European Green Deal, speeding up the transformation of critical sectors of the European economy in order to fight climate change and sustain their long term competitiveness.

Despite their strong relevance to the European Green Deal objectives, topics on electric batteries are not part of this call, because the Commission has created a separate cross-cutting call, bringing together all R&I activities dedicated exclusively to the development of new generation electric batteries. The call “Building a Low-Carbon, Climate Resilient Future: Next-Generation Batteries” is in the cross-cutting part of Horizon 2020 Work Programme 2018-2020, has an overall budget of EUR 246 million and contains 15 topics covering several technological aspects from short term research for advanced Li-ion electrochemistry processes to long term research for the development of next generations of smart, safe and high-performing batteries. Nevertheless, the Green Deal call contains complementary actions to facilitate effective and customised access of European researchers, from academia and industry, to specialised European research infrastructures in the field of energy storage.

As spelled out in further detail just below, the call is broken down into eight principal areas – reflecting the structure of the European Green Deal –, each comprising one to three broad, thematic topics. Alongside these eight core areas, the call features two supporting areas, on knowledge systems and research infrastructures and citizen engagement, respectively.

Area 1: Increasing climate ambition: cross sectoral challenges

In line with the long-term vision for climate neutrality set out in the *Clean Planet for All* Communication,⁶⁸ this area addresses research and innovation needs for climate mitigation and adaptation. The emphasis lies on three specific sectors where such needs are particularly acute, namely: (1) the devastating impacts of recurrent wildfires across Europe; (2) the pivotal role of Europe’s cities in driving climate action and related social and governance innovation and; (3) the equally important responsibility of Europe’s regions to accompany and assist their communities and economies in adapting to climate change.

The area comprises the following topics:

- 1.1. Preventing and fighting extreme wildfires with the integration and demonstration of innovative means

⁶⁸

A *Clean Planet for All*, EC COM (2018) 773 final, Brussels, 28 November 2018

1.2. Towards climate-neutral and socially innovative cities

1.3. Climate-resilient innovation packages for EU regions

Area 2: Clean, affordable and secure energy

The production and use of energy accounts for more than 75% of the EU's greenhouse gas emissions; therefore, further decarbonising the energy system is fundamental for reaching the climate targets set for 2030 and 2050. Renewable sources play a central role and their smart integration, using smart grids, power to X (like for instance hydrogen), storage solutions (for instance batteries) and corresponding networks, energy storage, and sector integration. Decarbonisation needs to take place at the lowest possible cost and ensuring circularity, while tackling energy poverty is critical for households unable to afford key energy services.

In the context of the Paris Agreement and the Sustainable Development Goals (SDGs), the EU and other developed nations have committed to assisting emerging and less developed ones in their transition to cleaner, more sustainable energy systems. The R&I Partnership on Climate Change and Sustainable Energy under the European Union/African Union High-Level Policy Dialogue on Science, Technology and Innovation is an expression of this commitment.

The area comprises the following topics:

2.1. Innovative land-based and offshore renewable energy technologies and their integration into the energy system

2.2. Develop and demonstrate a 100 MW electrolyser upscaling the link between renewables and industrial applications

2.3. Accelerating the green transition and energy access partnership with Africa

Area 3: Industry for a clean and circular economy

Energy-intensive industries, particularly steel, chemicals and cement, are an essential part of Europe's economy and supply critical strategic value chains. However, they also account for 20% of the EU's greenhouse-gas emissions, making their decarbonisation and transformation a top priority. At the same time, Europe faces a challenge of ensuring autonomy in strategic sectors along the whole value chains. Following the recommendations of the High-Level Expert Group on Energy-Intensive Industries, the actions under this area support switching to alternative, climate-neutral energy and feedstock sources. Furthermore, in line with the EU's new industrial strategy,⁶⁹ they support adopting more circular product designs, given that only 12% of the materials used by industry come from recycling. Therefore, actions should contribute to increasing Europe's autonomy in raw materials, including critical raw materials. Supportive policy measures, helping consumers to make more informed choices, are likewise covered.

⁶⁹

A New Industrial Strategy for Europe, EC COM (2020) 102 final, 10 March 2020

The area comprises the following topics:

- 3.1. Closing the industrial carbon cycle to combat climate change
- 3.2. Demonstration of systemic solutions for the territorial deployment of the circular economy

Area 4: Energy and resource efficient buildings

The construction and renovation of buildings, together with their use and operation, consumes significant amounts of energy as well as mineral resources. In total, buildings account for 40% of all energy consumed. By contrast, the annual renovation rate of the EU's building stock hovers around only 0.4-1.2% across Member States; it will have to at least double to reach the EU's energy and climate objectives. Renovating and retrofitting social housing, schools and hospitals is particularly important, as it could free up more financing for education and public health, as well as for supporting households that cannot afford all their energy needs.

The area comprises the following topic:

- 4.1. Building and renovating in an energy and resource efficient way

Area 5: Sustainable and smart mobility

For the EU to become climate-neutral by 2050, transport must become 'drastically less polluting': a 90% reduction in emissions is required. All transport modes must contribute to this goal, with an emphasis on boosting multimodality (using different transport modes). Slashing transport emissions at ports and airports, as well as in cities is a top priority; together with ramping up the production and deployment of sustainable alternative fuels; eliminating fossil-fuel subsidies; as well as developing automated and connected multimodal mobility.

The area comprises the following topic:

- 5.1. Green airports and ports as multimodal hubs for sustainable and smart mobility

Area 6: Farm to fork

Food production today causes air, water and soil pollution, accelerates climate change and the loss of biodiversity and consumes excessive amounts of natural resources, while a significant portion of food produced goes to waste. At the same time, current food consumption patterns are unsustainable from both health and environmental points of view. European food should become the global standard for sustainability; therefore, in line with the *Farm to Fork Strategy*,⁷⁰ the actions under this area are meant to pave the way to more sustainable food systems. This will strengthen the efforts of farmers, fishers, food businesses and consumers to tackle climate change, protect the environment and preserve biodiversity while contributing to more circular economies and sustainable, healthy lifestyles.

⁷⁰

A *Farm-to-Fork Strategy*, EC COM (2020) 381 final, 20 May 2020.

The area comprises the following topic:

6.1. Testing and demonstrating systemic innovations for sustainable food from farm to fork

Area 7: Biodiversity and ecosystem services

Ecosystems provide essential goods such as fresh water, clean air and healthy soil; they help mitigate natural disasters, including pests and diseases and they help regulate the climate. Contributing to the implementation of the *Biodiversity Strategy to 2030*⁷¹ adopted by the European Commission, the actions under this area aim to restore biodiversity and ecosystem services, caused by changes in land and sea use, direct exploitation of natural resources, climate change, pollution and invasive alien species. Particular emphasis is put on upscaling restoration on land and at sea, mitigating and adapting to climate change. Large-scale restoration of degraded ecosystems and deployment of nature-based solutions will accelerate transformative change in cooperation with vulnerable communities and regions.

The area comprises the following topic:

7.1. Restoring biodiversity and ecosystem services

Area 8: Zero-pollution, toxic-free environment

To protect Europe's citizens and ecosystems, the EU needs to better monitor, report, prevent and, if need be, remedy the pollution of its air, water, and soil, as well as address downstream effects that threaten the safety of consumer products. Restoring the natural functions of ground and surface water is essential for preserving and restoring biodiversity in lakes, rivers, wetlands and estuaries, as well as to prevent and limit damage from floods. Actions under this area envision measures addressing pollution from several sources, such as urban runoff, new or particularly harmful sources including micro-plastics and chemicals, or large industrial installations. In addition, they support the development of a chemicals strategy for sustainability, with the goal of ensuring a toxic-free environment.

The area comprises the following topics:

8.1. Innovative, systemic zero-pollution solutions to protect health, environment and natural resources from persistent and mobile chemicals

8.2. Fostering regulatory science to address chemical and pharmaceutical mixtures: from science to evidence-based policies

Area 9: Strengthening our knowledge in support of the EGD

The urgency and scale of the challenges addressed by the European Green Deal require the mobilisation and further advancement of the world-class scientific capacities and resources offered by the European Research Infrastructures. This will aid the transition towards a climate-neutral Europe, with a 50% emission reduction target by 2030. Pilot activities under this call will provide research and innovation services for breakthrough research in two

⁷¹ EU Biodiversity Strategy for 2030, EC COM (2020) 380 final, Brussels, 20 May 2020

priority areas: (1) energy storage and; (2) advanced climate/environment observation and monitoring. Expected impacts range from answering short-term needs under this call to longer-term perspectives under Horizon Europe.

The area comprises the following topics:

9.1. European Research Infrastructures' capacities and services to address European Green Deal challenges

9.2. Developing end-user products and services for all stakeholders and citizens supporting climate adaptation and mitigation

9.3. A transparent and accessible ocean: towards a digital twin of the ocean

Area 10: Empowering citizens for the transition towards a climate-neutral, sustainable Europe

The European Green Deal communication stresses that the transition towards sustainability must be just and inclusive, put people first and bring together citizens in all their diversity. This calls for citizen engagement and social innovation in all areas of the Green Deal. This also requires ambitious cross-cutting actions to engage and empower people and communities and to support behavioural, social and cultural changes wherever this is most needed for a fair and inclusive transition, leaving no-one behind. Such actions must address change at the collective level through participatory processes and experimental research on behavioural, social and cultural change; and at an individual level by empowering citizens as actors of change, including through the co-creation of R&I contents⁷².

The area comprises the following topics:

10.1. European capacities for citizen deliberation and participation for the Green Deal

10.2. Behavioural, social and cultural change for the Green Deal

10.3. Enabling citizens to act on climate change and environmental protection through education, citizen science, observation initiatives, and civic involvement

Contribution to focus areas

The Green Deal Call contributes in its entirety to the Horizon 2020 focus area ‘Building a low-carbon, climate resilient future’.

Area 1: Increasing Climate Ambition: Cross sectoral challenges

Proposals are invited against the following topic(s):

⁷² See UN Global Sustainable Development Report 2019, *The Future is Now – Science for achieving sustainable development*, <https://sustainabledevelopment.un.org/gsdr2019>

LC-GD-1-1-2020: Preventing and fighting extreme wildfires with the integration and demonstration of innovative means

Specific Challenge: The Green Deal explicitly calls to “reduce the incidence and extent of forest fires”. It also calls “to boost the EU’s ability to predict and manage environmental disasters” as an immediate priority. Large-scale and more intense wildfires are becoming an increasing concern. Fire is a natural component in many ecosystems across Europe but more and more Europeans suffer directly and indirectly from wildfires. Between 2017 and 2020, fires have killed hundreds of persons and ravaged forests and Natura 2000 sites not only in Southern Europe, but increasingly also in Central, Eastern and Northern Europe.

In addition to the extraordinary socioeconomic impact in terms of loss of human lives of residents and first responders, health, infrastructures and economic activity, extreme wildfire events have also serious and sometimes irreversible ecological impacts when considering soil degradation, water scarcity and biodiversity loss.

Moreover, wildfires are among the first contributors to climate change, with up to 20% of total global greenhouse gas emissions per year⁷³. Furthermore, the large surfaces burnt cannot absorb so much CO₂ any longer, reducing the climate change mitigation potential of carbon sinks. Extreme wildfires are now observed more frequently in higher altitudes and latitudes and further contribute to accelerating climate change by increased black carbon fall-out on ice/snow and by melting of underlying permafrost.

In addition, large wildfires degrade air quality through the direct emissions of toxic pollutants affecting first responders and local residents, while populations in regions far away from the wildfires can be exposed to other pollutants as the air is transported, with short- and long-term impact on human health.

Climate change, certain forestry practices, ecosystem degradation and rural depopulation increase the depth and breadth of wildfires in the EU. Climate change is predicted to increase fire risk, with longer fire seasons, more frequent fire events, new fire-prone regions and more severe fire behaviour. The burnt area in southern Europe during the 21st century would sharply increase. The number of people living near wildland and exposed to high-to-extreme fire danger levels for at least 10 days per year would grow by 15 million with 3°C warming, compared to now⁷⁴. Furthermore, global warming could result in a substantial shift northwards of European ecological domains, making the recovery or re-establishment of non-adapted ecosystems more difficult after a fire. Extreme wildfire events as in Southern Europe in 2017-2018 and in California, Brazil and Australia in 2019, are likely to become common throughout the whole of Europe.

Scope: The new context of extreme wildfires requires accelerating the shift towards implementing a more holistic fire management approach that integrates environmental, climate, health & safety/security, cultural and socio-economic aspects with:

⁷³ 7–16 Gt CO₂-eq per year <https://www.sciencedirect.com/science/article/pii/S1674927818300376>

⁷⁴ JRC’s PESETA IV Project: European wildfire danger and vulnerability in a changing climate: towards integrating risk dimensions (2020).

- research, demonstration and deployment of innovative means and methods tailored to extreme wildfire behaviour, such as better and more advanced techniques, models, solutions and capabilities for preventing, predicting, monitoring and fighting wildfires, and mitigating their impact, including better and advanced technologies, equipment and decision support systems for first responders;
- proactive governance, change of forest management practices, large-scale and community-based risk assessments, awareness and preparedness - where citizens, local communities, the forestry and bio-economy sectors play a central role.

Activities should go beyond the state of the art and previous R&I activities at EU level⁷⁵, cooperate with ongoing relevant Horizon 2020 projects⁷⁶ and make best use of existing EU initiatives and services (such as Copernicus, Galileo and EGNOS). Activities should involve relevant international, national and EU agencies (e.g. European Environment Agency (EEA), European Union Aviation Safety Agency (EASA), ...) and end-users (such as forest owners, forest-based industry actors, environmental and nature management organisations, firefighters, local and regional authorities, etc) from Member States and Associated Countries. In line with the strategy for EU international cooperation in research and innovation, multilateral international cooperation is encouraged.

The topic will be implemented through two distinct sub-topics. Proposals should address only one of the following subtopics:

Subtopic 1 (Innovation Actions): Actions funded under this call will speed up the pan-European adaptation process to extreme wildfires by advancing and applying research and innovation, including demonstration pilot sites, while making best use of existing data (e.g. remote sensing, in-situ or community-based data), technologies (e.g. Big Data and Artificial Intelligence) and services (as Copernicus, Galileo and EGNOS).

Innovative means and methods should be developed, integrated and demonstrated in different environments across Europe (including EU Outermost regions) and tailored to geographical and socio-economic conditions, with different types of fuels (e.g. forest/bush /peat fire threats), landscapes and biodiversity values (e.g. coastal/alpine/agriculture/rural/Wild-Urban Interface/islands) and scales (e.g. local/regional /national/cross-border/EU/international).

The approach should be systemic: encompassing different climate scenarios, biogeographical/socio-economic contexts, traditional practices and new means for faster and smarter management of all interconnected fire management phases, i.e. prevention and preparedness (including forecasting and landscape management for impact mitigation, adapting tree species composition and forest management practices), detection and response

⁷⁵ FP7/Horizon2020/COST/JRC, LIFE and Civil Protection projects examples in Projects For Policy (P4P) Forest fires - Sparking fire-smart policies in the EU: <https://op.europa.eu/en/publication-detail/-/publication/0b74e77d-f389-11e8-9982-01aa75ed71a1/language-en/format-PDF/source-91693190>, e.g. Firefighter Innovation Network FIRE-IN: <https://fire-in.eu>

EU Regional/Cohesion projects on forest fire protection and research and innovation
e.g. https://cohesiondata.ec.europa.eu/projects/row-2scn-y6qh_3fwi

⁷⁶ Such as from topic LC-CLA-15-2020 and call H2020 SU-DRS02-2018-2019-2020

(including fire containment, extinction, potential evacuation and recovery) and post-fire restoration⁷⁷ and adaptation to climate change.

Proposals should consider an Integrated Fire Management strategy⁷⁸ to include viewpoints from all parties in a participative way. They should cover all of the fire management phases (i.e. prevention and preparedness, detection and response, restoration and adaptation), while focusing within each phase on a subset of activities, as described below:

Phase A - Prevention and Preparedness

The integration of environmental, climate and socio-economic conditions (including tangible and intangible cultural heritage) with proactive governance (public and private actors), community-based risk awareness, prevention and preparedness activities may include among others:

- supporting the integration of socioeconomic and environmental information on wildfire causes and impacts into existing EU databases (e.g. EFFIS) with a focus on extreme wildfire events, the causes of wildfire ignitions (e.g., accidental, criminal and natural causes) and the demographic dynamics and trends (e.g. rural abandonment and other land use change activities);
- improving fire and landscape management of both public and private lands (including forest, agricultural and agro-forest lands using both traditional and innovative approaches for sustainable fuel management, improved forest management practices (i.e. enhanced diversity of forest tree species and forest structure, thinning, agroforestry, etc), including community-based incentive programmes for biomass monitoring and reduction, land requalification, and new bioeconomy value chains that maximise wood and non-wood forest products and services whilst improving biodiversity and resilience;
- enhancing access to official fire danger index rating and warnings in cooperation with existing EU initiatives (e.g. Copernicus services, EFFIS, with resolution tailored to the conditions), through upscaling the use of mobile apps, digital infrastructure and advanced cyber technologies;
- building a common culture on risk prevention and preparedness across Europe, including behavioural change of citizens, local authorities, businesses and schools, through education and training, community involvement and awareness campaigns to encourage self-protection, safety and environmental protection (through spatial planning), with special attention to Wildland Urban Interface areas;
- integrating fire safety knowledge and engineering to support the design, construction, and management of fire-resilient buildings and infrastructures;

⁷⁷ Based on CBD guidance on ecosystem-based approaches to climate change adaptation and disaster risk reduction <https://www.cbd.int/doc/decisions/cop-14/cop-14-dec-05-en.pdf>

⁷⁸ e.g. guidance developed by actions supported under Horizon 2020 topic LC-CLA-15-2020

- supporting the integration of wildfire prevention and resilience into governance and insurance models, including alternative risk transfer solutions and products, and accounting for risks due to cascading effects on society at large and critical infrastructures in particular;
- improve early-warning tools by integrating forest stand bio-geographical data (i.e. tree species composition, soil traits, tree age composition, etc) in forecasting models;
- improving the understanding of the link between the exposure to smoke and air pollutants from fires and health and well-being in local communities and first responders;
- developing Broad Earth System studies for weather and climate drivers as well as biophysical feedback of global forest fires on climate to improve existing wildfire information systems from national to global scales⁷⁹ - leading to new operational seasonal (coarse) and short-term (high-resolution) forecasts, using climate-vegetation-fires models but also historical wildfires records and paleoclimate evidence.

Phase B - Detection and Response

Anticipation and mitigation of high-impact events will benefit from research and innovation in space, aerial, ground, material and digital technologies, which should be integrated altogether with environmental, climate and social disciplines and existing EU initiatives on monitoring and suppression of wildfires. Activities should be demonstrated in a broad range of weather conditions and geographical scenarios. Activities may include among others:

- measures to stimulate investments from private sector in new technologies for retrofitting and/or developing new detection & response technologies;
- fast-track research and innovation in space and aerial means (e.g. satellites, pseudo-satellites, aircraft including drones, remote sensing systems) for detection, targeting and extinction of fires, such as better water-bomber helicopters / planes able to operate safely at night; modular firefighting units fit for cargo/multi-mission aircraft; improved scooping, tanking and discharging;
- improving firefighters' and manned & unmanned ground/air vehicles' location, route management, patrolling and automation in real time - including via (EU) aerial/satellite navigation/observation/communication services - to guide and protect fire brigades and vehicles operating simultaneously to respond efficiently to fires in all conditions;
- developing near real-time high-fidelity fire and smoke propagation forecasting, based on precise topography, weather, fuel and combustion modelling, via aero-space data and services, advance sensing (e.g. temperatures, winds), machine-learning and supercomputing;

⁷⁹

I.e., Global Wildfire Information System and European Forest Fire Information System.

- enhancing interoperable and secure incident-management, decision-making and communication, coordination and command systems, able to incorporate information from multiple platforms (manned and unmanned) and non-traditional sources (as social media), particularly in non-urban environments and across European countries e.g. air-to-air, ground-to-ground and air-to-ground, exploiting satellite and ad-hoc communication links for near real-time transmissions;
- developing strategies, procedures and tools for incident management teams to interact with citizens at risk and spread appropriate warnings, evacuation or confinement messages in consideration of human factors filters and psychological dimension, with the use of a broad range of means (including social media...) so that the entire targeted population can be efficiently reached;
- enabling better integration of wireless sensors, early warning systems, fire retardant rapid deployment, search & rescue and evacuation of persons and animals (e.g., contingency plans) and better connection with other sectors that also monitor forest data, such as Distribution System Operators tracking aerial power lines;
- developing advanced personal monitoring and protective equipment for emergency responders (e.g., smart garments, gear and breathing apparatus) tailored for wildfire conditions, assisted with advanced ICT decision support systems, land/air robotics and improved fire retardants/extinguishing agents;
- developing better training, including virtual reality simulators for air fleet and ground resources;
- enabling better and faster estimates of the impact of fire events on direct losses, including the number of people affected, interruption or damage to critical infrastructure networks, direct economic losses, dispersion of hazards and contaminants dispersion, impact on water sources and other cascading effects.

Phase C - Restoration and Adaptation

Proposals should aim at supporting the socio-ecological transition towards more resilient communities, in particular those most exposed to wildfire risk. Activities may include among others:

- evaluating and upscaling the deployment of ecosystem-based restoration solutions across various biogeographical contexts, building on the solutions developed by EU-funded demonstration projects on nature-based solutions (NBS);
- advancing and demonstrating systemic and structural measures for fuel treatments and tree/forest management aiming at resilient wildland-urban interfaces, taking into account the relevant spatial scales and fire ecology principles in relation to climate change;
- demonstrating sustainable post-fire ecosystem restoration solutions of damaged ecosystems aiming at restoring biodiversity, including local soil microbiota for

ecosystem resilience and supported by monitoring services and complementary geospatial analysis;

- contributing to the definition of a common EU legal framework for the governance systems and operational activities regarding forest and communities protection from climate-related risks;
- testing and developing public-private cooperation mechanisms to leverage investments from the private sector, including insurance companies in order to stimulate the development of preventive measures and reduce losses from wildfires;
- supporting mechanisms and promotion of governance systems for restoration and adaptation through the involvement, coordination, and cooperation of different actors and sectors bridging between national and local administrative levels.

The Commission considers that proposals requesting a contribution from the EU of between EUR 15 to 20 million would allow the specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

In line with the strategy for EU international cooperation in research and innovation, multilateral international cooperation is encouraged, in particular with United States, Canada, Australia, Russia, Japan, Brazil, South America, Indonesia and South Africa to leverage knowledge, resources and best practices, as well as to decrease risks and increase impact worldwide.

Proposals should ensure that the diversity of concerned actors (e.g. science, governance and practice communities, public and private sectors) is well represented in the consortium to address all phases, and should also dedicate resources to engage in the Coordinated Support Action (Subtopic 2) for clustering and partnering activities with other actions.

Subtopic 2 (Coordination and Support Action): This action aims to ensure that the demonstration of innovative and integrated approaches fulfils the expected impacts, by coordinating and supporting the Innovation Action projects funded under this topic.

Activities may include among others:

- supporting clustering and cooperation among the projects funded under this topic and with other relevant actions funded under Horizon 2020 (including in this European Green Deal call, such as topic 7 on biodiversity and ecosystems), and the Cohesion and Civil Protection funds.
- facilitating the integration of the three fire management phases covered by each of the Innovation Action projects funded under this topic;

- engagement with citizens, local communities, forest owners and the forestry-based industry, nature conservation organisations, insurance and social infrastructure sectors as well as all relevant actors to facilitate the implementation of demonstration projects;
- extensive and structured knowledge sharing (e.g. Disaster Risk Knowledge Management Centre DRKMC) and evaluation-based analysis of past wildfire events (lessons learnt) to improve the effectiveness of activities and better prevent wildfires;
- developing recommendations for wildfire prevention and preparedness activities targeted at the different actors involved (i.e. forest owners, nature protection organisations, residents, local and regional authorities, etc);
- developing better readiness of response units for cross-border, regional, international assistance, in line with the Union Civil Protection Mechanism framework;
- developing recommendations for harmonized training and standard operating procedures for first responders to improve interoperability, to achieve better preparedness of available assets and to share facilities;
- facilitating international collaboration and global outreach in the areas covered by this topic.

The Commission considers that proposals requesting a contribution from the EU of between EUR 2 to 3 million would allow the specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

In line with the strategy for EU international cooperation in research and innovation, multilateral international cooperation is encouraged, in particular with United States, Canada, Australia, Russia, Japan, Brazil, South America, Indonesia and South Africa to leverage knowledge, resources and best practices, as well as to decrease risks and increase impact worldwide.

Expected Impact: The actions funded under this call topic should jointly contribute substantially to achieving by 2030 the following targets in Europe (with respect to 2019):

- 0 fatalities from wildfires
- 50% reduction in accidental fire ignitions
- 55% reduction in emissions from wildfires
- Control of any extreme and potentially harmful wildfire in less than 24 hours
- 50% of Natura 2000 protected areas to be fire-resilient
- 50% reduction in building losses
- 90% of losses from wildfires insured

- 25% increase in surface area of prescribed fire treatments at EU level

In order to maximise impact, the most promising results demonstrated in the actions are expected to be up-scaled and deployed into:

- national climate change adaptation and disaster risk reduction strategies, land use policies and spatial planning, in line with EU policy guidelines and legislation, including forest, biodiversity and bio-economy related strategies;
- national guidelines and legislation on forest management planning, nature conservation and management of protected areas and habitats, restoration of damaged forests and landscapes, etc;
- European Forest Fire Information System (EFFIS) (including forecasts and risk assessments) and the Disaster Risk Management Knowledge Centre (DRMKC) Risk Data Hub, as well as the Knowledge Centres for Biodiversity and Bioeconomy and the Forest Information System for Europe (FISE);
- Union Civil Protection Mechanism (UCPM) and Emergency Response Coordination Centre (ERCC)⁸⁰;
- Copernicus Emergency Management System (EMS) e.g. for Rapid Mapping, Risk & Recovery; Copernicus Land Service e.g. for monitoring changes in land cover and land use; Copernicus Atmosphere Monitoring Service e.g. for detecting, monitoring the intensity of fires and forecasting pollutants propagation; Copernicus Security Service e.g. for support to EU external action; the Group on Earth Observations^{81,82} and Galileo Emergency Warning Service;
- the planned Horizon Europe Mission on Adaptation to Climate Change including Societal Transformation - with a strong focus on citizens' engagement;
- EU co-funded regional and interregional initiatives promoting climate change adaptation, risk prevention and disaster resilience e.g. to support environmental areas and regional civil protection infrastructures and units to prevent and fight wildfires;
- at international policy level, the Sendai Framework for Disaster Risk Reduction (2015-2030), placing disaster risk reduction as a key element of sustainable development efforts;
- international standardisation bodies for international industrialisation of solutions, such as the International Forum to Advance First Responder Innovation (IFAFRI) among others.

Type of Action: Innovation action, Coordination and support action

⁸⁰ https://ec.europa.eu/echo/what-we-do/civil-protection/forest-fires_en

⁸¹ http://www.earthobservations.org/documents/gwp20_22/GWIS.pdf

⁸² http://www.earthobservations.org/documents/gwp20_22/SPACE-SECURITY.pdf

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-GD-1-2-2020: Towards Climate-Neutral and Socially Innovative Cities

Specific Challenge: The strategic long-term vision⁸³ published by the Commission for a prosperous, modern, competitive and climate-neutral economy calls for a drastic reduction of greenhouse gas emissions by 2050.

The European Commission's Green Deal⁸⁴ proposes a new growth strategy that aims to preserve the planet for future generations. It should serve as the compass to emerge from the present COVID-19 crisis and offers the opportunity to bounce forward and accelerate our progress towards meeting the EU climate change objectives. It sets an ambitious target of a 50%-55% reduction of greenhouse gas emissions by 2030. Through its roadmap for action it outlines a long-term vision for the environment, involving all sectors of the economy, geared towards reaching the goal of climate neutrality.

While cities occupy only 2% of the planet's landmass, they consume over 65% of the world's energy and account for more than 70% of global man-made CO₂ emissions. Currently 75% of European citizens live in cities and this percentage is expected to rise to 80% by 2050. Therefore, cities⁸⁵ must play a crucial role in helping Europe reach the targets of the Green Deal. The Commission will support their systemic transformation towards climate neutrality leveraging, in particular, technological, non-technological and social innovation and new AI-based solutions.

The challenge resides with achieving significant progress towards climate neutrality at a large (European) scale by fostering climate-neutrality and social innovation in cities. This means capitalising on existing research and innovation, valorising available knowledge in Europe, and using Green Deal-targeted social, financial, and technological innovation to co-create, test, and deploy systemic, integrated solutions, technologies, and incentive schemes with cities to tackle the largest sources of pollution in urban and metropolitan areas. It also implies designing incentives promoting investments such as green infrastructure into cities committed to climate neutrality and the Green Deal objectives. This will help test innovative solutions, technologies, and incentives to reach the scale that will make them attractive for industry economically, for citizens in terms of affordability, liveability, and inclusiveness, and for local authorities as concern effectiveness, efficiency, and quality of life. Testing these solutions and incentives will require listening to the needs of citizens and engaging cities to act. Framing the above-mentioned elements necessitates taking into account the consequences and long-lasting impacts on cities of the current health and economic crisis, affecting for

⁸³ https://ec.europa.eu/clima/policies/strategies/2050_en

⁸⁴ https://ec.europa.eu/commission/sites/beta-political/files/political-guidelines-next-commission_en.pdf

⁸⁵ For the purposes of this topic "cities" should be intended as either city district (neighbourhood or zone of special interest of a city administered or governed by some type of "district council"), a city represented by a government unit (e.g. municipality) or an urban area (conglomeration or a functional area composed of many neighbouring cities or government units, represented by the respective government units).

example mobility, transportation, urban planning, digitisation, provision of services, etc. It requires triggering and supporting lasting changes in social, business, and administrative practices and in individual behaviours with clear impacts on the reduction of greenhouse gas emissions, air pollution and other co-benefits that citizens, businesses and public authorities find desirable.

Scope: This purpose of this topic is to develop a one-stop shop platform providing the necessary technical, regulatory, financial and socio-economic expertise as well as assistance to cities for developing and implementing their climate action plans, and related social innovation action plans. The project can involve research organisations, academia, industry including social entrepreneurs, the financial sector including impact financiers, investors, philanthropists, NGOs, national and local authorities and citizens. The project should also be responsible for the management of competitive calls addressed to third parties to fulfil the objectives of this action. The platform should facilitate the coordination of ongoing European activities in the area of climate neutrality for cities and should be sustainable, scalable and self-financed beyond the life of the action. Where relevant, the action should take into due account and build on existing platforms⁸⁶, experience already matured by the Covenant of Mayors⁸⁷ initiative and methodologies, analysis and processes developed by the Joint Research Centre of the European Commission as well as based on the principles and standards of the Join, Boost, Sustain Declaration⁸⁸.

The proposal should address all of the following four activities:

Activity 1: Climate action plans and Green Deal innovation:

- Develop a science-based set of indicators⁸⁹ enabling the assessment of the climate, environmental and socio-economic impact of cities' climate neutral action plan, as well as its replication and scaling potential, in terms of greenhouse gas emissions reduction within the framework of the European Green Deal
- Develop innovative urban greening assessment methodologies for planning⁹⁰ and monitoring⁹¹ GHG emissions reduction to meet the Green Deal ambitious targets.
- Provide harmonised specifications for inter-operable and comparable evidence repositories for cities, documenting action plan approaches and impacts;
- Support cities in identifying and possibly overcoming regulatory, institutional, governance, financing, public acceptance and other barriers preventing progress and coordinated pathways towards climate neutrality;

⁸⁶ E.g. Smart Cities Marketplace and its Matchmaking facility: <https://eu-smartcities.eu>

⁸⁷ <https://www.covenantofmayors.eu>

⁸⁸ <https://ec.europa.eu/digital-single-market/en/news/join-boost-sustain-european-way-digital-transformation-cities-and-communities>

⁸⁹ For urban transport, the Sustainable Urban Mobility Indicators (SUMI) should be further replicated and support offered for adoption in the context of benchmarking urban mobility in the climate neutral city

⁹⁰ Including Sustainable Urban Mobility Plans (see <https://www.eltis.org>)

⁹¹ Existing monitoring and forecasting programmes, in particular Copernicus, should be properly taken into account where relevant.

- Design, in close collaboration with the cities and the European Commission, a concept for a climate-neutral city contract⁹² corresponding to climate action plans that includes the application process and assessment criteria. Particular attention should be paid to citizens' engagement, social innovation and social entrepreneurship, environmental, economic and health benefits, and Just Transition mechanisms.
- Support cities in innovating their local governance and, where appropriate, building capacity to implement systemic and integrated climate-neutral policies, also building on existing experiences developed by local networks⁹³;
- Coordinate the group of cities committing to the climate-neutral city contract, ensuring an operational customer-driven link of this action with the cities as final users. Facilitating the sharing of experience and good practices and mutual learning between cities regarding setting up and mainstreaming co-creation processes engaging all relevant actors for the framing, deployment and assessment of their vision, strategy, and an action plan to reach climate neutrality while ensuring shared ownership.

Activity 2: Investment project preparation and finance:

- Provide information and consulting services to cities on preparing and financing investment projects for the transition to climate neutrality. This should take into account and build on the good practices developed by global, European and national initiatives and programmes such as Horizon 2020, ELTIS, ELENA, CIVITAS, EIP on Smart Cities and Communities (EIP-SCC) Marketplace, EIT Climate KIC, Intelligent Cities Challenge (ICC), European City Facility, JPI Urban Europe, Positive Energy Districts, Green City Accord, the European Green Capital award. Financial solutions should include, but should not be restricted to, those provided by InvestEU, EIB, EBRD and the European Structural and Investment Fund. Collaboration with national development banks as well as commercial banks is also encouraged.

Activity 3: Social innovation and citizens' engagement:

- Support cities and local communities in testing solutions (including new technologies, non-technological, and social innovations) that stem from European R&I. This should entail a matching of cities' and local communities' needs to R&I results through various means, e.g., match-making and brokerage hubs;
- Combine existing results of European R&I with social innovation, and take advantage of the digital transformation and digital infrastructure to co-create and test solutions with local communities, including changes in social practices and behaviour;
- Provide support to cities for reinforcing not only communication but also citizens' engagement activities involving also marginalised or vulnerable to exclusion citizens.

⁹² Additional information available at: https://ec.europa.eu/info/horizon-europe-next-research-and-innovation-framework-programme/mission-area-climate-neutral-and-smart-cities_en#documents

⁹³ E.g. CIVINET: <https://civitas.eu/civinet>

This should include sharing and using good practices on social innovation as well as enabling cities and local communities to exchange experiences and learn from each other when testing and implementing solutions, connecting more innovators and researchers and making them aware of citizens' needs, and, through all these channels, helping cities move closer to climate neutrality.

Activity 4: Research and Innovation for climate-neutral transformation of cities:

- Once the services of the platform are made available, open calls for proposals will be launched to support large scale pilots for the deployment in lead cities or districts of systemic solutions combining, as appropriate, technological, nature-based, social, cultural, regulatory and financial innovation and new business and governance models to underpin the climate transition, taking stock of existing best practises and already available solutions. These calls should be evaluated by external, independent experts in a fair and transparent process.
- In order to facilitate the upscaling of these solutions and their replicability, the pilots will also support for each lead city and/or district, activities dedicated to the twinning with and mentoring of at least 2 other cities and/or districts from different EU Member States or H2020 associated countries facing structural disadvantages or with a size smaller than 50 000 inhabitants, which are willing to develop their proper climate action plan and implement it in a subsequent phase beyond the life of the current action.

This action aims at a rapid, full-scale deployment of systemic and integrated climate actions at city or district level in order to reach climate neutrality by 2030. It should integrate a package of measures covering all sectors such as health promotion, water, food, energy, industry, housing (private housing and public buildings such as schools and other critical infrastructures), transport (including connected mobility and modal shift) and other sectors considered essential for climate neutrality, with digital, circularity as well as nature-based solutions as critical enablers, while respecting the do no significant harm (DNSH) principle in the specific city context and the set timeline.

Cities and/or local communities participating in the pilots are expected to engage the necessary resources and commit to the deployment of their action plan and the achievement of the expected impacts stated below.

This action, in particular the activities covered under Activity 4, allows for the provision of financial support to third parties in line with the conditions set out in Part K of the General Annexes. Due to the nature of the work to be supported under the call(s) supporting deployment of innovative solutions, the contribution to a third party may go beyond EUR 60 000. The Commission considers that the size of the pilots should range between EUR 0.5 million up to EUR 1.5 million, depending on the expected impact of the proposed projects. The selection of the third parties to be supported under the grant will be based on an external review by independent experts of the proposed work.

The open calls for proposals to be launched within the grant for the selection of third parties should respect all the rules and conditions laid out in Annex K of the Work Programme, in particular as regard transparency, equal treatment, conflict of interest and confidentiality.

The consortium should possess, among others, good knowledge and expertise in European urban-relevant programmes and initiatives, urban planning, state-of the-art in technological innovation for climate neutrality, social innovation and stakeholders engagement, financing programmes (such as the, Horizon 2020, European structural and investment funds, EIB, EBRD...) and European / international umbrella organisations (such as the C40, CIVITAS, POLIS, EU Covenant of Mayors/ Global Covenant of Mayors, ICLEI etc.).

Proposals should ensure that an appropriate geographical balance across Europe is achieved through twinning activities and other means to maximise impact without leaving anyone behind, and by demonstrating commitment of cooperation.

The Commission considers that proposals requesting a typical contribution from the EU up to EUR 53 million would allow this specific area to be addressed appropriately, of which at least 60% should be allocated to activities covered under Activity 4 for the financial support to third parties. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

As the scope of this action is to support a one-stop shop platform, at most one proposal is expected to be funded under this topic.

Expected Impact:

- Contribution to achieving climate neutrality by 2030 in the participating leading cities and districts due to the development and deployment of a comprehensive methodology, including selecting criteria, and model covering cross-sectoral governance, citizens participations, social innovation and social entrepreneurship impact, financing and policy approaches, and an urban digital platform;
- Systemic transformation of cities towards climate neutrality, via support from a European level structure;
- Crossing of social tipping points and implementation of the Green Deal, through social innovation that empowers cities and local communities;
- Leading the transition to climate neutrality by mobilising the demand (citizens' needs) and showcasing testing of innovative solutions drawing from European R&I through a socially inclusive mechanism;
- European cities moving towards climate neutrality by 2030 through measures that demonstrate visible substantial reduction of greenhouse gas emissions and air pollution as part of an agreed pathway to climate neutrality by 2050 or earlier;

- Improved share of sustainable and active transport modes. Reduced negative externalities of urban and peri-urban transportation: congestion, pollution and road collisions. Enhanced multimodality and facilitated use of sustainable and clean modes of transport.

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-GD-1-3-2020: Climate-resilient Innovation Packages for EU regions

Specific Challenge: Every additional half-degree of global warming may inflict a new order of magnitude of harmful consequences on planetary health as well as economic and social cohesion. The failure of economic, financial and industrial policies to sufficiently mitigate and adapt to climate change is more than ever a primary concern for societies worldwide⁹⁴. Europe's commitment to accelerate efforts regarding climate change adaptation and to reach climate neutrality and resilience by 2050 is emphasised in the European Green Deal and will be further supported by the European economic recovery plan from the COVID-19 pandemic. In some regions and communities, incremental adaptation will not be sufficient to mitigate the impacts of climate change on socio-ecological systems⁹⁵. They need radical and transformative ways of reducing climate vulnerability and building resilience. Some solutions for regional adaptation have been developed and successfully tested at small scale, ranging from innovative technologies to nature-based solutions, new business models, as well as governance and social innovations. Now, the challenge is to scale up and demonstrate at large scale systemic solutions to trigger behavioural change and new ways of decision-making, while accounting for local and regional contexts. Multidisciplinary approaches that integrate technological, digital, business, governance, environmental dimensions with social innovation are needed for the development of adaptation pathways consistent with European Green Deal targets, and tailored to support the regions and communities most exposed to climate change impacts.

Scope: The planned Horizon Europe Mission on Adaptation to Climate Change, including Societal Transformation⁹⁶ will test, evaluate and scale-up a range of adaptation solutions with the aim to trigger societal transformations among **key community systems** (i.e., health; primary production including agriculture, forestry, fisheries and aquaculture; water; environment, including biodiversity; and infrastructure including clean energy and transport) that are central to resilience building and sustainable growth. Therefore, the actions funded under this call topic will serve as early facilitators in pre-identifying and upscaling the most promising cross-sectoral solutions at a regional scale⁹⁷.

⁹⁴ World Economic Forum 2019 - Global Risks Report

⁹⁵ IPCC 2018 - Special Report on Global Warming of 1.5 °C

⁹⁶ <http://ec.europa.eu/mission-climate>

⁹⁷ The definition of region and community is intentionally left open for proposals to present a compelling case for the targeted area.

Proposals should address only one of the following sub-topics:

1) Innovation Packages for transformational adaptation of European regions and communities (Innovation Actions)

The actions should aim at **enabling rapid and far-reaching change** through the development of region-specific portfolios of R&I solutions, mature enough for demonstration, which may include nature-based solutions, innovative technologies, financing, insurance and governance models, awareness and behavioural change. The innovation packages should cover the key community systems and comprise the adaptation solutions and pathways deemed essential for climate and social resilience in the specific regional contexts and the set timeline. While accounting for disparities in adaptive capacities and rates of change across countries, regions and communities, the innovation packages should:

- propose and implement multiscale and multisectoral regional adaptation pathways based on transformative and no-regret measures, in line with national and regional climate objectives, hence ensuring a just transition and environmental justice,
- implement and test innovations in key systems demonstrating their contribution to improving resilience in the region and/or community
- prioritise the key systems that most urgently need to be protected from climate impacts and risks, and which would significantly improve the resilience of the region or community,
- prioritise vulnerable European regions or communities with the highest exposure, the highest vulnerability and/or least adaptive capacity to climate change impacts,
- integrate systemic risk analyses and management, considering multihazards and cascading effects, as well as interdependencies between key systems,
- make use of operational climate services (e.g. Copernicus Climate Change Service, Copernicus Emergency Management Service) available for public institutions and key sectors,
- stimulate wide citizen and stakeholder engagement and ensure ownership of the solutions through co-creation processes,
- take stock of existing good practises and solutions already available from other programmes, such as Horizon 2020, EIT KICs, LIFE+ Programme, Structural Funds programmes the EIB, the EBRD and at national, regional, local and private level.

Expected size of proposals: The Commission considers that IA proposals requesting a contribution from the EU of between EUR 10 to 15 million would allow the specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

2) Support the design, testing and upscale of Innovation Packages (Coordination and Support Action)

The action should support the implementation and wide dissemination of the solutions developed and tested under sub-topic 1.

In particular this action area should include:

- Citizens and regions engagement
 - o ensure the wide deployment and integration of Innovation Packages through educational and training activities across relevant sectors and involving diverse groups and covering all categories of population,
 - o ensure that targeted regions and communities are involved and benefit from the Innovation Packages through early multi-stakeholder dialogue and citizens engagement and surveys,
 - o engage with pan-European regional and cities networks and partnerships from the beginning, e.g. European Committee of the Regions, EU Urban Agenda Partnership on Climate Change Adaptation, Covenant of Mayors for Climate and Energy, European Institute for Innovation and Technology Knowledge Communities (EIT KICs), etc.
 - o support regions and communities in identifying and possibly overcoming institutional, regulatory and financial barriers preventing the implementation of Innovation Packages; including testing of innovative public-private partnerships prioritizing greater citizen involvement throughout the process.
- Monitoring and assessment:
 - o develop a set of indicators⁹⁸, in collaboration with the activities carried out under area 1, which consider regional specificities and
 - o enable the monitoring and assessment of Innovation Packages,
 - o identify cases of maladaptation at regional level and analyse the root causes of failures in practice; formulate region-specific recommendations to address these root causes,
 - o address issues of replicability across scale and sustainability over time for the cross-sectoral solutions and regional pathways,

⁹⁸ The set of indicators should comply with or complement existing standards at EU and global level. For guidance, refer to the European Topic Centre on Climate Change impacts, Vulnerability and Adaptation ETC/CCA, Technical Paper (2018) “Indicators for adaptation to climate change at national level - Lessons from emerging practice in Europe”. doi: [10.25424/cmcc/climate_change_adaptation_indicators_2018](https://doi.org/10.25424/cmcc/climate_change_adaptation_indicators_2018)

- Portfolio of Solutions
 - o support the preparation of the portfolio of solutions, through in-depth diagnosis and prioritization of actions, in close cooperation with regional actors,
 - o support the regions in identifying, mapping and leveraging EU and national funding and financing programmes to support the deployment of the Innovation Packages,
 - o foster an enabling environment for the demonstration projects implemented under subtopic 1, including digital services; citizen engagement, education and capacity building; business and insurance models, resource leveraging; innovative coordination approaches, etc.
 - o develop a fully functioning and free-access online platform or upgrade existing knowledge-exchange platforms with user-friendly information on Innovation Packages covering all relevant aspects (financial, social, technological and regulatory) and priority areas (health, agriculture, water, environment including biodiversity, and infrastructure including energy, etc.).

Expected size of proposals: The Commission considers that CSA proposals requesting a contribution in the range of EUR 3 million would allow the specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Support the European Green Deal targets, in particular the new EU Strategy on Adaptation to Climate Change, the EU biodiversity, bioeconomy and circular economy strategies, the objectives of the Union Civil Protection Mechanism, as well as the Clean Air Programme for Europe.
- Contribute to the economic restart from the Covid 19 crisis and foster transformative change across all regions and sectors of society to increase climate resilience.
- Contribute to strengthening social acceptance and social resilience.
- Sub-topic 1) Massive increase of community resilience and capacities to cope with unavoidable effects of climate change. Performance indicators should include for instance reduction of the climate protection gap, increase in Green investments, etc.
- Sub-topic 2) Improve knowledge access to adaptation solutions through synergies and/or integration of the online platform with Climate-ADAPT, Copernicus services and other existing Pan-European platforms,

Type of Action: Innovation action, Coordination and support action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Area 2: Clean, affordable and secure energy

Proposals are invited against the following topic(s):

LC-GD-2-1-2020: Innovative land-based and offshore renewable energy technologies and their integration into the energy system

Specific Challenge: The European Green Deal expects to transform Europe into a fair and prosperous society with a modern, resource-efficient and competitive economy with no net emissions of greenhouse gases in 2050. To decarbonise Europe, land-based and offshore renewables must become the main energy source, while keeping the stability and resilience of the European Energy System. Research and Innovation is still needed to be able to achieve a full system transformation and to realize the ambition of other EU policies like the Clean Planet for all, the SET-Plan, and the New Circular Economy Strategy and to contribute to the Sustainable Development Goals of the United Nations (in particular SDG 7 Affordable and Clean Energy and SDG 9 Industry, Innovation and Infrastructure).

Given that the topic contains two subtopics, the specific challenge for the first one, about **the development of land-based renewable energy technologies and their integration into the energy system**, includes in particular the following:

Renewable energy-based systems for district heating and cooling (DHC) and for cogeneration of heat and power (CHP) can play a key role in energy system integration, and make a significant contribution to the decarbonisation of the energy system. The Energy System Integration Communication points as one of the solutions towards an acceleration of smart, highly-efficient, renewables-based district heating and cooling networks COM2020(299) https://ec.europa.eu/energy/sites/ener/files/energy_system_integration_strategy_.pdf.

Renewable energy-based DHC and CHP systems that are at the same time robust, reliable and flexible to respond to peak demands require effective and efficient combinations of different renewable energy sources in the same system. This is because for example solar thermal technologies are challenged by sunshine hours, bioenergy by biomass availability and geothermal heating by geology, hydrology and land availability. Research and innovation are necessary to develop the renewable energy-based DHC and CHP systems of the future that are secure, cost-effective, affordable and robust to renewable energy fluctuations. These innovative approaches will have to take into account the specific conditions of the different geographical regions of Europe. Digital solutions can be an important enabler for the operation of multi-source DHC and CHP networks.

Similarly, the specific challenge for the subtopic on **demonstration of innovative technologies to enable future large scale deployment of offshore renewable energy** includes in particular the following:

The Commission's long-term strategy, *A Clean planet for all*, identifies offshore renewable technologies, amongst others, as a key energy system for the Clean Energy Transition. It provides estimates for the offshore wind capacity in Europe of 240-440 GW by 2050, compared to about 22 GW today, while other offshore renewables follow a more modest

scenario. This increase would represent a paradigm shift in the European energy system and require a modern infrastructure to seamlessly integrate the power of offshore resources in the energy system via the grid to onshore, or via the option of power-to-X taking into account grid constraints, investments and evolving /new energy market design.

This buildout needs to ensure cost efficiency and to foster the green economy, while protecting the environment and biodiversity, and assuring a just transition. There is a need for more efficient, cost-effective, affordable and secure technologies using wind, solar, wave and/or tidal resources, considering the potential of the different European sea basins (Baltic Sea, North Sea, Atlantic Ocean, Mediterranean Sea and the Black Sea) and the complementarity of resources to reach the best capacity factor and optimized use of all the power equipment. At the same time, developed solutions should ensure resource efficient use of raw materials, in particular critical raw materials.

Scope: Proposals should address one of the following two subtopics and clearly indicate which subtopic is addressed

Subtopic 1 (Research and Innovation action): Development of land-based renewable energy technologies and their integration into the energy system

Projects should develop innovative solutions for either district heating and/or cooling systems or CHP, which allow satisfying a significant or possibly total share of the energy demand by means of combining different highly efficient land-based renewable energy sources. Projects should combine at least two or more renewable energy sources and/or two or more renewable energy technologies. The seasonal loads of the DHC or daily/seasonal loads of the CHP system (for example when coupled to an industrial process), and the daily/seasonal availability of the renewable energy sources have to be properly taken into account. Projects should assess the sustainability of the proposed solutions in environmental, social and economic terms.

For DHC systems, the integration of sources of otherwise wasted excess heat or cold as well as the interfacing with existing heating or cooling distribution networks can be considered. For CHP solutions, the minimum capacity in terms of power supply should be 2,5 MW and the electrical efficiency is expected to go well beyond the state of the art. The optimization in terms of energy efficiency and cost-effectiveness of the proposed solutions, as well as the adaptability to existing systems for a representative variety of network conditions in the EU should be addressed. Projects should assess the sustainability of the proposed solutions in environmental, social and economic terms and should also take into account the requirements of the final users.

Projects should bring the proposed solutions to TRL 4-5.

In order to ensure a balanced portfolio, at least the highest ranking proposal addressing CHP and DHC will be funded, provided it attains all thresholds.

The Commission considers that proposals requesting a contribution from the EU of between EUR 3 to 6 million would allow this challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Subtopic 2 (Innovation Action): Demonstration of innovative technologies to enable future large scale deployment of offshore renewable energy

Projects must demonstrate at sea critical offshore renewable energy innovations considering the efficiency, reliability, scalability, sustainability and circularity that is needed in all areas of the offshore renewable energy system, notably:

- Offshore renewable energy power generating systems: innovative integrated offshore (floating) wind, wave, tidal and/or solar systems, on a floating or fixed-bottom substructure, considering the varied subsea and metocean conditions.

And/or

- Grid infrastructure: real life demonstration of innovative Direct Current (DC), AC/DC hybrid technologies and systems as a supporting step towards large offshore DC, AC/DC hybrid grids (e.g. multi-vendor Multi-Terminal HVDC (MT HVDC) systems, grid forming converter, HVDC diode rectifiers, Modular Multilevel Converters (MMC), DC Circuit Breaker (DCCB); DC/DC converter and DC/power hub) and their control and management systems; for floating renewable energy technologies: innovative dynamic inter-device/inter-array cables and connections to converter stations at sea or offshore hubs.

In order to ensure a balanced portfolio, at least the highest ranking proposal addressing Offshore renewable energy power generating systems and the highest ranking proposal addressing Grid infrastructure will be funded, provided it attains all thresholds. This condition to ensure a balanced portfolio will also considered to be met if one project addressing both aspects will be funded. Furthermore, projects may also include:

- Power to X /battery/ storage systems: innovative offshore storage, battery and/or power to X systems to maximise the use of offshore resources and increase the system resilience.

The innovative demonstration actions might be part of a larger project or already making use of existing infrastructure. Multi-functional platforms can be considered.

Proposals should address also the following:

- Industrial design and manufacturing processes, circularity of (critical) raw materials, scalability,, installation methods, transport, operation & maintenance, supply chains and the related digital infrastructures.
- Regulatory, market and financial challenges.

- Marine spatial planning issues (making multi-use of the seas possible, but also considering optimising environmental impacts) as well as currently known barriers such as costs, public acceptance and vulnerability to changing climate conditions in offshore areas, and considering needs, values and expectations of society through close and continuous discussion with stakeholders.
- Projects are requested to demonstrate the technologies at sea while respecting existing environmental regulatory framework.
- Present an environmental monitoring plan to be implemented during the demonstration action.

The project consortium should demonstrate how it contributes to knowledge building and innovation. Development of new knowledge, models and solutions are paramount to maximize the benefits of the energy transition, to ensure that the right choices are made, and to optimize technologies and systems.

The project has to include a clear go/no go moment ahead of entering the deployment phase. Before this go/no-go moment, the project has to deliver the detailed engineering plans, a complete business and implementation plan and all needed permits for the deployment of the project. The project should clearly demonstrate a proposed pathway to obtaining necessary permits for the demonstration actions and allow for appropriate timelines to achieve these. The project should also demonstrate how it will get a financial close for the whole action. Independent experts will assess all deliverables and will advise for the go/no-go decision.

The project should bring the demonstrated technologies to TRL 7.

The Commission considers that proposals requesting a contribution from the EU of between EUR 20 to 35 million would allow the specific challenge to be addressed appropriately.

Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. Funding for proposals being part of a larger project will be related to the eligible costs based on the innovative part of the project.

Expected Impact: Subtopic 1: Development of land-based renewable energy technologies and their integration into the energy system

Projects will bring clear benefits in terms of reducing greenhouse gas emissions, air pollutants emissions and the use of fossil fuels. They will also demonstrate that an affordable, reliable, secure and flexible DHC and/or CHP systems based on onshore, local renewables can be designed to be adaptive and scalable according to the energy demand.

Subtopic 2: Demonstration of innovative technologies to enable future large scale deployment of offshore renewable energy

The project should clearly demonstrate all potential impacts on the future roll-out of large-scale deployment of offshore renewable energy, the market perspective considering existing

or alternative (decentralised) systems and all other environmental (like GHG reductions), ecological, social and economic impacts along the value chain.

It should increase incentives for investment and economies of scale in offshore bringing down costs and create new business models and services.

Type of Action: Research and Innovation action, Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-GD-2-2-2020: Develop and demonstrate a 100 MW electrolyser upscaling the link between renewables and commercial/industrial applications

Specific Challenge: The European long term decarbonisation strategy (LTS) “A Clean Planet for All” published by the European Commission in November 2018 refers to the potential key role of hydrogen in decarbonising hard-to-abate sectors, such as industry, cement, steel, and also contributing to decarbonisation of heavy duty and long distance transport.

To help achieve the climate neutrality objective, hydrogen needs to be produced at large scale, mainly through electrolysis powered by renewable electricity. The LTS scenarios achieving climate neutrality envisage an installed electrolyser capacity ranging between 400 and 511 GW by 2050 in the EU. However today the technology is only available at multi-MW scale (a 20 MW electrolyser project is being implemented through the co-funding of the Fuel Cells and Hydrogen Joint Undertaking, under the call 2018).

In order to reach the GW scale, an important milestone would be the development and demonstration of a 100MW electrolyser.

The challenge for this topic is to develop larger modules than the state of the art, with reduced balance of plant, managing efficiently the input power, the output hydrogen and oxygen streams, as well as the heat flows, while ensuring the reliability of the system and reducing the footprint through a more compact design. It is expected that the development of bigger modules will help create economies of scale, thus leading to further cost reductions.

The modules will then be assembled into a 100MW electrolyser system, which will be tested and demonstrated in real life conditions, operating flexibly to harvest maximum renewable power. The system will provide grid-balancing services as well as supplying renewable hydrogen to a commercial/industrial application. The hydrogen purity should meet the hydrogen market requirements. The output pressure should be designed to fulfil, when possible, the required pressure for the hydrogen application targeted - including buffer storage needs if any - and reduce as far as possible the need for dedicated hydrogen compression units downstream. The performance and the durability of the electrolyser operating dynamically need to be assessed and potential safety issues addressed.

The activities related to the development of test methodologies, protocols and procedures for the performance and durability assessment of electrolyser components could envisage a

collaboration with JRC in order to support the EU-wide harmonisation of testing protocols to benchmark performance and quantify technology progress. Where possible, the collaboration with JRC could include electrolyser component testing.

Scope: The scope of this project is to install and operate a 100 MW electrolyser to produce renewable hydrogen, as energy carrier or as a feedstock. Specific activities are:

The main activity will consist of:

- Development, installation and operation a 100 MW electrolyser for managing and using efficiently renewable energy, water, Hydrogen and Oxygen flows;
- Demonstrate the increased usage and economic impact of RES mix, addressing potential curtailment issues in Demand Response operation (if grid connected) or island mode functioning (if dedicated to hydrogen production);
- Operation of an electrolyser system in real life conditions in an industrial or port environment, for example feeding a mobility hub, a fertiliser production plant, a synthetic fuel production plant, a refinery, biorefinery or other industries, or injecting in natural gas transmission/distribution grid;
- Investigate possibility to make use of rejected heat or vented Oxygen;
- Operating pressure should be suitable for the application & any buffering / compression requirements.

Other activities will consist of economic, safety, social/societal impact and environmental assessments:

- Demonstration of the future economic viability of the technology depending on cost of electricity and hours of operation of the electrolyser. The effect of intermittent generation on the cost-effectiveness of large electrolyzers should be taken into account;
- Reduce footprint and address potential health and safety issues;
- Evaluation of the environmental performance of the system, notably in terms of GHG emissions reduction in line with the methodology of the Renewable Energy Directive II and in terms of water consumption;
- Evaluation of other ecological and societal benefits along the value chain;

The project should help develop a European value chain by building on technology and business concepts developed by European companies.

Mandatory knowledge sharing activity:

- Cross border dimension and knowledge sharing within Europe: as part of mandatory activities, organise 3 workshops, out of which at least 2 in European countries, outside of

the beneficiary's main implantation, involving policy makers and energy stakeholders, to share knowledge on experience gathered and replication of experiences.

- Contribute to addressing common challenges, information (like reporting on impact indicators) and dissemination activities through cooperation with other relevant projects funded by the European Commission in the context of this call.

To ensure that projects jointly contribute to energy system integration, and create synergies and supply chains for Hydrogen, through synergies between, and to enhance the visibility of H2020 supported actions, projects are requested to reserve a small part of their funding to such cooperation.

The knowledge to be shared will cover the whole project cycle including project management, procurement, permitting, construction, commissioning, performance, cost level and cost per unit performance, environmental impacts, health and safety, as well as needs for further research and development.

The Commission considers that proposals requesting a contribution from the EU of EUR 25 - 30 million would allow the specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. Due to the nature of the supported developments that undertake innovation activities in a market environment, funding rate is reduced to 50%. Funding for proposals being part of a larger project will be related to the eligible costs based on the innovative part of the project. The topic aims to support different electrolysis technologies.

Projects should have a duration of 5 years, with at least 2 years of operation. Capital equipment can be amortised outside the 5 years of the grant duration.

Combination with other EU or national financing instruments will be incentivised, namely the usage of financial instruments to de-risk the operational activity, covering the hydrogen off-take in particular in the ramping-up of the project. The grid connection costs, building costs and the electricity costs for the commissioning phase are eligible for funding. Electricity costs during demonstration / business operation are not eligible.

The project has to include a clear go/no go decision point ahead of entering the deployment phase. Before this go/no go decision point, the project has to deliver detailed engineering plans, a complete business and implementation plan and all the required permits for the deployment of the project. A committee of independent experts will assess all deliverables and will give advice on the go/no go decision.

Expected Impact: The proposed topic of the call for proposals is expected to have the following impacts:

Technological impacts:

- Establish a European industry capable of developing novel hundreds of MW electrolyzers using a European value chain, consisting of modules and a suitable balance of plant for managing power (electricity and heat), water, Hydrogen and Oxygen flows;
- Increase the efficiency of the electrolyser reaching an energy consumption of 49 (ALK) to 52 (PEM) kWh/kg H₂ at nominal power;
- Increase the current density to at least 0,5A/cm² (ALK) or 3A/cm² (PEM) and delivery pressure to 30 bar. Power electronics should allow for dynamic operation of electrolyser from 25 to 100% in seconds (following the JRC harmonised testing protocols);
- Reduce the plant's footprint by 30% thanks to the larger modules and the plant layout as well as the higher current densities;
- Reduce the electrolyser CAPEX by 20% down to EUR 480/kW and EUR 700/kW for Alkaline and PEM electrolyzers respectively, meeting the Fuel Cells and Hydrogen Joint Undertaking targets for 2024;
- Increase the stack lifetime with a degradation target (Minimum nominal energy consumption at end of Life) of 0.12%/1000 hours for Alkaline and 0.19%/1000 hours for PEM;
- Improve the overall efficiency valorising also by-product heat (e.g. for space heating).

Operational and environmental impacts:

- Demonstrating feasible operation of 100 MW-scale electrolysis and the use of the produced hydrogen in an application valorising the renewable character of the produced hydrogen;
- Assessment and operational experience, including safety, of the contractual and hardware arrangements required to distribute and supply hydrogen to the specific industrial and/or transport market;
- Assessment of feasibility to connect the electrolyser to a production site of renewable sources of energy such as offshore/onshore wind, or solar plants;
- Technical assessment of the suitability of the electrolyser equipment to operate in its expected environment and suggestion of best practices;
- Evaluation of the environmental performance of the system (in alignment with RED II compliant methodologies) – with attention to the CO₂ intensity of the hydrogen produced versus Natural Gas route, which should include an understanding of the CO₂ impact of the grid services mode selected and CO₂ footprint impact in the addressed hydrogen end-user markets;
- Evaluation of other ecological and societal benefits along the value chain.

Cost competitiveness impacts:

- Demonstrate a compelling economic and environmental case, including boundary conditions, for key applications such as transport, energy storage, raw material (hydrogen and oxygen) or heat and power production. For a LCOE of up to EUR 40/MWh (renewable sources), achieve a significant cost reduction of green hydrogen compared to the price at the time of proposal submission striving for below EUR 3 /kg and aim for further reductions possibly also by generating income from the provision of services to the electricity grid (e.g. balancing or frequency services).

Additional end study impacts addressed directly to the European Commission:

- Assessment of the legislative and Regulations, Codes, and Standards (RCS) implications of these systems and any issues identified in obtaining consents to operate the system;
- Recommendations for policy makers and regulators on measures helping to maximise the value of renewable energy and stimulate the market for renewables-electrolyser systems.

Proposals are expected to bring the technologies from TRL 6/7 to TRL 8 at the end of the project.

Type of Action: Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-GD-2-3-2020: Accelerating the green transition and energy access Partnership with Africa

Specific Challenge: This action responds to the Joint Communication for a Comprehensive Strategy with Africa⁹⁹ adopted on 9/3/2020, which highlights that innovation is key to enable African countries to pursue sustainable pathways to development through a low-carbon, climate resilient and green growth trajectory, leapfrogging fossil fuel technologies. It will contribute to the present R&I Partnership on Climate Change and Sustainable Energy of the EU/AU High-Level Policy Dialogue¹⁰⁰ on Science, Technology and Innovation that is expected to strongly contribute to Action 1 of the Comprehensive Strategy with Africa.

The African continent has an enormous renewable energy potential which just began to be harnessed successfully. The adoption of innovative, affordable and efficient renewable energy solutions will support Africa in achieving sustainable development growth and economic transformation.

Africa still faces major challenges related to ensuring access to energy for all and beyond, to the development of its industrial base to create much-needed jobs. In line with the Africa-

⁹⁹ https://ec.europa.eu/international-partnerships/priorities/eu-africa_en

¹⁰⁰ <https://ec.europa.eu/research/iscp/index.cfm?pg=africa>

Europe Alliance¹⁰¹ for sustainable investment and jobs, the EU-AU R&I Partnership on Climate Change and Sustainable Energy aim to support the development of sustainable energy solutions appropriate to the African context that will address these challenges.

Experience has shown that existing innovative solutions and technologies generated for developed markets need to be adapted and tailored to, and demonstrated in, the multi-faceted context of Africa. The goal is to bring not only economic, but also environmental, social and health benefits. To facilitate market uptake and sustained deployment of technologies, R&I policies need to be coupled with capacity building and appropriate financing solutions. Additional considerations of affordability, suitable distribution channels as well as meaningful engagement with civil society in the implementation of research projects are also key for the success of potential technological solutions. The involvement of private and/or public European and African investors to sustainable energy solutions is key to the sustainable economic development of Africa with benefits to both continents.

Significant efforts are being made (including with the support of the European Commission) to address the development of innovative solutions through research and innovation actions. However, demonstrations of the value of these solutions are still needed.

Scope: Actions should demonstrate innovative sustainable energy solutions that consider climate adaptation and mitigation potential compared to other technologies/solutions in the African social, economic and environmental contexts. The solutions may address:

- development of renewable energy sources, including solutions for off-grid communities, and their integration into the existing energy system, considering the generation of renewable energy, the transmission, and the use of storage/battery systems.
- energy efficiency

Solutions should consider both urbanised and rural contexts in Africa, and the ongoing water-energy-food nexus action, with the aim of providing sustainable energy access (electricity/cooking) and/or creating improved health, economic wealth and jobs (productive use of energy/energy efficiency).

Actions should design, construct, commission and operate the demonstration installation. Actions should also develop and implement a tailored value chain approach, identifying the most suitable manufacturing value chains, on the basis of the local context, local material supply chain(s) and local workforce, with the objective of ensuring sustainable local economic development. Actions should also include the identification of technical, vocational and educational needs of the workforce and propose relevant training and qualification activities. Actions should finally define a market and business strategy to ensure impact through a quick and viable commercial take-up of the technological solution demonstrated.

Proposals should include a life cycle analysis showing the impact of the proposed solutions compared to other technologies/solutions on the environment, on climate change targets and

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https://ec.europa.eu/commission/africaeuropealliance_en

on the social and the economic dimensions, taking a cradle to grave viewpoint. Where relevant, proposals should consider adopting a circular economy approach, aligned with the European Green Deal¹⁰² priorities.

In line with the Union's strategy for international cooperation in research and innovation, international cooperation is encouraged. As the demonstration installation will be located in Africa, relevant African partners have to participate in the implementation of the project. A balanced consortium between European and African partners will be considered an asset in the evaluation.

Copernicus¹⁰³ data and products (focussed on available hydro, wind, solar or marine energy resources) may also support life cycle analysis to evaluate the impact on humans and the environment (including impact on biodiversity) these new energy plants.

Actions should also participate in and contribute to the EU/AU Partnership on Climate Change and Sustainable Energy, in particular through cooperation/collaboration with the project to be funded under the topic LC-SC3-JA-5-2020, "Long Term EU-Africa Partnership for Research and Innovation actions in the area of renewable energy".

The Commission considers that proposals requesting a contribution from the EU of between EUR 5 to 10 million would allow the specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: The demonstrators should provide evidence of the following short-term expected impacts:

- technologically reliable and economically viable solutions;
- proven positive environmental, health, climate, social and economic impacts of the renewable energy solutions, by putting in place measures and mechanisms in line with the highest European Environmental and Social standards (see ESIA procedure), and taking into consideration the upcoming taxonomy principles and mechanism;
- climate adaptation and climate mitigation potential of the solutions compared to other technologies/solutions;
- strengthening of the joint EU-AU Climate Change and Sustainable Energy Partnership efforts, with emphasis on improving the visibility of EU Science Diplomacy actions in Africa.

The following medium term impacts are expected:

- creation of new market opportunities for both European and African companies on the African continent;

¹⁰² https://ec.europa.eu/info/research-and-innovation/strategy/european-green-deal/call_en
¹⁰³ <https://www.copernicus.eu/en>

- technological uptake on the African continent;
- acceleration of the achievements of the African continent's targets of the Paris Agreement, in line with Europe's Green Deal ambition of climate neutrality, and its external dimensions.

Longer term impacts expected:

- economic growth and job creation, both in the EU and in African countries.

In addition, the proposed solutions are expected to evidence benefits to contribute to the Sustainable Development Goals¹⁰⁴ 2, 4, 5, 6, 7, 8, 11, 12 and 13.

Type of Action: Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Area 3: Industry for a clean and circular economy

Proposals are invited against the following topic(s):

LC-GD-3-1-2020: Closing the industrial carbon cycle to combat climate change - Industrial feasibility of catalytic routes for sustainable alternatives to fossil resources

Specific Challenge: Greening of industrial and energy production, storage and distribution¹⁰⁵ by use of CO₂ emissions from industrial processes.

The challenge is to sustainably convert CO₂ emissions from industrial processes into synthetic fuels and chemicals utilising renewable energy driven processes with novel, highly optimised and energy efficient catalytic systems. This has the potential e.g. to reduce by over 30 % the current ~665 Mt of CO₂ emissions per annum¹⁰⁶ related to the Energy Intensive Industries in Europe. However, it is necessary to demonstrate the industrial and economic feasibility of producing synthetic fuels and chemicals by scaling-up the developed technologies to reach industrial production levels and validate the industrial exploitability and circularity.

Scope:

- Develop and deploy highly innovative and recyclable catalytic material systems to facilitate the production of synthetic fuels and chemicals from industrial flue gas emissions: mainly CO₂ (but also CO and H₂), aiming at 50 % increase in the overall efficiency compared to the State-of-the-Art;

¹⁰⁴ <https://sustainabledevelopment.un.org/?menu=1300>

¹⁰⁵ Masterplan for a Competitive Transformation of EU Energy-Intensive Industries Enable a Climate-neutral, Circular Economy by 2050. Report by the High-Level Group on Energy-intensive Industries, 2019

¹⁰⁶ Low carbon energy and feedstock for the European chemical industry, DECHEMA 2017. Industrial Value Chain - A Bridge Toward a Carbon Neutral Europe, VUB-IES 2018, Table 1, page 21: https://www.ies.be/files/Industrial_Value_Chain_25sept_0.pdf

- Develop innovative, renewable energy driven, catalytic processes, to produce synthetic fuels and chemicals, at a sufficiently large scale to demonstrate its cost effectiveness, while reducing the use of critical raw materials;
- Demonstrate the full value chain for industrial production (including SMEs) of synthetic fuels and chemicals, whilst reducing greenhouse gas emissions;
- Address financial, regulatory, environmental, land and raw material (including critical raw materials) constraints, as well as public acceptance issues and socio-economic impact related to the proposed technological pathways.

Proposals are expected to bring the core technology from TRL 4-5 up to TRL 7 at the end of the project. The Commission considers that proposals requesting a contribution from the EU of up to EUR 40 million and with a duration of up to 5 years would allow this specific challenge to be addressed appropriately. In line with the Union's strategy for international cooperation in research and innovation, international cooperation is encouraged.

Expected Impact:

- Industrial scale demonstrator operational by 2026 based on Industrial Symbiosis and novel, highly optimised and energy efficient catalytic systems.
- Significant reduction of industrial CO₂ emissions (~200Mt p.a. reduction by 2050) with the potential to achieve a carbon intensity below 20g CO₂eq/MJ.
- Enhance the effectiveness of renewable energy sources (i.e. solar, wind) by enabling the production and transmission of a flexible high energy density storage medium in the form of chemicals and synthetic fuels to be used for specific industry segments (e.g. aviation, chemical, shipping, defence) and validated through Techno-Economic and Life Cycle assessment (TEA/LCA).
- Demonstrate and validate the industrial feasibility and cost effectiveness of the technologies, at pilot plant level with a minimum chemical production capacity of 4000 tons per annum, while enhancing Europe's sustainable competitiveness in accordance with the Commissions Industrial Strategy¹⁰⁷.
- Significant indirect impact on air quality and citizen health through the filtering of flue gas emissions from large industrial plants (e.g. energy, cement, chemical, non-ferrous metals and steel).
- Foster a cross-sectorial European innovation eco-system to deploy sustainable alternatives to fossil resources and create demonstration capacity for sustainable catalytic systems of superior efficiency towards 2030 and 2050.

Type of Action: Innovation action

¹⁰⁷

https://ec.europa.eu/info/sites/info/files/communication-eu-industrial-strategy-march-2020_en.pdf

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-GD-3-2-2020: Demonstration of systemic solutions for the territorial deployment of the circular economy

Specific Challenge: Boosting circularity is part of the policy response to address systemic crisis such as climate change, pollution, waste generation, and biodiversity loss. Circular economy can play an important role in the EU's recovery from the adverse socio-economic and environment impacts of the COVID-19 crisis, by providing systemic solutions for sustainable growth and economic recovery. As indicated in the European Green Deal Communication, with increasing global consumption and growing pressure on resources there is an urgent need to decouple economic growth from resource use and to ensure a swift transition to climate-neutral and circular solutions. Europe also needs to increase its resilience in the face of uncertainty in the supply of critical raw materials and to increase the security of its value chains such as for example the new Circular Economy Action Plan key product value chains: batteries and vehicles, electronics and ICT, packaging, plastics, textiles, construction and buildings, food, water and nutrients¹⁰⁸. A circular economy which is sustainable, regenerative, inclusive and just can help our economies to function within the boundaries of our planet by restoring natural systems, reducing GHG emissions and minimising loss of natural capital and biodiversity. It can also connect environmental policies with social justice through just transition ensuring environmental sustainability, jobs and social inclusion. Where relevant, attention should also be paid to occupational health and safety aspects and potential challenges of the transition towards a circular economy.

It is essential that the transition to a sustainable, resource-efficient and circular economic model also delivers on social objectives and contributes to sustainable human development.

The circular economy concept should be a central component in local and regional economies, which have a suitable scale for closing resource loops, creating sustainable circular ecosystems and designing participatory community-based innovation schemes. An increasing number of cities, regions, industries and businesses are engaged in testing and improving circularity in their territories, economic sectors, value chains and services. Nevertheless, the concrete implementation of systemic solutions for the territorial deployment of the circular economy still needs to be demonstrated and replicated effectively in other areas. In particular, a major challenge is how to effectively apply the circular economy concept beyond traditional resource recovery in waste and water sectors. The EU added value can be obtained through the demonstration of territorial systemic circular solutions in one territory and their replication in other areas in Europe. This process of demonstration and replication of circular systemic solutions will multiply the local contribution to achieving the

¹⁰⁸

https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan.pdf

policy targets of the European Green Deal, the Circular Economy Action Plan¹⁰⁹, the Bioeconomy Strategy¹¹⁰ and the European Industrial Strategy¹¹¹.

Scope: Proposals funded under this topic will form part of the demonstration projects for the implementation of the European Commission's Circular Cities and Regions Initiative (CCRI) and must be carried out in close cooperation and coordination with it. The CCRI is part of the new Circular Economy Action Plan and aims to support the implementation of circular economy solutions at local and regional scale. The CCRI will be implemented in the coming months: <https://ec.europa.eu/research/environment/index.cfm?pg=circular>.

Each proposal is expected to implement and demonstrate circular systemic solutions for the territorial deployment of the circular economy (including the circular bioeconomy) in one 'circular territorial cluster'.

A 'circular territorial cluster' (hereinafter referred to as 'cluster') is a socio-economic and environmental system composed of all relevant actors and dimensions to implement, demonstrate and facilitate the replication of at least one circular systemic solution (hereinafter referred to as 'systemic solution'). In this context, a systemic solution is a cross-sectoral demonstration project for the territorial deployment of a circular and climate-neutral economy. Examples of relevant actors for a cluster are: public administrations and utilities; private sector services and industries, including small and medium enterprises (SMEs), scientific and innovator communities; financial intermediaries; civil society, including citizens and non-governmental organisations and philanthropy. National governments could also play an important role in providing support to the implementation of these systemic solutions. Each cluster should include a geographically cohesive territory (e.g. a group of neighbouring urban, peri-urban and rural areas, not necessarily limited by administrative or national borders) or territories, linked by a systemic solution. The composition and dimension of a cluster should be clearly defined and justified in the proposal.

Ideally each cluster should have a Circular Economy Action Plan (CEAP) in which the proposed systemic solution is embedded.

It is essential that the systemic solutions implemented demonstrate the role of the territorial circular economy to reconcile our economies and human activities with the planetary boundaries and to respond to citizens' needs in the wake of systemic crisis such as climate change, pollution, waste generation, biodiversity loss and the adverse socio-economic and environmental impacts of the COVID-19 crisis. The systemic solutions implemented should increase resilience and provide concrete options for socio-economic recovery as well as generating sustainable and inclusive growth in their clusters. Sustainability, regeneration of ecosystems, inclusiveness and social justice should be at the core of each systemic solution. Particular attention should be given to avoid social, gender and intergenerational inequalities. Potential distributional effects of moving from a linear towards a circular economy should

¹⁰⁹ <https://ec.europa.eu/environment/circular-economy/>

¹¹⁰ <https://ec.europa.eu/research/bioeconomy/index.cfm?pg=policy&lib=strategy>

¹¹¹ https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en

also be addressed in order to produce just and fair outcomes, to boost urban and regional economies and create jobs.

The systemic solutions implemented should address economic, social and environmental dimensions of the transition towards a circular economy and include science, technology and governance components. They should demonstrate circular governance models and support the active participation of all relevant actors in each cluster. These systemic solutions should prove the effectiveness and sustainability of circular business models. They should support a sustainable and effective symbiosis within and between economic sectors, foster cooperation along and/or across value chains and increase the integration between production, services and consumption.

It is essential that the systemic solutions implemented address the major challenge of effectively applying the circular economy concept beyond resource management and recovery in the waste and water sectors. It is essential that systemic solutions, and the economic sectors involved in them, are selected and based on a detailed analysis of the cluster's socio-economic needs to be addressed, circular potential to be exploited, challenges to be tackled and, when feasible, smart specialisation priorities. The selection of economic sectors in each cluster should be clearly defined and justified in the proposals and, when relevant, it should take into account international dimensions with regards to value and supply chains. In addition, thought should be given to the importance of the new Circular Economy Action Plan key product value chains - batteries and vehicles, electronics and ICT, packaging, plastics, textiles, construction and buildings, food, water and nutrients - to the economy of Europe as well as delivering on Green Deal objectives.

The systemic solutions implemented should also help to create critical mass for public and private investments and public procurement pull for new solutions, and should contribute to overcoming market failures. They could test public-private partnership models, interregional cooperation mechanisms and multilevel funding synergies useful for de-risking business investments. They should improve consumers' understanding and acceptance of circular and climate-neutral services and products. Proposals should also explore synergies with other funds, including Cohesion Policy funds, the Just Transition Fund and InvestEU, hereby showing pathways to market uptake.

The systemic solutions implemented could include criteria and elements of eco-design, industrial symbiosis and industrial ecology. They could promote the role of ecosystems services and nature-based solutions in the circular and climate-neutral economy. They should promote the use of natural capital accounting into business strategy and decision making.

The systemic solutions implemented should facilitate technology deployment, including digital technologies. Systemic solutions should also facilitate the industrial exploitation of the already demonstrated research results and, when relevant, contribute towards connecting SMEs to the value chains of larger companies.

Systemic solutions should ensure the sustainable circular use and valorisation of local resources. Special attention should be dedicated to more efficient and sustainable businesses,

processes and value chains promoting zero-waste solutions and recycling quality, increasing products' function recovery and reuse, using secondary raw materials (including critical raw materials) and valorising local bio-based feedstock.

It is essential that the systemic solutions implemented also involve one or more community- based innovation schemes, such as local repairing schemes for products. These schemes are expected to promote circular social practices and address environmental, behavioural and cultural aspects of the territorial transition towards a circular economy. The systemic solutions implemented are expected to include specific training for local actors and education services for local communities.

Each systemic solution should identify, analyse and when relevant, quantify the economic, social and environmental benefits and challenges related to its implementation and demonstration in its respective cluster. It should include the monitoring and evaluation of the cluster's transition towards a circular economy, identify its strengths and weaknesses as well as their causes. It should analyse regulatory obstacles and drivers and provide clear and precise policy recommendations to improve circular economy related EU and national/local regulation (including, when relevant, inputs on standardisation and certification). It should analyse the effectiveness of the available financial schemes for territorial circular solutions and propose concrete options for their improvement. Environmental externalities should be addressed and life cycle assessment (LCA) should be included in each systemic solution. Benchmark cost and environmental footprint of each systemic solution should be compared with equivalent linear solutions. The information and data collected and the knowledge gathered by the projects under this topic must be shared with the CCRI. CCRI will ensure a wider dissemination among policy-makers and stakeholders not involved in these proposals.

It is crucial that the systemic solutions implemented and their business models have a high replicability and scalability potential. This is fundamental to facilitate the replication of circular solutions in other areas.

It is essential that proposals dedicate resources to engage in cooperation with other circular territorial clusters funded under this topic and to transfer relevant information and good practices to policy-makers and stakeholders not involved in the proposals. Actions should contribute to the open access to information on circular systemic solutions across Europe. Setting up twinning exercises between the clusters could be an efficient way to facilitate the exchange of experiences and expand to new activities along and across value chains. The cooperation and coordination between projects and clusters under this topic and their dissemination activities must be carried out in close cooperation and coordination with the CCRI.

It is essential that proposals ensure complementarity and cooperation with existing relevant European projects and initiatives on the circular economy and the circular bioeconomy, with special reference to the local and regional scale, and avoid overlapping and repetitions.

The technology readiness level (TRL) of each circular solution should be within the 6-7 range at the end of the project. Each proposal should clearly state the starting and end TRL of the key technology, processes and value chains targeted in the project.

The Commission considers that proposals requesting a contribution from the EU of between EUR 10 to 20 million would allow the specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: Proposals are expected to contribute to the implementation of the CCRI by providing policy-makers, public and private investors and local communities with concrete and demonstrated examples of circular systemic solutions at local and regional scale with the following impacts:

- decoupling of economic and human activities from the consumption of finite resources and GHG emissions, ensuring the transition towards circular and climate-neutral economy;
- improved sustainability and circularity of clusters' economic sectors, natural ecosystems, management and valorisation of local resources;
- emergence of circular business opportunities and a structured pipeline of investment projects;
- increased circular and climate-neutral practices among citizens and their participation in systemic solutions;
- creation of jobs in the short to medium term;
- more effective development of circular solutions through knowledge transfer between the territorial clusters funded under this topic and other territories across EU member states and associated countries ;
- more effective widespread uptake and easier replication, scalability and visibility of circular systemic solutions and hence multiplication of the economic, social and environmental benefits to achieve the policy targets of the European Green Deal, Circular Economy Action Plan, EU Bioeconomy Strategy and the European Industrial Strategy at local, regional, national, European and international levels.

Type of Action: Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Area 4: Energy and resource efficient buildings

Proposals are invited against the following topic(s):

LC-GD-4-1-2020: Building and renovating in an energy and resource efficient way

Specific Challenge: With rising focus on the building sector (e.g. the ‘renovation wave’ initiative of the European Green Deal) in view of the full decarbonisation by 2050, the built environment remains a strategic domain for R&I. The priority is the design and construction of new or retrofitting of existing buildings as zero-emission/zero-pollution¹¹², positive energy-houses in sustainable green neighbourhoods. There are two major components in this transition. **Firstly**, a transition in designing and constructing buildings to reduce their embodied emissions and to increase the energy efficiency of their operation; the same applies to retrofitting existing buildings to increase their efficiency. **Secondly**, a transition to energy positive buildings (producing electricity, covering their heating and cooling needs and contributing to the energy grid stability) with sustainable, renewable energy technologies. These two components are closely linked, since greater building efficiency can reduce demand for heating and cooling and allow a greater range of zero emission technologies to become viable. It also means, reducing demand through effective building designs, including those that are adapted to their local environments (bioclimatic architecture conditions) and use. Spreading such building concept allows the creation of green neighbourhood “living labs” (including social housing and non-residential buildings such as hospitals, schools, public buildings, commercial buildings, etc.) with additional urban functionalities (e.g. shared EV charging facilities).

Scope: Proposals are expected to deliver at least two (residential and non-residential, new and/or retrofitted) large-scale, real-life demonstrations of promising technology, process and social innovations, in different regions of Europe. The demonstrations should address the following aspects:

- Scalable design of green, positive energy neighbourhoods well embedded in the spatial, economic, technical, environmental, regulatory and social context of the demonstration sites.
- Energy and resource efficient, seamless industrial construction/renovation workflows from design to eventual offsite manufacturing, installation and post-construction monitoring:
 - With recycling/reuse of construction materials (or industrial by-products) or reduction of the amount of materials and components used, in order to reduce the embodied energy of buildings;
 - Demonstrating high replicability, reduced maintenance costs and long-term performance, as well as socio-environmental performance (e.g. air quality/natural ventilation, natural lighting, etc.) and potential for adaptation, reuse or deconstruction in the future;

¹¹² For the service life of the buildings

- o Ensuring that proposed solutions do not influence negatively the fire and seismic safety of the buildings;
- o Minimizing disruption for building's occupants and the time spent on site;
- o Delivering post-construction/renovation monitoring of both operational energy performance (minimizing design-built performance gap) and durability of the construction/renovation components.
- Sustainable and highly energy-efficient building designs adapted to local environments and climatic conditions, including active-passive solutions, with:
 - o Digital and EGNSS¹¹³ based methods of design and construction, smart monitoring and tracking of building and renovation processes (e.g. Building Information Modelling, digital twins and augmented reality, robotics, etc.);
 - o Innovative and more energy efficient Building Integrated Photovoltaics (BIPV) converting the building envelope into electricity-producing surfaces, while satisfying building functions in addition to architectural and aesthetic considerations.
- Sustainable, innovative zero-emission and more cost and energy efficient, renewable energy generation in the buildings combined with urban service facilities (e.g. charging facilities) and heating-ventilation-air conditioning (HVAC) solutions :
 - o Renewable power generation and H&C systems (e.g. highly performant Photovoltaic solutions adapted to the conditions of use; BAPV where BIPV is not an option; micro-CHP);
 - o HVAC solutions (e.g. reversible heat pumps with refrigerants that are not greenhouse gases, or less developed clean heating options such as hydrogen).
- Energy storage systems (e.g. using second life batteries from electric vehicles) with bidirectional charging functionalities, that do not limit the use of living space (e.g. neighbourhood optimized storage including management systems for optimal integration, flexibility and interoperability with the grid).
- Highly energy-efficient building operation at reduced maintenance costs and long-term performance with the help of digital technologies to optimise energy generation, consumption, storage and flexibility at neighbourhood scale, as well as digital solutions to increase the usability, energy efficiency and secure operation of building systems and appliances, ensuring optimal comfort for users and a healthier living environment:
 - o Optimal dynamic matching of on-site renewable energy generation and building/neighbourhood consumption; integrated demand-response, considering also non-energy benefits (e.g. occupant security; indoor/outdoor air quality, etc.);

¹¹³ European Global Navigation Satellite System. See <https://www.gsa.europa.eu/segment/egnss-service>

- o Smart home services, advanced automated controls, i.e., smart meters, smart water control, smart EV charging, smart elevators, smart security etc.; based on inclusive design, understanding the occupants preferred usage of the building and harmonising the building - occupants interaction;
- o Integration between building energy management systems/building automation control systems, renewable electricity/energy generation, storage, urban service facilities and the grid;
- o Potential for local flexibility to be aggregated and bundled; possibility to trade and commoditise energy flexibility creating new services and revenue streams for building owners/tenants;
- Citizen awareness raising activities linked to green neighbourhood “living labs” (led by “green schools” where relevant), to facilitate social innovation, promote education and training for sustainability, conducive to competences and positive behaviour/good habits for a resource efficient and environmentally respectful energy use.
- Coordination on standards and regulatory aspects to ensure operational efficiency of buildings and HVAC technologies also addressing the design-built performance gap.

The objective of the demonstrations is to test, in view of scaling up and wide replication, the proposed innovations across the whole value chain (from planning and design through manufacturing and construction to end use, including all relevant players, governance and financing institutions, planners, owners, architects, engineers, contractors, facility managers, tenants, social partners, etc.). The objective is also to adapt this value chain to new operation patterns resulting from the innovations (new business models and services, new usages, changed behaviour). Therefore, the validation of the market and consumer uptake potential should be carried out in the form of real life “living-labs” and under conditions that are open to innovation and promoting affordable access to housing. On this purpose, the project will set up (or use existing) innovation clusters in different regions of Europe, where relevant with a link to other initiatives (e.g. R&I partnerships). Such innovation clusters need to include the local/regional/national value chain(s), to demonstrate, evaluate and ultimately replicate the innovative solutions in different environment and market conditions, with due consideration of social, business and policy drivers. This will also ensure the validation of the innovations for different building types - residential (e.g. social housing) and non-residential (e.g. hospitals, schools, public buildings) - and various climatic zones.

Proposals are expected to bring the technologies from TRL 5/6 to TRL 7/8 at the end of the project.

The Commission considers that proposals requesting a contribution from the EU of between EUR 10 to 20 million would allow the specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: Actors along the construction and renovation value chains are qualified and have integrated the innovative technologies in their business models and operations. Strong innovation clusters are able to accelerate the spread of green building and renovation concepts to provide momentum to the ‘renovation wave’ that will be politically underpinned.

When compared to the state of the art the innovative technical solutions further developed and demonstrated by n the projects are expected to bring the impacts listed below:

- Primary energy savings triggered by the project (in GWh/year);
- Investments in sustainable energy triggered by the project (in million Euro);
- Demonstration sites that go beyond nearly-zero energy building performance;
- High energy performance (nearly zero-energy level within the meaning of Directive 2010/31/EU for retrofitted / positive-energy level buildings for new constructions);
- Reduction of greenhouse gas emissions towards zero (in tCO₂-eq/year) for the total life-cycle compared to current situation shown through cradle-to-cradle Life Cycle Assessment;
- Reduction of the embodied energy in buildings by 50 % without concessions with respect to energy consumption and comfort;
- Reduction of air pollutants towards zero (in kg/year) for the total life-cycle compared to current situation shown through cradle-to-cradle Life Cycle Assessment;
- Demonstration of high potential for replicability using new or existing innovation clusters incorporating the whole value chain;
- Shortened construction/retrofitting time and cost by at least 30%, in order to allow market uptake and social affordability;
- Improved final indoor environment quality by at least 30% and reduction of dust and noise during retrofitting by at least 30%, leading to higher rate of users’ satisfaction, demonstrated according to the relevant CEN standard (or equivalent).

Relevant indicators and metrics, with baseline values, should be clearly stated in the proposal.

Type of Action: Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Area 5: Sustainable and smart mobility

Proposals are invited against the following topic(s):

LC-GD-5-1-2020: Green airports and ports as multimodal hubs for sustainable and smart mobility

Specific Challenge: A clear commitment of the European Green Deal is that “transport should become drastically less polluting”, highlighting in particular the urgent need to reduce greenhouse gas emissions (GHG) in aviation and waterborne transport. In aviation, traffic volumes are expected to increase significantly by 2050 and the sector is already generating 14% of the EU GHG emissions from transport. At the same time, waterborne transport accounts for approximately 90% of global trade and 13% of EU transport GHG emissions, while also experiencing continuous growth. In this context, airports, maritime and inland ports play a major role, both as inter-connection points in the respective transport networks, but also as major multimodal nodes, logistics hubs and commercial sites, linking with other transport modes, hinterland connections and integrated with cities. As such, green airports and ports, as multimodal hubs in the post COVID-19 era for sustainable and smart mobility have a great potential to immediately contribute to start driving the transition towards GHG-neutral aviation, shipping and wider multimodal mobility already by 2025. This topic therefore addresses innovative concepts and solutions for airports and ports, in order to urgently reduce transport GHG emissions and increase their contribution to mitigating climate change.

Scope: Building on best practices (technological, non-technological and social), as well as ongoing projects and planned initiatives in European airports and ports, actions should address the activities EITHER under area A) Green Airports OR under area B) Green Ports. Proposals should clearly indicate which area they are covering.

Area A: Green Airports

Actions should perform large-scale, real-life high TRL (6 or above) demonstrations of green airports, addressing all of the following four headings, collectively describing the various airport aspects to be considered: 1) Transport, 2) Terminal, 3) Energy and 4) Cross-cutting aspects.

1. Transport

Actions should cover all of the following aspects:

- a. access and multimodal connections to the airport (e.g. from cities or other nodes);
- b. from the airport terminal to the aircraft (airside);
- c. at the airport landside (logistics, ground handlings and operations, as well as green energy production/supply of sustainable alternative fuels or electricity).

Actions should also cover at least three of the following, as appropriate:

- demonstrating low-emission energy use (electrification or sustainable alternative fuels) for aircraft, airports, other/connected and automated vehicles accessing or operating at airports (e.g. road vehicles, rolling stock, drones), as well as for public transport and carpooling, with re-charging/re-fuelling stations and use of incentives;

- showcasing the use of innovative de-icing and anti-icing procedures and infrastructures;
- applying innovative digital and EU satellite-based solutions, including new tools and traffic optimisation mechanisms for multimodal access, passenger and freight flows into and out of the airport, as well as between airports, facilitating airport access and reducing traffic from/to the city or other nodes;
- promoting the development of production facilities for sustainable alternative fuels, as well as the necessary underlying infrastructure (for distribution, fuel handling logistics and blending operations) to facilitate the conversion of waste to sustainable alternative fuels and the delivery of the fuels to the airport, for small and medium airports, and scalable to large airports, therefore allowing deployment at a significant number of airports;
- promoting intermodal mobility (e.g. in the context of mobility/logistics as a service or transport-on-demand), including efficient rail interconnection solutions and innovative train-airport station concepts;
- conceiving, developing and preparing for future implementation of a new autonomous, integrated and operational EU Clearing House for Sustainable Kerosene (EU-CHSK). The EU-CHSK would undertake testing for new value chains of renewable kerosene in Europe, involving relevant laboratories for the analyses of fuels and facilities to carry out testing in jet engines, in compliance with existing or newly developed standards.

2. Terminal

Actions should cover at least two of the following, as appropriate:

- demonstrating integration of new solutions with operations, green and smart logistics and infrastructures;
- developing the built environment (construction/demolition) using more ecologically-friendly materials and processes and incorporating these improvements in the procurement processes to sustainably decrease the ecological footprint;
- improving the energy efficiency of buildings; optimising services such as lighting, heating, natural ventilation and air conditioning (taking into account strict public health criteria), water/energy usage and efficiency;
- enhancing biodiversity, green land planning and use, as well as circular economy (e.g. repair, reuse and recycling of buildings and waste, in the context of zero-waste concepts).

3. Energy

Actions should cover at least two of the following, as appropriate:

- addressing the entire energy value chain from supply to use: demonstrating energy efficient facilities for green energy production (e.g. electricity, advanced biofuels, synthetic kerosene, mixture SAF/Jet A1, green hydrogen) to power/electrify the built environment and infrastructure, transport and airport ground operations;
- envisaging industrial scale pilot advanced biofuels refineries or retooling of existing fuel refineries, as a means of producing sustainable alternative fuels and generating additional heat and power in an efficient manner and minimal environmental impact;
- identifying effective incentives to address challenges in the sustainable alternative fuels system (e.g. fuel producers, fuel distributors, airport operators, airline operators) and promoting the penetration of sustainable alternative fuels within the aviation sector;
- assessing the scalability of solutions – e.g. enabling sustainable alternative fuel producers to cover investment risks and promote advanced technology, while securing buy-in of end users (air operators).

4. Cross-cutting aspects

Actions should cover at least three of the following, as appropriate:

- air quality (indoor, outdoor, including decontamination from microbiological pathogens) and noise trade-off;
- impact on the existing legal framework covering operational and environmental aspects, eco-labelling, certifications (robust certification and green standards setting) and measurement, reporting and verification (MRV);
- use of ICT and, among others, EU satellite-based solutions to effectively manage resources and assets, including management of information and production of knowledge, taking into account all the related safety and security aspects of the solutions developed and proposed;
- sustainable evolution of airports, also in the context of circular economy (e.g. activities linked to aircraft decommissioning and collection/sorting of recyclable waste), considering institutional and governance aspects, ownership, regulation, performance indicators and balance of force between regulators, airlines and airport operators;
- feasibility of a market-based instrument to prevent/reduce Food Loss and Waste (FLW) and to valorise a business case of transformation of FLW into new bio-based products. This includes FLW measurement and monitoring methodologies and the subsequent mapping of FLW total volume at stake in the considered airport;
- assessing non-technological framework conditions, such as market mechanisms and potential regulatory actions in the short and medium term, which can provide financial/operational incentives and legal certainty for implementing low-emission solutions;

- developing and promoting new multi-actor governance arrangements that address the interactions between all airport-related stakeholders, including authorities, aircraft owners and operators, local communities, civil society organisations and city, regional or national planning departments.

Area B: Green Ports

Actions should perform large-scale, real-life high TRL (6 or above) demonstrations of sustainable maritime and inland ports, addressing the first aspect below and at least five of the following ones :

- demonstrating integrated low-emission energy supply and production at ports (e.g. electricity, green hydrogen, advanced biofuels and bioliquids) and supply systems (on-shore or off-shore), with storage, distribution and power/re-charging/sustainable alternative fuel re-fueling infrastructure for ships and other vehicles operating at/to/from ports, as well as for other uses (e.g. port equipment/machinery, on-shore power supply systems for vessels mooring in the port, etc.);
- demonstrating sustainability and innovation beyond energy supply and demand at ports, particularly the integration with green and smart logistics and operations at/to/from ports, energy-efficient buildings, innovative construction, dredging and infrastructure activities, effective and green land use;
- demonstrating seamless and highly efficient logistics operations, for integrated sea/river-port-hinterland connections (e.g. between sea/river, rail and road), to enable modal shifts and system-wide door-to-door multimodal passenger mobility and freight transport;
- performing pilot activities to showcase the positive environmental effects of digitalisation (incl. EU satellite-based solutions) in ports, particularly with clean (e.g. electrified/hydrogen) connected and automated vehicles and cranes, as well as intelligent port systems and dynamic vessel traffic flows for improved routing and scheduling, to minimise ship time at port, enabling efficient and automated logistics chains and multimodal inter-connections;
- delivering new tools and optimisation mechanisms for multimodal access, passenger and freight flows into and out of the port, as well as between ports, facilitating port access and reducing traffic from/to the city or other nodes;
- assessing non-technological framework conditions, such as market mechanisms and potential regulatory actions in the short and medium term, which can provide financial/operational incentives and legal certainty for implementing low-emission solutions (e.g. considering first-mover advantage, best-equipped-best-served principles and port market share effects);
- developing and promoting new multi-actor governance arrangements that address the interactions between all port-related stakeholders, including port authorities, ship owners, local communities, civil society organisations and city, regional or national

planning departments, in order to accelerate the production and use of sustainable energy;

- delivering a Master Plan for the future Green Port, with a bold vision and a roadmap with milestones to achieve GHG neutral shipping and minimal pollution in maritime and inland port areas (incl. ships in and approaching port) by 2030, 2040 and 2050; as well as addressing the associated investment/cost implications (incl. operational and capital expenditures). This master plan should also address:
 - a wider socio-economic perspective, covering sustainable and smart mobility, technical, operational, economic, environmental and social aspects, relevant to shaping the green ports of the future and their integration with other sustainable transport modes, the hinterland, cities and urban mobility;
 - solutions with the highest potential for emission reduction at ports, focusing on CO₂ and noxious pollutant emissions (SOx, NOx and particulates), as well as water pollution and noise, but also on improving biodiversity, the soil and the aquatic environment, while considering climate change effects (e.g. sea/river-level rise, new tourism patterns, etc.);
 - analysis of the various alternatives for the provision of power supply at the port, such as fixed land energy grid vs. mobile power production and supply (e.g. LNG generators/containers) and mobile storage, for instance through the use of barges or trucks bringing energy/batteries, etc.;
 - assessment of whether existing fossil fuel, LNG or other/chemical infrastructures in the broader port areas could be used to facilitate the transition towards low-emission shipping and bunkering of carbon neutral fuels;
 - a holistic sustainable port design concept, leveraging green construction, demolition and dredging activities, with energy-efficient or renovated buildings, optimising land and sea/river use, improving biodiversity and circular economy;
 - scalable solutions that can be replicated/gradually scaled-up to larger or scaled-down to smaller ports, together with the demonstration of their environmental sustainability and technical, operational, and economic viability;
 - governance, business, deployment models and plans, including internal/external costs;
 - collaboration models across multiple stakeholders, paving the ground for large-scale deployment of the demonstrated innovative solutions across European ports;
 - a comprehensive report of all project findings in detail, including the identified proposed suitable pathways for European ports to achieve GHG-neutrality, by use of standardised tools for assessing the comparative emission reduction of different ports;

- o a handbook on how to move from planning, to implementation, replication and scaling-up the deployment of the demonstrated solutions, for different sizes and locations of ports across Europe.

Applicable to both Area A: Green Airports and Area B: Green Ports

Actions for both areas (Green Airports and Green Ports), in addition to addressing the aspects described above should, where appropriate, incorporate field performance monitoring with a view to assessing the effectiveness of the deployable solutions. This should be determined by measuring the performance difference (for comparable activity levels) between the initial status, considered before the innovative solutions are applied (baseline), and the status at a point in time at 2-3 years into the project, after a number of the solutions produced by the project have been applied.

Actions should also provide a quantified assessment of the expected improvement in airport or port energy consumption, as well as in greenhouse gas emissions and air quality.

In order to enhance synergies and impact, proposals should foresee a work package for cooperation with other actions in the same area and earmark appropriate resources for coordination, communication efforts and relevant research work with other projects and initiatives.

Each consortium should include a leading “Lighthouse” airport or port, which will demonstrate the novel concepts and solutions and a further three (at most) “Fellow” airports or ports that will be actively associated in helping to define and incorporate their specificities in the more general approach and solutions, follow closely the demonstration actions and are committed to implement the best practices identified and results produced by the project. For Green Ports, each consortium should include at least one inland port. All consortia should also be multidisciplinary in nature by including partners with the appropriate complementary knowledge and skills (e.g. industry, consultancy, airport/port authorities, academia). All participating airports or ports must be from different EU Member States and/or Associated Countries.

In line with the Union’s strategy for international cooperation in research and innovation, international cooperation is encouraged.

The Commission considers that proposals requesting a contribution from the EU of between EUR 15 and 25 million each would allow this specific challenge to be addressed appropriately. Typically, projects should have a duration of 48 to 60 months. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts or durations. A maximum of 20% of the requested EU contribution should be for the Fellow airports or ports.

Grants will be awarded to proposals according to the overall ranking list. However, in order to ensure a balanced portfolio of supported actions, at least the two highest-ranked proposals in each area will be funded (i.e. two proposals for area A) Green Airports and another two for area B) Green Ports), provided they attain all thresholds.

Expected Impact: The project results are expected to contribute to:

- accelerated deployment of sustainable alternative fuels (including advanced biofuels), green hydrogen and electromobility in transport, as well as sustainable energy supply and storage and waste heat recovery in airports and ports;
- clean energy/fuel production and distribution (particularly green hydrogen and electricity) and increased alternative (bio-) fuel supply, with re-fueling and re-charging capabilities;
- green airports and ports as multimodal hubs, optimising passenger and freight flows for low emission mobility, in a context of much stricter public health criteria;
- energy-efficient and green airport and port operations and buildings, green and smart logistics, integration with other low-emission transport modes (in particular rail) and promoting effective modal shifts;
- reduced aviation, waterborne and other transport emissions, as well as improved air quality, biodiversity, contribution to the circular economy and reduction of noise at airports and ports;
- reduced emissions for cities and urban mobility, as well as improved city integration for airports and ports;
- clear commitments and contributions to Europe-wide take up of technological, non-technological and socially innovative solutions during and beyond the project are expected, which could be in the form of follow-up actions, for instance supported by EU's Connecting Europe Facility or other funding programmes;
- significant, direct and immediate contribution to the achievement of the European Green Deal, as well as other EU transport policy objectives (including TEN-T), while strengthening the competitiveness of the European transport sector.

Type of Action: Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Area 6: Farm to Fork

Proposals are invited against the following topic(s):

LC-GD-6-1-2020: Testing and demonstrating systemic innovations in support of the Farm-to-Fork Strategy

Specific Challenge: European food is recognised as being safe, nutritious and of high quality. It should now also become the global standard for sustainability. Although the transition to more sustainable systems is in its infancy, it remains a big challenge to feed a fast-growing

world population and steer food systems within a safe and just operating space – encompassing planetary health, economic viability and social welfare, and including human health. Many current production practices and consumption patterns still result in air, water and soil pollution, contribute to the loss of biodiversity and to climate change, challenge animal welfare and consume excessive amounts of natural resources, including water and energy, while an important part of food is wasted. At the same time, unbalanced diets contribute to obesity and other nutrition-related, non-communicable diseases. Here are some of the facts:

- Agriculture is responsible for 10.3% of the EU's GHG emissions¹¹⁴; Food is a significant source of GHG-emissions contributing to about 17% of EU household emissions, similar to housing (22%)¹¹⁵;
- Nitrogen and phosphorus cycles exceed their safe operating space in Europe, respectively by a factor of 3.3 and 2 resulting in diffuse pollution of terrestrial, aquatic and atmospheric ecosystems¹¹⁶;
- The value of the direct contribution of insect pollinators to EU agricultural output has been estimated at around € 15 billion per year¹¹⁷. Pesticides have been shown to negatively affect pollinator populations¹¹⁸. In addition, excess pesticide can leach into soils and water potentially leading to wider biodiversity losses and impacting human health.
- Antimicrobial resistance (AMR) linked to the excessive and inappropriate use of antimicrobials in animal and human healthcare leads to an estimated 33,000 human deaths in the EU/EEA every year¹¹⁹, and considerable healthcare costs;
- About 20% of the food produced in the EU is being wasted¹²⁰;
- One in five EU adults are obese and half are overweight¹²¹. On average, nearly one in eight children aged 7-8 is obese in EU countries¹²². Many Europeans die prematurely, or suffer from illnesses due to diet related diseases.

¹¹⁴ EEA (2019), Annual European Union greenhouse gas inventory 1990-2017 and Inventory report 2019. These figures do not include CO2 emissions from land use and land use change.

¹¹⁵ D. Ivanova, et al, 2017, Mapping the carbon footprint of EU regions (<https://iopscience.iop.org/article/10.1088/1748-9326/aa6da9/meta>)

¹¹⁶ EEA/FOEN report (2020) ‘Is Europe living within the limits of our planet?’ <https://www.eea.europa.eu/publications/is-europe-living-within-the-planets-limits>

¹¹⁷ Gallai, N., et al., (2009), quoted in SWD(2018) 302 final/2 Commission Staff Working Document. EU Pollinators Initiative.

¹¹⁸ IPBES (2016) Summary for policy makers of the assessment report og the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services on pollinators, pollination and food production. Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany.

¹¹⁹ Cassini et al., (2019) ‘Attributable deaths and disability-adjusted life-years caused by infections with antibiotic-resistant bacteria in the EU and the European Economic Area in 2015: a population-level modelling analysis’, in Lancet Infect Dis. Vol.19, issue 1, pp. 55-56

¹²⁰ <http://www.eufusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf>

In addition, the COVID19 pandemic highlighted the importance of robust and resilient EU food systems within a sustainable, circular bioeconomy to respond to global shocks and disruptions in supply chains, and to mitigate socio-economic impacts of crises notably as regards food poverty.

The Farm to Fork Strategy, which is at the heart of the European Green Deal, aims to address the challenges and accelerate the transition to sustainable food systems, to ensure that the economic, social and environmental foundations of food and nutrition security are not compromised for current and future generations. It places emphasis on enabling a “just transition” for all actors of the food systems, in which also social inequalities are reduced, food poverty is addressed, and a fair income for all actors is ensured. It requires and builds on innovative solutions that can be scaled up, such as agro-ecological and organic practices, alternative sources of protein (e.g. plant-based, ocean-based, insect-based, etc.), sustainable food from the oceans and aquaculture, and personalised advice relating to sustainable healthy diets¹²³. Conceted efforts are needed to test, demonstrate and scale-up innovative systemic solutions to achieve the Farm to Fork targets and objectives in this decade.

Scope: A range of activities will support the deployment and scaling up of innovations that contribute to the objectives of the Farm-to-Fork Strategy¹²⁴. Proposals will test, pilot and demonstrate innovative systemic solutions (TRL 5-7) to one of the following six subtopics, corresponding to urgent and pressing food systems’ challenges:

Subtopic A. [2021] Achieving climate neutral farms by reducing GHG emissions and by increasing farm-based carbon sequestration and storage (IA)

Subtopic B. [2021] Achieving climate neutral food businesses by mitigating climate change, reducing energy use and increasing energy efficiency in processing, distribution, conservation and preparation of food (IA)

Subtopic C. [2021] Reducing the dependence on hazardous pesticides; reducing the losses of nutrients from fertilisers, towards zero pollution of water, soil and air and ultimately fertiliser use Proposals have to address all challenges (those related to pesticides, and to fertilisers, and to losses of nutrients) specified under Subtopic C.]] (IA)

Subtopic D. [2021] Reducing the dependence on the use of antimicrobials in animal production and in aquaculture (IA)

Subtopic E. [2021] Reducing food losses and waste at every stage of the food chain including consumption, while also avoiding unsustainable packaging (IA)

¹²¹ <http://www.euro.who.int/en/health-topics/noncommunicable-diseases/obesity/data-and-statistics>

¹²² WHO Europe (2018), Children Obesity Surveillance Initiative, Highlights 2015-17, Preliminary data, *in* OECD/EU (2018), Health at a Glance: Europe 2018: State of Health in the EU Cycle.

¹²³ These solutions/approaches serve as examples only. Applicants should not assume that proposals that include these specific solutions are preferred.

¹²⁴ See European Commission Communication “[A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system](#)”, COM(2020)381.

Subtopic F. [2021] Shifting to sustainable healthy diets¹²⁵, sourced from land, inland water and sea, and accessible to all EU citizens, including the most deprived and vulnerable groups (IA)

The Commission considers that proposals requesting from EUR 6 million up to 12 million would allow the specific challenge to be addressed appropriately under each of these subtopics (A), (B), (C), (D), (E), or (F). Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Grants will be awarded to proposals according to the ranking list. However, in order to ensure a balanced portfolio of supported activities, at least the highest-ranked proposal per subtopic (A), (B), (C), (D), (E), or (F) will be funded provided that it attains all thresholds.

All subtopics (A), (B), (C), (D), (E), and (F):

The proposals should focus on systemic innovations that maximise synergies and minimise trade-offs to deliver co-benefits on the three dimensions of sustainability (climate/environmental, economic, social/health, including biodiversity and animal welfare), that enhance resilience of food systems to various shock and stresses, and that enable them to operate within a safe and just operating space and ensure sufficient, safe, healthy, nutritious, and affordable food for all.

Proposals should pay particular attention to:

- Applying system thinking/system approaches to define the challenge, including an in-depth systemic analysis of its drivers and root causes; to identify possible innovative systemic solutions from production¹²⁶ to consumption; to assess their expected and actual impact including risks, synergies, and trade-offs with regards to the three pillars of sustainability (social/health, climate/environmental and economic), food and nutrition security, food system resilience, food safety and the objectives outlined in the Farm to Fork Strategy and the Green Deal.
- Adopting a multi-actor¹²⁷ and cross-sectoral approach engaging practitioners (primary producers, processors, retailers, food service providers, consumers), public and private institutions (governmental institutions, NGOs, industry) and citizens from farm¹²⁸ to fork to co-create, test and demonstrate solutions from production to consumption, in practice, on a European scale but with attention for regional and sectoral needs and contexts (environmental, socioeconomic, geographical, cultural). Foster collaboration, building bridges and breaking silos between actors of the food chain and between primary sectors

¹²⁵ “Sustainable Healthy Diets are dietary patterns that promote all dimensions of individuals’ health and wellbeing; have low environmental pressure and impact; are accessible, affordable, safe and equitable; and are culturally acceptable.” (FAO & WHO. 2019. Sustainable healthy diets – Guiding principles. Rome, page 11).

¹²⁶ From land, inland water and seas; including fisheries

¹²⁷ Requirements for multi-actor projects can be found in [Horizon 2020 Work Programme 2018-2020 for Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the Bioeconomy](#) (p.11-13).

¹²⁸ From land, inland water and seas; including fisheries

as well as collective action. Take specific care to engage young professionals (e.g., young farmers, young fishers, young researchers, young entrepreneurs, etc.), SMEs, consumers and citizens.

- Including the most appropriate mix of innovations, such as novel, digital and space-based technologies using EGNSS and Copernicus data and services, new business and supply chain models, new governance models, ecological and social innovations¹²⁹ while taking into account regional and sectoral contexts (environmental, socioeconomic, geographical, cultural) and needs, both for production and consumption. The projects should focus on upscaling innovations (TRL level 5-7), and can include limited research activities to address specific gaps for solution building, testing and demonstration. Particular attention should be given to understand behaviours, motivations and barriers, with a view to maximizing the uptake of solutions. The innovations delivered by the proposals have to take into account the EU market regulatory frameworks (e.g. safety, environmental) and relevant requirements.
- Where appropriate, capitalise on existing testing and demonstration facilities to strengthen their capacity to address the challenge and showcase solutions.
- Delivering and implementing an action plan for dissemination, communication and engagement, for building awareness, education and skills relevant to the solutions on a European scale, in and beyond the regions where the activities take place, among businesses, investors, entrepreneurs, institutions, stakeholders and citizens. Promote their widespread uptake, realize behavioural change, and stimulate investment. Proposals should foresee a dedicated work package for cooperating with European Commission services and with all selected projects under this topic on the implementation of this action plan, with a view to increasing the impact of that plan. Projects may link with other relevant European and national programmes, where appropriate.

In line with the Union's strategy for international cooperation in research and innovation, international cooperation is encouraged.

Expected Impact: Proposals are expected to:

- Demonstrate innovative systemic solutions that have the potential to generate significant positive impacts by 2030 with regards to :
 - o Achieving climate neutrality of farms and farming systems (on land, water and sea); reducing GHG emissions; increasing carbon sequestration and storage (Subtopic A);

¹²⁹

The innovations should go well beyond the technological solutions. However, the categories specified are only examples. The applicants should include the most appropriate mix of innovations to achieve the impacts in a systemic way, rather than try to integrate all these exemplary categories.

- o Achieving climate neutrality of food businesses; reducing energy use and increasing energy efficiency in processing, distribution, conservation and preparation of food (Subtopic B);
 - o Decreasing the dependency on the use of hazardous pesticides (Subtopic C);
 - o Reducing loss of nutrients from fertilisers and ultimately fertiliser use; increasing the efficiency of fertilisers (Subtopic C);
 - o Decreasing the dependency on antimicrobials in animal production and in aquaculture (Subtopic D);
 - o Reducing food losses and waste and the use of unsustainable packaging, at every stage of the food chain including consumption (Subtopic E);
 - o Increasing the share of citizens that adhere to healthy sustainable diets, including among the most deprived and vulnerable groups (Subtopic F);
 - o Providing sufficient, safe, nutritious, healthy and affordable food for all (Subtopics (A), (B), (C), (D), (E), and (F));
 - o Improving the overall sustainability of food systems (social/health, climate/environmental and economic) (Subtopics (A), (B), (C), (D), (E), and (F));
 - o Improving the resilience of food systems to shocks and stresses (Subtopics (A), (B), (C), (D), (E), and (F)).
- Contribute significantly to the achievement of the objectives and targets of the Farm to Fork Strategy¹³⁰ and The European Green Deal¹³¹, and in particular to:
 - o Reducing GHG-emissions by at least 50% by 2050 compared with 1990 levels (Subtopics A, B, E, F);
 - o Reducing the overall use and risk of chemical pesticides by 50% and the use of more hazardous pesticides by 50% by 2030 (Subtopic C);
 - o Reducing nutrient losses by 50%, which will reduce the use of fertilisers by at least 20% by 2030 (Subtopic C);
 - o Reducing the EU sales of antimicrobials for farmed animals and in aquaculture by 50% by 2030 (subtopic D);
 - o Halving the per capita food waste at retail and consumer levels by 2030 (Subtopic E);

¹³⁰ See European Commission Communication “[A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system](#)”, COM(2020)381

¹³¹ See European Commission Communication “[The European Green Deal](#)”, COM(2019)640

- o Reversing the rise in overweight and obesity rates across the EU by 2030 (Subtopic F);
- o Bringing European diets more in line with dietary recommendations (Subtopic F).
- Achieve an increase in awareness among policy makers, businesses, investors, entrepreneurs, institutions, stakeholders and citizens of selected innovative systemic solutions, of their potential and of the requirements to promote and realise their uptake at EU scale and behavioural change (Subtopics (A), (B), (C), (D), (E), and (F)).

Type of Action: Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Area 7: Biodiversity and ecosystem services

Proposals are invited against the following topic(s):

LC-GD-7-1-2020: Restoring biodiversity and ecosystem services

Specific Challenge: Underpinned by knowledge in the latest IPCC and IPBES reports, large-scale ecosystem restoration is urgent – the window of opportunity is closing rapidly. It needs a systemic approach to deliver tangible benefits on the European Green Deal actions for climate (mitigation, adaptation and disaster risk reduction), biodiversity, zero pollution and sustainable food systems (from farm to fork), health and wellbeing. Actions under this topic should therefore be pivotal in demonstrating and promoting systemic solutions for upscaling urgent restoration to increase biodiversity and support a wide range of ecosystem services, as requested in the Biodiversity Strategy for 2030 for damaged terrestrial, freshwater, coastal and marine ecosystems.

Resilient, healthy ecosystems are natural carbon stocks and sinks. They can remove CO₂ from the atmosphere and support adaptation to climate change and disaster risk reduction. In addition to delivering a wide range of other services (oxygen source, improved health and well-being, recreation, water retention and purification, air quality, nutrient cycling or pollination), ecosystems are essential in a wide range of sectors which impact the everyday life of Europe's citizens (food, feed, fibre or fuel provision across the bioeconomy). However, biodiversity is being lost and ecosystems are degrading at an alarming rate. Pressures on biodiversity are increasing at a faster rate than the efforts to protect it¹³². The integrity of terrestrial and aquatic ecosystems, and their capacity to deliver a wide range of essential services to people, will be further undermined by the effects of unavoidable climate change. There is therefore a need to strengthen their resilience against environmental and climate stressors while integrating the local socio-economic specificities of their surrounding environment.

¹³² See SOER 2020, IPBES (2018, 2019).

While solutions for the restoration of biodiversity and ecosystem services are available now, they are neither up-scaled nor integrated enough in today's governance, investment or policy support landscapes. Research and demonstration on how to scale up technical and non-technical approaches for the spatial and social-economic integration of restoration impacts is therefore needed. The environmental emergency highlights the limits of current management approaches and calls for investment in innovative, sustainable and effective restoration including through mobilising innovative funding and cross-sectoral collaborations that could trigger transformational change. Moreover, the global biodiversity post-2020 framework seeks voluntary commitments by business and stakeholders to invest in biodiversity and new approaches to speed up actions in the framework of the UN decade for restoration.

From increased social awareness to more engagement with the private sector, there is a distinct need to build trans-disciplinary collaborations at all scales and across relevant ecosystem types. Win-win solutions and multi-purpose usage that support local biodiversity while delivering specific services and socio-economic benefits are sought. Hence, this topic seeks answers on how to frame transformational change which supports a just transition¹³³ – to show how investing in nature restoration can explicitly help vulnerable regions and communities to improve their resilience to social and environmental shocks, when rapid changes in climate and environment, economies and social conditions occur.

This topic therefore responds to the urgent double challenge of (i) accelerating transformative change through (ii) upscaling restoration of ecosystems at sea or on land.

Scope: Actions should:

- provide large-scale demonstrators of how systemic upscaling and replication of best practice ecosystem restoration¹³⁴ can be deployed at regional, national and cross-border levels, focusing on degraded terrestrial, freshwater, coastal or marine ecosystems, responding to relevant restoration goals enhancing biodiversity;
- in line with the EU Biodiversity Strategy for 2030, restore degraded ecosystems, in particular those with high potential to capture and store carbon and to prevent and reduce the impact of natural disasters, and, where relevant, to contribute to the achievement of favourable status for species and habitats of the Birds and Habitats Directives inside and outside the Natura 2000 network of protected areas;
- adapt, integrate and demonstrate innovative methods (technological, non-technological, social and governance, including sustainable financing) on upscaling ecosystem restoration, also in regions and for communities in transition;

¹³³ See EU Biodiversity Strategy for 2030, COM(2020) 380 final: “The implementation [will] recognise the need to ensure social justice, fairness and inclusiveness [...], and will require a sense of responsibility and strong joint efforts from the EU, its Member States, stakeholders and citizens.”

¹³⁴ Based on CBD guidance on ecosystem restoration, and in line with the EU 2030 Biodiversity Strategy whose Restoration Plan aims to help bring diverse and resilient nature back to all landscapes and ecosystems.

- support the development of specific demand and supply chains in restoring ecosystems on land or at sea – recognising that conditions at sea can considerably differ from the ones on land (including freshwater), that speed of change and disturbance might differ, and that solutions to reverse biodiversity decline are context-specific;
- demonstrate and test how restoration activities and socio-ecological management of ecosystems enable sustainable, climate-neutral and climate-resilient, inclusive, transformative approaches, including across the bioeconomy (agriculture, forestry, marine and innovative bio-based sectors) and as investments in disaster risk reduction;
- promote scaling up and stepping up of implementation of nature-based solutions¹³⁵ building on existing experience in particular on lessons learned and best practices gained through EU-funded projects and initiatives such as those supported by Horizon 2020 and the LIFE programme¹³⁶ in order to address barriers to implementation for systemic nature-based solutions focussing on restoration in urban, peri-urban, rural or marine areas;
- showcase how restoring ecosystems at large scale will also help human communities to adapt to changing conditions at their local level, and how restoration activities can be integrated into economically and socially viable land use practices, enabling a shift of social and behavioural patterns towards increased benefits for biodiversity and strengthening social acceptance and social resilience;
- demonstrate how to maximise synergies and avoid trade-offs between priorities for restoring biodiversity, mitigating and adapting to climate change (such as those identified jointly by the IPCC and IPBES).
- generate knowledge on how large-scale restoration can accelerate transformative change beneficial for biodiversity and climate resilience, and bring this information to UN programmes, as well as to IPCC and IPBES¹³⁷, processes.

Actions should demonstrate how restoration (in biodiversity richness and abundance, structure, function and connectivity) of ecosystems and their services can be scaled up¹³⁸, in collaboration with stakeholders, so that opportunities for substantial biodiversity and ecosystem services gains will be realised, which in turn deliver social and economic benefits.

¹³⁵ <https://ec.europa.eu/research/environment/index.cfm?pg=nbs> “Nature-based solutions are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions”. – Hence, nature-based solutions must benefit biodiversity and support the delivery of a range of ecosystem services.

¹³⁶ <https://ec.europa.eu/environment/life/project/Projects/index.cfm>

¹³⁷ In particular assessments in preparation, policy tools and capacity building.

¹³⁸ “Up-scaling” means here substantial increase in area of restored ecosystem(s), provision of ecosystem services, leading to enhanced ecological integrity at the landscape scale as well as greater community resilience and well-being. This implies a systemic approach, which usually combines several ecosystems, integrates with relevant sectorial policies and incorporates the identified solutions in policy and related actions.

This pilot is a European Green Deal enabler and can be used as a testbed for further green infrastructure/nature-based solution investment by the European Investment Bank (EIB), for LIFE SNAPs¹³⁹, and relevant further budget lines in the next Multiannual Financial Framework.

Appropriate budget for cooperation with and use of tools resulting from previous projects on ecosystem restoration and nature-based solutions¹⁴⁰, including from LIFE projects¹⁴¹ and with Horizon Europe activities such as the European Partnerships¹⁴² and Missions¹⁴³ should be envisaged.

Actions should also test and evaluate innovating approaches for creating value with human communities undergoing transformative change, avoiding negative externalities and improving their living conditions by restoring their terrestrial and/or aquatic environment.

Actions should also address all of the following issues:

- Together with the concerned communities, developing a scalability plan, including at landscape scale and using spatial planning legislation where relevant. The scalability plan should include diffusion of innovative solutions, and a process for commitments in adopting large-scale restoration within governance and financing systems, so other relevant communities can replicate the upscaling across the EU and internationally. It should seek guarantees for the non-reversibility and/or continuity of up-scaled restoration activities and/or further replication and/or expansion, implementation of sustainable management practices and monitoring after the end of the projects.
- Setting baselines, goals and a monitoring framework for the projects: why an activity is being undertaken, what changes are expected and by when, and how changes are monitored in order to determine if the action was successful in relation to the original goals. Activities should be prioritised according to their urgency for addressing upscaling restoration challenges, the restoration potential of degraded ecosystems, the significance of research for supporting EU policy needs, their contribution to the international biodiversity agenda, and their potential to trigger transformative change.
- Restoration actions should be paired with supportive and robust management practices that reduce pressures and direct habitat damage at the local scale, and empower civil society in planning and deployment of restoration and maintenance of its achievements to support restoration efforts in the long term.

¹³⁹ SNAP = Strategic Nature Action Projects.

¹⁴⁰ See SC5-27-2020, CLA-11-2020, SC5-13-2018-2019, SCC-02-2016-2017, BiodivERsA, Oppla, NetworkNature and their joint work streams.

¹⁴¹ <https://ec.europa.eu/easme/en/life>

¹⁴² https://ec.europa.eu/info/horizon-europe-next-research-and-innovation-framework-programme/european-partnerships-horizon-europe_en

¹⁴³ https://ec.europa.eu/info/horizon-europe-next-research-and-innovation-framework-programme/missions-horizon-europe_en

- Prioritisation should be informed by social, economic and ecological conditions and recovery efficiency to ensure restoration efforts are resilient and efficient. Approaches should be based on existing knowledge from prior research or experience and tested restoration methods¹⁴⁴ and should seek complementarity with LIFE projects¹⁴⁵. To increase the scale, scope and pace of restoration, efforts should be based on evidence, better understanding and communication of ecosystem service recovery and thresholds for effective ecosystem restoration, and the inclusive involvement of social and economic actors.
- Activities related to improving ecosystem condition should be integrated into best practice monitoring activities within respective monitoring governance schemes¹⁴⁶. No new restoration monitoring approaches should be developed. Actions should explicitly include deliverables which apply (or test, if necessary) monitoring schemes with efficiency and output indicators related to restoration, its benefits and trade-offs.
- Actions should promote innovative funding, cross-sectoral collaborations and social participation to support the design, implementation and monitoring of sustainable and effective restoration efforts. They should explore how upscaling and mainstreaming of ecosystem restoration could facilitate systemic transformation in governance, policy making, financing, public procurement, economic development, social innovation, infrastructure and regional strategic planning.
- In line with the strategy for EU international cooperation in research and innovation (COM(2012)497), international cooperation is encouraged for adapting the upscaling approaches for restoration demonstrated for use in European conditions¹⁴⁷ and applying them to harness transformative change internationally.

Project consortia must evidence that they have the rights to undertake actions on the areas to be restored. No land purchase or lease can be funded under this topic. Projects are expected to mobilise additional funding or in-kind contributions when implementing restoration actions.

Proposals should dedicate appropriate resources to develop joint deliverables with all projects funded under this topic and for cooperation with other projects. Actions should use existing platforms and information sharing mechanisms relevant for restoration and nature-based solutions, giving open access to its results.

The Commission considers that proposals requesting a contribution from the EU of between EUR 16 and 25 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

¹⁴⁴ E.g on Mapping and Assessing Ecosystems and their Services, LIFE, or through SC5-07-2015.

¹⁴⁵ in particular LIFE Integrated projects , and LIFE Strategic Nature Projects (in LIFE database, choose as strand “Integrated Projects for Environment” or “Integrated Projects Clima”).

¹⁴⁶ As developed for restoration in EU and worldwide schemes, or through SC5-2020-20, or pollinator monitoring, or Earth Observation-based monitoring, using Copernicus data, or natural capital accounting, where adequate and relevant.

¹⁴⁷ This could include the EU Outermost regions.

Projects are expected to give priority in their budgets for hands-on action on restoration. In order to ensure a balanced portfolio of supported actions, at least two proposals covering terrestrial and/or freshwater ecosystems, and at least two covering coastal and/or marine ecosystems will be funded.

Expected Impact: Actions are expected to demonstrate how transformational change through ecosystem restoration delivers at large scale, delivering first visible results and examples on land and at sea by 2024, with benefits increasing in the long-term.

The project results are expected to contribute to:

- maintained and enhanced natural carbon sinks and reduced greenhouse gas emissions through the important role of biodiversity, local reversal of the degradation of ecosystems, recovery of ecosystem functions, increased connectivity and resilience of ecosystems, and improved delivery of a range of ecosystem services¹⁴⁸;
- the objectives of the European Green Deal, including the EU commitment to reduce emission by 50-55% by 2030 and become net carbon-neutral by 2050; the implementation of the EU Biodiversity Strategy for 2030¹⁴⁹ and the EU Nature Directives¹⁵⁰, the Water and Marine Strategy Framework Directives, the Farm-to-Fork Strategy, the Pollinators Initiative, the Climate Law, the Bioeconomy Strategy and Action Plan, EU Urban Policies, and the revised EU Adaptation Strategy; supporting the EU Covenant of Mayors, the Sendai Framework for Disaster Risk Reduction (2015-2030), the UN Decade of Restoration including land/sea degradation neutrality, and the UN Sustainable Development Goals;
- widespread and innovative scaling-up of ecosystem restoration to maintain and enhance natural carbon sinks and other ecosystem services, with a view to significantly reducing the carbon and environmental footprint of Europe;
- increased restoration through uptake of public-private partnerships and (voluntary) market-based incentives for business and individuals within restoration initiatives, including as the result of trans-disciplinary research and stakeholder engagement to help identify co-funding for long-term maintenance and buy-in from the private sector;
- enhanced empowerment, engagement and reconnection of local communities with nature and increased social awareness on restoration actions, and their benefits;
- transformational change supporting a just transition based on investing in nature together with vulnerable regions and communities improving their resilience of in the face of rapid changes in climate and environment, economies and social conditions.

¹⁴⁸ For socio-economic benefits restoration to improving ecosystem services, see e.g. SWD(2019)305 final.

¹⁴⁹ In particular the EU Nature Restoration Plan as announced in the EU Biodiversity Strategy for 2030.

¹⁵⁰ On restoration needs identified in the EU State of Nature Report, and identified by EU Member States in their Prioritised Action Frameworks <https://www.eea.europa.eu/themes/biodiversity/state-of-nature-in-the-eu/state-of-nature-2020>.

Type of Action: Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Area 8: Zero-pollution, toxic free environment

Proposals are invited against the following topic(s):

LC-GD-8-1-2020: Innovative, systemic zero-pollution solutions to protect health, environment and natural resources from persistent and mobile chemicals

Specific Challenge: A recent Eurobarometer survey (2020) showed that a large majority of respondents are worried about the impact on their health of chemicals present in everyday products. There is also solid scientific evidence substantiating health and environmental concerns related to chemicals. The European Green Deal includes a commitment to a zero-pollution ambition for a toxic-free environment. In this context, it specifically mentions the need to rapidly address the risks posed by hazardous chemicals and, more specifically, very persistent chemicals.

Pollution from persistent and mobile chemicals is often a systemic problem, as it is driven by factors closely related to the prevailing ways of production and consumption and is reinforced by missing appropriate technical solutions, including (bio)remediation and monitoring techniques for the environment (including the marine environment). These chemicals also pose challenges for regulatory authorities to develop or enforce effective policies.

An example of these very persistent chemicals is per- and polyfluoroalkyl substances (PFAS), a group of thousands of manmade chemicals that are widely used in various consumer and industrial products (e.g. water- and stain repellent textiles, fire-fighting foams, plastics, food contact materials and cosmetics) and to which citizens and the environment are exposed. They are an increasing concern as they are persistent in the environment, very mobile, toxic and can bioaccumulate. For these reasons, they are found everywhere in the environment and their concentration increases over time, creating additional risks for human health and ecosystems. There are examples of contamination by PFAS of water and soil in most EU countries, which are costly or in some cases impossible to remediate. The overall costs to society from PFAS alone as an example are estimated by one source to be € 52-84bn across Europe (Nordic Council of Ministers, 2019)¹⁵¹, which is likely to be an underestimate, as it includes only a limited range of health effects (high cholesterol, impaired immune system, and cancer). Some studies have shown negative effects of PFAS on the immune system, including a reduced response to vaccines. Similar effects are known also in connection to other kinds of persistent chemicals. This is of concern considering the current COVID-19 pandemic.

Scope: Taking into account latest policy needs and developments, this call topic aims at establishing new knowledge, exploring the feasibility of new or improved technologies and demonstrating innovative solutions to protect health, environment and natural resources from

¹⁵¹

[1] <https://chemicalwatch.com/75340/pfas-cost-to-eea-health-estimated-at-up-to-84bn-report>

persistent and mobile chemicals. Selected projects are expected to advance our knowledge on health impacts and environmental effects and to address and preferably prevent a specific pollution problem involving contamination of environmental resources (such as soil, sediments, air, food and drinking water). The solutions developed should lead to cost-effective prevention, monitoring and to, as a last resort, mitigation or elimination of the issues (e.g. mitigation or remediation efforts in particularly affected geographic areas). They should also lead to better understanding of environmental fate and help proactively prevent negative impacts from persistent and mobile chemicals (and, where relevant, their precursors) on humans and the environment. The projects may include appropriate technologies, business, governance and social innovation aspects and the demonstration of innovative solutions in a relevant environment (TRL 4-6). In particular, projects may consider analytical methods and monitoring, enabling to quantify entire groups of persistent and mobile chemicals in food, soil or drinking water. This would allow achieving a higher level of consumer protection, as such grouping methods are essential for regulating groups of harmful substances that have similar structures.

The successful projects should target persistent and mobile chemicals and include elements (one or several), such as

- gain insight to the uses, sources and environmental fate of persistent and mobile chemicals
- development of new cost-effective high-resolution methods to analyse and model the presence of persistent and mobile chemicals in products/materials and in different media;
- environmental and human (bio)monitoring¹⁵² of persistent and mobile chemicals;
- gathering of toxicity and toxicokinetic information (including animal-free approaches such as *in vitro* and *in silico* approaches) in order to allow characterising risks to human health and ecosystems, including at low environmental levels and combined/cumulative exposure;
- detection and identification of specific pollution problems and their sources¹⁵³
- research and development of (bio)remediation technologies of soil and water (including sources of drinking water) contaminated by persistent and mobile substances and their precursors;
- development and improvement of models to predict and assess long-term trends and risks for persistent mobile substances and propose preventive solutions

¹⁵² All exposure data resulting from the projects data shall be shared via Information Platform for Chemical Monitoring IPCHEM (<https://ipchem.jrc.ec.europa.eu/RDSIdiscovery/ipchem/index.html>). Procedures and the network of reference laboratories established by HBM4EU (<https://www.hbm4eu.eu>) should be used.

¹⁵³ Wherever relevant, applicants are invited to make use of the services offered through Copernicus data, in particular the Copernicus Climate Change and Atmosphere Services, for better understanding the complex relationships between pollution and climate change.

- development of best practices for the management and treatment of waste, soil and water containing persistent and mobile substances, in line with the ambitions of the Circular Economy Action Plan¹⁵⁴.

Proposed solutions should be suitable for real life challenges, environmentally sustainable, cost-effective and easily implementable to encourage their uptake. Therefore, close consultation or collaboration with potential end-users of the expected results during the project lifetime is recommended.

The Commission considers that proposals requesting a contribution from the EU of between EUR 8 to 12 million would allow the specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Provide a foundation for prevention and mitigation solutions based on better understanding the sources and distribution of the targeted chemicals, access to models of their environmental fate and degradation pathways and improved understanding of relevance for human and environmental health of the problem of emerging and persistent pollution;
- Provide solutions and support decision making for addressing large-scale diffuse contamination of water and soil with persistent and mobile chemicals (including for combinations of pollutants) in an integrated manner;
- Contribute to achieving a toxic-free environment through solutions for better load reduction, (bio)remediation and detection technologies, including real time monitoring approaches;
- Improve risk assessment to facilitate optimal risk management and preventive solutions;
- Support policy development, regulatory action and risk communication with FAIR¹⁵⁵ data of regulatory relevance;
- Support actions deriving from several EU documents on persistent and mobile chemicals¹⁵⁶, the upcoming Zero Pollution Action Plan and the aims of the new Circular Economy Action Plan¹⁵⁷ to minimise the presence of substances that pose problems to human and environmental health.

¹⁵⁴ <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN>

¹⁵⁵ Findable, Accessible, Interoperable, and Reusable.

¹⁵⁶ <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12264-Chemicals-strategy-for-sustainability-> ; <https://www.eea.europa.eu/themes/human/chemicals/emerging-chemical-risks-in-europe>; <https://www.efsa.europa.eu/en/consultations/call/public-consultation-draft-scientific-opinion-risks-human-health>.

¹⁵⁷ COM(2020) 98 A new Circular Economy Action Plan For a cleaner and more competitive Europe (https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan_annex.pdf.)

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-GD-8-2-2020: Fostering regulatory science to address combined exposures to industrial chemicals and pharmaceuticals: from science to evidence-based policies

Specific Challenge: Under ‘Towards a zero-pollution ambition for a toxic free environment’, the European Green Deal will propose a new Chemicals Strategy for Sustainability, aiming at better protection of both humans and the environment against hazardous chemicals. In addition, there is growing concern about the occurrence of pharmaceuticals in the environment¹⁵⁸.

Humans, wildlife and domestic animals are exposed to combinations of different chemicals via air, water (including the marine environment), food and feed, consumer products, materials and goods. The scientific understanding of combination effects has progressed in recent years and approaches for risk assessment and management of unintentional mixtures and combined exposures to chemicals are available.

In parallel with the development and implementation of regulatory approaches, there is a need to improve the scientific knowledge base. Current knowledge shows that exposures to combinations of chemicals pose risks to ecosystems and human health that may not be sufficiently managed under existing regulations. There is a need to advance regulatory science to provide policy-makers and risk assessors with validated and practically applicable approaches, methods and tools and to study the effectiveness and efficiency of different policy approaches. The effects of exposure of humans and the environment to combinations of chemicals should also be further explored.

Scope: This topic calls for applied research studies, demonstrating how new tools and methodological approaches from regulatory science that are workable in a regulatory context and are based on the latest scientific evidence, can be applied to identify, quantify and prevent harmful co-exposures to industrial¹⁵⁹ chemicals and pharmaceuticals.

The applicants can address some or all of the following:

- i. Development of innovative tools and analytical methods to detect and measure complex mixtures in the various environmental compartments¹⁶⁰;

¹⁵⁸ Commission Communication on the EU strategic approach to pharmaceuticals in the environment [COM\(2019\) 128 final](#).

¹⁵⁹ In this context the term ‘industrial chemicals’ is used to identify chemicals of anthropogenic origin, e.g. including pesticides, biocides, cosmetics etc.

¹⁶⁰ Chemical exposure data resulting from the projects data shall be shared via Information Platform for Chemical Monitoring IPCHEM (<https://ipchem.jrc.ec.europa.eu/RDSIdiscovery/ipchem/index.html>). Procedures and the network of reference laboratories established by HBM4EU (<https://www.hbm4eu.eu>) should be used.

- ii. Comparisons of different possible regulatory approaches to manage unintentional chemical mixtures and co-exposures, regarding effectiveness (improved protection of health and the environment), workability, cost-effectiveness and benefits to society and business;
- iii. Estimations of the degree to which current and possible future regulatory practices/approaches underestimate (or possibly occasionally overestimate) risks related to chemicals exposure (based on particular case studies, modelling and overall estimations);
- iv. Develop and apply modelling, statistical approaches and other relevant methods to identify and study the health impacts on human populations and the environment of exposures to combinations of different chemicals, e.g. through linking results from exposure monitoring with observed health effects;
- v. Scientific case studies to identify safety margins for specific unintentional exposures to combination of chemicals to protect human and ecosystems health, while taking into account chronic exposures over longer time scales;
- vi. The possible effects on humans, in particular on vulnerable sub-populations, from combined (chronic) exposure to low levels of pharmaceuticals via the environment, taking account the inherent pharmacological properties and the potential for combined effects from co-exposures with other chemicals;
- vii. Combining and analysing EU data sources to generate insights on real-life and potential exposure combinations, typical exposure routes and uses;
- viii. Development, improvement and validation of models for predicting (chronic) exposure to combinations of chemicals, which can be applied in a premarket stage (risk assessment, risk management measures, including, e.g. authorisation and restriction of chemicals) and possibly already at the design phase of chemicals and materials as well as retrospectively (e.g. in the setting of environmental quality objectives).

Expected Impact:

- Scientific evidence to enable prevention and/or mitigation of co-exposure to pharmaceuticals and industrial¹ chemicals in the environment and the technosphere.
- Support the implementation of existing risk assessment and risk management approaches to reduce the most critical exposures, including the setting of limit values for exposures taking into account co-exposures..
- Support the assessment of new regulatory approaches such as, e.g. Mixture Assessment Factors

- Support activities on combined exposures as relevant for the Strategic Approach to Pharmaceuticals in the Environment² and as to be defined in the forthcoming Chemical Strategy for Sustainability¹⁶¹

Selected projects under this topic are strongly encouraged to continuously share information and participate to joint activities to optimise synergies to address policy-relevant knowledge gaps.

The Commission considers that proposals requesting a contribution from the EU of between EUR 4 to 6 million would allow the specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Area 9: Strengthening our knowledge in support of the EGD

Climate action requires additional research and innovation efforts that extend beyond innovative solutions at a relatively mature state of development. Despite significant progress in our understanding of the complex issues linked to climate change and sustainability over the past few decades, it is crucial to further improve relevant knowledge. Area 9 of the Green Deal call contains dedicated activities to strengthen the European knowledge base, adopting a longer-term perspective while also acting as a bridge to Horizon Europe.

This section calls for activities that:

- mobilise world-class capacities and resources, notably those provided by European Research Infrastructures (RIs), to support breakthrough solutions in energy storage and advance climate/environment monitoring and observation;
- deliver end-user products and services that help decision-makers identify which modes of production, consumption and lifestyle are compatible with climate resilience and pathways achieving climate neutrality by 2050;
- prepare the ground for the development of a digital twin of the ocean, to better connect and understand the unknown ocean and its crucial role in our survival, and provide evidence for informed decisions.

Proposals are invited against the following topic(s):

¹⁶¹

<https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12264-Chemicals-strategy-for-sustainability->

LC-GD-9-1-2020: European Research Infrastructures capacities and services to address European Green Deal challenges

Specific Challenge: The urgency and the scale of Green Deal challenges require the mobilisation and advancement of world-class scientific capacities and resources such as those offered by European Research Infrastructures. They will contribute to the transition towards a climate neutral Europe, targeting at least 50% emissions reduction by 2030. As a pilot under Horizon 2020, activities will focus on the provision of research and innovation services for breakthrough research in two priority areas: energy storage and advanced climate/environment observation and monitoring. Expected impacts range from answering short-term needs of thematic European Green Deal objectives to longer-term perspective including Horizon Europe.

Energy storage:

In order to boost the advancement of knowledge and technology in the field of energy storage, European researchers need effective and customised access to the best research infrastructures. The aim of this action is to bring together, integrate on European scale, and open up key national and regional research infrastructures to European researchers from both academia and industry, as well as to develop any missing services, which better fit specific needs for research and technological developments.

Advanced climate/environment observation:

European research infrastructures such as ICOS, ACTRIS and IAGOS¹⁶² are key enablers of the knowledge necessary to conceive, develop and assess European policies to address climate change and air pollution. They are essential to observe, understand and predict complex processes of the atmosphere, the concentration and flux of (long-lived) greenhouse gases, the interaction of short-lived atmospheric constituents and air pollutants. They provide sustained long-term, high quality and interoperable data, also used to calibrate satellites, validate or constrain climate models, weather forecasts, air pollution forecasts etc.

Yet, these research infrastructures do not cover appropriately “hotspots” such as cities and industry intensive sites (frequently not far from cities) despite their major role: cities and their surrounding are strong emitters of greenhouse gases and air pollutants; due to the high density of population, the impact on citizens’ health is very high. In particular, in situ measurements in and around cities to quantify anthropogenic emissions of greenhouse gases¹⁶³ and nanoparticles (with still unknown potential health damage) are lacking.

Scope: Proposals will address one of the following sub-topics:

(a) Support Europe leadership in clean energy storage technologies

¹⁶² [ICOS](#) Integrated Carbon Observation System; [ACTRIS](#) Aerosols, Clouds and Trace gases Research Infrastructure; [IAGOS](#) In-Service Aircraft for a Global Observing System; when relevant, complemented by European networks of national facilities and satellite-based observations.

¹⁶³ [CO2 Green Report 2019](#).

This sub-topic aims at:

- supporting the development of a world-class European research and industrial ecosystem underpinning energy storage activities and the related value-chain;
- enhancing the competitiveness of current and emerging industries by providing easy and seamless access to the most advanced scientific infrastructure available in Europe and related services;
- enabling breakthrough research and innovation in energy storage systems and related materials across the whole value chain and with a life-cycle approach;
- supporting a fair transition towards climate neutrality through a better understanding of socio-economic issues underpinning a paradigm change and of how to foster climate-neutral social practices.

Activities will cover the coordinated and integrated provision of transnational and virtual access by wide communities of key research infrastructures as well as joint developments of specific services to facilitate and integrate the access procedures, to improve and customise the services the infrastructures provide, and to further develop on-line and testing services. User training may be supported, to maximise the benefits and to ensure the optimal use of the services provided.

This action brings together several complementary and interdisciplinary facilities relevant for energy storage research and innovation, addressing different TRLs and covering the whole value chain in view of possible industrial applications. They will provide transnational and virtual access to technically advanced instrumentation and scientific methods in a coordinated and user-friendly way as well as training for their use and services linked to material modelling, data mining and experiment design.

Activities will also contribute to address the objectives of the European initiatives to tackle critical issues relating to performance, reliability and safety of storage technologies and to support strategies addressing the whole life-cycle.

Proposals should clearly identify potential industrial users and research communities, which can benefit from this pan-European open access to services and advanced instrumentations offered by internationally renowned facilities and strengthen the cooperation among researchers and industrial users.

Proposals are expected to duly take into account all relevant ESFRI and/or ERICs and other world-class research infrastructures as well as relevant major European initiatives, such as the Open Innovation Test Beds, to exploit synergies.

Proposals will also have to highlight how they contribute to attract new talents and create expertise support new skills through training addressing researchers and industrial users.

Trans-national and virtual access provision shall follow the rules specified for integrating activities under point (ii) “Trans-national and/or virtual access activities” in part D of the

section “Specific features for Research Infrastructures”. Compliance with these provisions will be taken into account during evaluation.

Proposals should adopt the guidelines and principles of the [European Charter for Access to Research Infrastructures](#). They should define a data management plan, even when they opt out of the extended Pilot on Open Research Data. When they address the curation, preservation and provision of access to the data collected or produced under the project, proposals should build upon the state of the art in ICT and e-infrastructures for data, computing and networking, and ensure connection to the European Open Science Cloud.

In line with the strategy for EU international cooperation in research and innovation (COM(2012)497), proposals should, whenever appropriate, pay due attention to any related international initiative (i.e. outside the EU) and foster the development of global standards.

Proposals should include clear indicators allowing the assessment of the progress towards the general and specific objectives, other than the access provision.

As the scope of this topic is to ensure integration and access to key European infrastructures in this domain and to avoid duplication of effort, at most one proposal is expected to be submitted.

The Commission considers that proposals requesting a contribution from the EU of up to EUR 7 million would allow this topic to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

(b) Enhancing European research infrastructures for greenhouse gases observation in and around cities

The action should enhance greenhouse gases observation capacity of European research infrastructures, notably anthropogenic CO₂ emissions, in and around cities and other large emissions sites such as industrial sites, transport infrastructures.

The action should include:

- Scientific and technical work, i.e. (1) the drafting of concepts, architecture and engineering plans for extending and upgrading existing European research infrastructures and, when relevant, the creation of instrumentation prototypes or testbeds for up-to-date instrument arrays; (2) plans for the efficient curation, preservation and provision of access to their data in line with FAIR principles;
- Conceptual work i.e. (1) plans to integrate the new capacities into the existing European research infrastructures and related governance; (2) estimated budget for upgrade and operation and outlines of long-term funding plans;
- Pilot implementation in at least one representative urban site, showing the engagement of national/local authorities and demonstrating the ability to integrate complementary measurements systems and methods as well as data. When applicable, the action should consider solutions relevant to air quality assessment e.g. measurement of co-emitted

species from fossil fuel burning. It should address quality control, traceability of measurements and standards. It should include the development of core data services upgrading the current services offered by the European research infrastructures. The action should address the selection criteria and process for selecting the pilot implementation site(s).

- Roadmap for upscaling:

The action should propose a flexible design with generic core elements and complementary observations depending on the specific nature of sites. The action should seek, at all stages, synergies and interoperability among European research infrastructures and with air quality monitoring networks as well as coordination with European observational programmes and initiatives¹⁶⁴. In particular:

- The action should propose strategies to engage stakeholders, including citizens, to build commitment at local, national and European level and promote long-term sustainability.
- The action should engage in networking and training and promote interoperability, dissemination and exchange of experience and practices.
- The action should propose appropriate framework to coordinate with or contribute to key relevant European initiatives such as Copernicus, EOSC, and support global initiatives such as the Paris Agreement, 2030 Agenda for Sustainable Development Goals, IPCC. It should also ensure relevance to the Mission on Climate Neutral Cities by 2030.
- The action should propose possible roadmaps for upscaling and replicating the solutions for enhancing the European research infrastructures.

The Commission considers that proposals requesting a contribution from the EU of up to EUR 13 million would allow this topic to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

(c) Enhancing observations for air quality and citizens' health in urban areas

The action should enhance urban air quality monitoring networks and other relevant observing infrastructures in measuring air pollutants such as particles and their precursors (both in mass and particles number concentrations, including specific nanoparticles data at traffic and airport sites). Engagement of the health community and citizens is required to address the scarce availability of sub 100nm particles concentration data, which has hampered epidemiological studies on their effects.

The action should include:

¹⁶⁴ Such as Copernicus (including the CO2 monitoring Task Force), GEOSS and IG3IS framework of WMO.

- Scientific and technical work to upgrade air quality monitoring networks ensuring measurement of maximum exposure to nanoparticles and efficient curation, preservation and provision of access to data in line with FAIR principles;
- Pilot implementation in at least two representative sites, showing the engagement of national/local authorities and demonstrating the ability to integrate complementary measurements systems and methods as well as data. It should address quality control, traceability of measurements and standards. In particular, it should develop interoperable solutions and ensure measurements between cities are comparable. It should test innovative solutions such as mobile instrumentation and build on citizens' observatories initiatives. The action should address the selection criteria and process for selecting the pilot implementation sites.
- Roadmap for upscaling:

The action should explore, at all stages, synergies and interoperability with European research infrastructures, among air quality monitoring networks and, when relevant, satellite-based observations. The action should propose the optimal design of well-coordinated, interoperable, large city scale networks building on existing European research infrastructures and city air quality monitoring networks. In particular:

- The action should propose strategies to engage stakeholders, including citizens, to build commitment at local, national and European level and promote long-term sustainability.
- The action should engage in networking and training and promote interoperability, dissemination and exchange of experience and practices.
- The action should propose appropriate framework to coordinate with or contribute to key relevant European initiatives such as Copernicus, EOSC, and support global initiatives such as the Paris Agreement, 2030 Agenda for Sustainable Development Goals. It should also ensure relevance to the Mission on Climate Neutral Cities by 2030.
- The action should propose possible roadmaps for upscaling and replicating the solutions for enhancing the European research infrastructures and city air quality monitoring networks.

The Commission considers that proposals requesting a contribution from the EU of up to EUR 8 million would allow this topic to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- The development of synergies among research infrastructures in different disciplinary areas, including social sciences, and improved, optimised and harmonised research services to address Green Deal objectives will foster economies of scale and improved use of scientific resources across Europe and beyond.

- Users, both from the scientific and industrial community, will benefit from integrated and efficient access to the best research infrastructures as well as from advanced research services addressing their specific needs.
- RIs will foster the development of new skills and a new generation of researchers ready to optimally exploit the most advanced and essential instruments and resources for research and innovation addressing Green Deal challenges.

(a) Support Europe leadership in clean energy technologies

- This activity will: enable breakthrough research and innovation in energy storage across the whole value chain and in line with a life-cycle approach, in view of possible industrial applications, by providing access to their advanced, integrated and interdisciplinary research services;
- support the development of a strong and competitive research and industrial energy storage ecosystem addressing the different steps in the value chain, including advanced materials and modelling, chemistry, systems, advanced manufacturing, reuse and recycling, innovative business models;
- allow users to benefit from integrated and efficient access to the best research infrastructures as well as from advanced services addressing specific needs;
- support, more broadly, the transition towards a climate neutral continent, with a target of at least 50 % emissions reduction by 2030;
- foster a new generation of researchers ready to optimally exploit the most advanced and essential tools for research and innovation in a key field for Europe;
- enhance synergies and complementary capabilities among existing infrastructures, leading to improved and harmonised services as well as foster economies of scale and improved use of resources across Europe thanks to less duplication of services, common development and optimisation of operations.

(b) Enhancing European research infrastructures for greenhouse gases observation in and around cities and (c) Enhancing observations for air quality and citizens' health in urban areas

- These activities will:enable the development of evidence-based sustainability strategies, taking also account of impacts on health, through the provision of interoperable data, tools/equipment and models needed by the scientific community and public authorities/decision makers;
- trigger the decision making process leading to the upgrade of existing infrastructure;.
- develop synergies and complementary capabilities between Research infrastructures and monitoring networks, thus promoting economies of scale and improved use of resources

across Europe through the common development and optimisation of operations as well as interoperability of data and data streams;

- enhance ability to assess the impact at city scale of policy implementations initiated at city, national and European levels with respect to air quality, citizens' health and progress towards the greenhouse gas reduction-targets of the Paris Agreement as well as the impact of the EU Bioeconomy Strategy;
- boost multidisciplinary research and innovation actions including modelling to address climate change (mitigation, adaptation) and understand the potential health damage of nanoparticles;
- strengthen and sustained Copernicus in-situ component; improve air quality monitoring; facilitate the engagement of citizens;
- strengthen the technological development capacity and effectiveness as well as the scientific performance, efficiency and attractiveness of the European Research Area.

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-GD-9-2-2020: Developing end-user products and services for all stakeholders and citizens supporting climate adaptation and mitigation

Specific Challenge: The science underpinning the European Green Deal has outlined what is at stake in terms of the impacts of climate change, the need to adapt to them, and the need to pursue decarbonisation pathways towards net zero. However, the challenges of mitigation and adaptation will ultimately be met by business and investors, government, and citizens. These actors therefore need to be empowered with solutions that are in keeping with scale of the challenge. As today's planning decisions affect our emissions and resilience for decades ahead, decision-makers need to know which modes of production, consumption and lifestyle are compatible with climate-resilience and pathways achieving climate neutrality by 2050. Climate change adaptation and mitigation solutions still fail, to a large extent, to incorporate social and behavioural factors that would increase efficiency towards our climate goals, and overcome barriers preventing achieving those goals.

Scientific research has provided a vast variety of information on the climate system, the impacts of climate change at different scales and options for adaptation as well as integrated assessments of mitigation pathways. However, actions are needed for relevant and practical climate adaptation and mitigation solutions and information to reach the end users, help them in building the climate-neutral future they want and address environmental challenges posed by climate change. Actions are also needed to support the use of climate information in risk management and planning across sectors and regions.

Scope: This action should contribute to informing citizens and decision-makers about the impacts of climate change in the decades to come, identify adaptation options, and illustrate what pathways towards climate neutrality entail in terms of production, consumption, planning and lifestyle, incorporating behavioural factors. In particular, the last mile of the climate service delivery should be tackled for the most relevant sectors, in order to deliver solutions towards meeting the decarbonisation goals of the European Green Deal as well as adaptation options for dealing with climate change impacts.

The projects under this topic should cover some of the following aspects:

- Building on existing services and frameworks, such as Copernicus, GEOSS, EMODnet and ESA actions. This includes addressing the downstream part of the value chain and engage with end users and stakeholders, customising of data and exploitation platforms, the use, scale-up and replication of existing service models, brokerage of knowledge and dissemination to the public;
- Build robust knowledge on how the climate is changing at a scale meeting the user's needs, and what impacts are to be expected at sectoral and regional levels in Europe. Identification of barriers to the predictive potential of climate adaptation models should be addressed, including by blending the latest information from climate models, downscaling products, observations, user or citizen knowledge or other intelligent ways of filtering relevant information for users;
- Synthesising/exploiting this knowledge in a way that bridges the gap between the expert tools already used by scientists, and the needs of stakeholders who are making decisions today that will both, affect and be affected by climate change and its impacts;
- Making the above findings accessible to the public, going beyond existing tools in both scientific robustness and user relevance;
- Demonstrating the climate services in a near-to-operational environment with the provision of guidance services and measuring the results through key performance indicators defined with users and stakeholders;
- Multiplying the outreach through scaling up and replication to a number of players in the business and public sector, as well as in less represented areas in Europe and beyond. This includes the development of appropriate business models and knowledge brokerage activities as well as activities to tackle other relevant barriers, such as quality assurance and standards, institutional barriers, capacity building.

Actions under this topic should more specifically focus on one of the following aspects:

- Converting the mitigation pathways that are compatible with EU climate goals and adaptation strategies for potential impacts to 2050 and beyond into clear information about how climate change impacts will evolve and how production, consumption, infrastructure and lifestyle needs to change. Including consideration of co-benefits and

trade-offs, and insights into the drivers and barriers for these changes, and how barriers can be overcome;

- Contributing to delivering the next-generation of climate services, in collaboration with the commercial sector, through addressing part or all of the downstream part of the value chain, focusing on sectoral and geographical gaps, providing actionable information to non-specialists for adapting to extreme climate events and new climatic conditions through tools, platforms (e.g. GEOSS & Copernicus) and/or mobile applications.

The Commission considers that proposals requesting a contribution from the EU of EUR 3 to 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. In line with the Union's strategy for international cooperation in research and innovation, international cooperation is encouraged in particular for this topic addressing the climate priority of the Group on Earth Observation (GEO).

Expected Impact:

- Enable citizens, stakeholders and decision-makers to factor climate change and climate action into the decisions that will affect our lives for decades to come;
- Contribute to the exploitation of information and data from the Copernicus programme and GEO initiative;
- Improve robustness and predictive quality of data, and information and knowledge on climate adaptation and mitigation;
- Bring a step change in the use of knowledge and information and allow users to become active players in climate action;
- Make high-level information on climate change more accessible to people's lives and to provide data in a format that makes it useful for its users;
- Improve European capacity regarding availability of solution to adapt to and mitigate climate change, including by tackling sector and/or geographical gaps;
- Provide appropriate responses to European and international climate policies we committed to;
- Increase resilience of society, organisation (private and public), and individual to multiple risks;
- Support the development of the European Service sector regarding end-user climate services.

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-GD-9-3-2020: Transparent & Accessible Seas and Oceans: Towards a Digital Twin of the Ocean

Specific Challenge: Fit for purpose and sustained ocean and sea observations are essential for understanding and forecasting ocean behaviour. Measures to protect marine social-ecological systems and support the blue economy are based on these insights and forecasts. 10-20 years ago, marine data from these observations were difficult to find, only accessible through long and sometimes costly negotiations and hard to put together to create a complete picture because of different standards, nomenclature and baselines.

For the past two decades, the European Union invested in policies and infrastructures to enable this sustainability and fitness for purpose. Its Member States, together with neighbours, have created an unrivalled marine data, modelling and forecasting infrastructure, essentially based on EMODNet – the European Marine Observation and Data Network - gathering in-situ and reference ocean data in Europe and the Copernicus marine environment monitoring service (CMEMS) providing European and global operational ocean forecasting and ocean climate services based on the assimilation of these in-situ ocean observation into numerical ocean models. They are supported by European Research Infrastructures and by major R&D projects to deploy ocean observatories at sea and collect marine data (e.g. Eurofleets+, EuroArgo, Jerico, Danubius, EMBRC, EMSO, ICOS, LifeWatch, etc). Cooperation and the principles of free and open access, interoperability, and “measure once, use many times”, were largely promoted, as well as the added-value demonstrated through Copernicus, the European Research Framework Programmes FP7 and Horizon 2020, Blue Cloud and EMODnet activities.

The Digital Twin of the Ocean concept is to make a step further by integrating all European assets related to seas and oceans (data, models, physical ocean observatories at sea) with digital technologies (cloud, super HPC capacities, AI and data analytics) into a digital component that represents a consistent high-resolution, multi-dimensional and (nearly) real-time description of the ocean. It will contribute to the Commission’s Green Deal and Digital Package commitments to develop a very high precision digital model of the Earth (Destination Earth initiative).

AI and analytics, thematic or sectorial models and computing power will transform data into knowledge. They will facilitate co-creation and inter-disciplinary approaches between natural sciences, humanities and social sciences for the co-construction of methods, expertise and applications to support decision making. This digital view of the ocean will enable a multi-angle perception of the ocean: its physics, chemistry, geology, biology as well as the environmental and socio-economic impact of human activity.

It will be a simulator to test scenarios that deal with different evolutions of the ocean environment. It will empower citizens, governments and industries to collectively share the responsibility to monitor, preserve and enhance marine and coastal habitats, while supporting

also a sustainable blue economy (fishing, aquaculture, transport, renewable energy, etc.). It will enable measures to increase resilience to climate change, improve disaster risk management, develop spatial plans, report on the state of the environment, coastal or offshore activity and measure its impact.

Scope: Proposals for such a development should demonstrate their usefulness with regard to Green Deal priorities (e.g. impact of ocean climate scenarios on aquaculture and fisheries, impact of sea-level rise and extreme waves on coastal risks, pollution monitoring and scenarios for mitigation and remediation strategies, and maritime spatial planning). It needs to fulfil all of the following criteria: deliver break-through in accuracy and realism, represent optimal synergy between observations and models; fully integrate downstream impact sectors of the socio-economic areas addressed in their test case; include a rigorous handling of quality and confidence information.

Proposals should address:

- The development of an ocean digital twin at high resolution including the ocean model representation and the integration of all available datasets into a single digital framework compatible of Destination Earth infrastructure and technologies (cloud, euroHPC, AI-ready standards, datacubes, ...). It should build on existing infrastructures and relevant Horizon 2020 and R&D projects to achieve this integration at short-term (e.g. CMEMS, BlueCloud, EMODNet, portals from ERICs, IMMERSE, ESA Ocean Science Cluster);
- The configuration of it as a simulation environment built on a consistent multi-variable multi-dimensional description of the ocean consistent from estuaries to the coast and to open ocean, from the surface to the seabed and allowing a digital exploration in time and space of the ocean physics and biodiversity according to different scenarios. It should provide an integrated, timely and persistent description of the ocean including at least physics, biogeochemistry, geology and human activities;
- The integration of data from existing or new automated sensors and autonomous mobile and fixed platforms, additional structured and unstructured data, alternative sources such as private companies data, citizen science or historic data collected before the digital age (chemical, physical, biological and ecological) and delivered through EMODnet and Copernicus;
- The implementation of data and model outputs in state-of-art standards and formats (INSPIRE, FAIR, ontologies, ...) compliant with their exploitation by applications and appropriate user interfaces based on big data and artificial intelligence technologies;
- The development of what-if scenarios to validate the representativeness of the digital ocean simulator in “real conditions of use” by configuring different ocean conditions and exploiting AI/data analytics tools, on concrete cases in local or regional sea basins.

The Commission considers that proposals requesting a contribution from the EU of up to EUR 12 million would allow this specific challenge to be addressed appropriately.

Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. In line with the Union's strategy for international cooperation in research and innovation, international cooperation is encouraged.

Expected Impact: The action will deliver a digital interactive framework based on digital technologies compatible of Destination Earth and the Digital Package including an digital ocean simulator based on a high-resolution numerical model of the ocean, including available ocean observation datasets in Europe and digital analytic toolboxes to configure the digital ocean simulator and to access what-if scenarios.

This will enable:

- Complementing the core European existing operation ocean forecasting and ocean climate services provided by Copernicus to European public, scientific and private users, with a simulation capacity that will enable the plug-in of vertical applications based on innovative solutions (sectorial methods, coupled models, statistical approaches, assimilation, ensembles, massive computing, deep learning, ...) to support science-driven policies implementation;
- Moving towards a European Ocean Observing System, fully integrated with multidisciplinary observatories of estuarine, coastal and marine environments and socio-ecological systems, and promoting shared data management strategies (infrastructure development, data standardization, sharing, availability, access, interoperability, visualisation and use of data according to the FAIR principles).

It will:

- Support science-driven approaches to policies implementations by users that reinforce conservation and ecosystem-based management of marine habitats/green infrastructure, improve the planning and management of marine areas, and safeguard productivity and biodiversity of marine ecosystems and how this is influenced by the river-to-sea interaction;
- Increase citizen engagement, taking into account cultural and emotional aspects, through increased awareness and understanding of the dynamics, interactions and evolution of seas and oceans and their role in our well-being and survival, and promoting bottom-up actions, empowering citizens in innovative co-designed services and new project designs where citizens' opinions are considered from the initial stages;
- Encourage and enable the infusion of 'non-scientific data streams', in a coordinated way, through citizens engaged in data gathering, and through joint efforts from a community composed of users of the sea, including private companies, public authorities, social innovators, researchers, citizens and policy makers;
- Support industry to develop new business models and opportunities in ocean data and related services.

- Facilitate the operationalising of long term observing systems and contribute to the objectives of the UN Decade of Ocean Science for Sustainable Development.

Type of Action: Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Area 10: Empowering citizens for the transition towards a climate neutral, sustainable Europe

The European Green Deal communication stresses that the transition towards sustainability must be just and inclusive, put people first and bring together citizens in all their diversity. This calls for citizen engagement and social innovation in all areas of the European Green Deal. This also requires ambitious cross-cutting actions to engage and empower people and communities and to support behavioural, social and cultural changes wherever this is most needed for a fair and inclusive transition, leaving no-one behind. Such actions must address change at the collective level through participatory processes and experimental research on behavioural, social and cultural change; and at an individual level by empowering citizens as actors of change, including through the co-creation of R&I contents¹⁶⁵.

Activities under this area will be implemented through three different topics addressing both collective level actions (topics LC-GD-10-1-2020 and LC-GD-10-2-2020) as well as individual level actions (topic LC-GD-10-3-2020)

Proposals are invited against the following topic(s):

LC-GD-10-1-2020: European capacities for citizen deliberation and participation for the Green Deal

Specific Challenge: All areas of the European Green Deal, from climate action to zero pollution, require citizens' active support at all stages of the transitions. Workable solutions, accepted and taken-up at scale, can only be found through the active participation of all concerned. This is particularly the case of complex issues with diverging views or interests at stake, such as the rural-urban gap, attitudes to the bio-economy, water management, the choice of energy sources, etc. Such issues can best be addressed through participatory processes involving citizens from different cross-sections of society across Europe, including by engaging them throughout the innovation life cycle¹⁶⁶ as social innovators. The Conference on the Future of Europe has further heightened awareness of the need for participatory processes and raised expectations in this respect. Strong expectations of citizen participation have also been raised in the context of Horizon Europe preparation, in particular for Horizon Europe Missions, which will be highly relevant to the European Green Deal.

¹⁶⁵ See UN Global Sustainable Development Report 2019, *The Future is Now – Science for achieving sustainable development*, <https://sustainabledevelopment.un.org/gsdr2019>.

¹⁶⁶ From co-design to co-implementation and co-evaluation.

Such processes may include a large spectrum of co-creation activities and events based on dialogue and information exchange, including but not limited to virtual ones. Modalities of participatory processes differ according to goals and expected outcomes, from harnessing diversity of knowledge, expectations and views in order to improve knowledge quality and enrich the inputs to policy discussions; up to creating ‘mini-publics’ in order to extend the arenas of public discussion and improve the representativeness of policy decisions. For these processes to be effective, participants should be equipped with appropriate tools and information, they should be strongly connected to decision-making bodies – examples span from simple feedback mechanisms to participatory budgeting – and they should be empowered to reflect, deliberate and propose change at a systemic level.

Participatory processes in general and citizen deliberation in particular, require different levels of expertise, as well as upfront clarification of ethical and methodological principles and a clear commitment on the side of institutions about the processes’ outcomes. Successful experiences have been led at European, national and local levels, which would gain to be expanded, structured and scaled. Moreover, such actions should be accompanied by comparative research and feedback to ensure continuous monitoring, evaluation and learning.

Scope: This topic covers citizen deliberation and participation. Actions should establish transnational networks of experts, researchers, practitioners and relevant civil society organisations specialised in deliberative democracy and civic participation across Europe, including professionals in the field of public engagement. Experts on gender equality and climate justice should also be included. They should share good practice, tools and resources and implement participatory and deliberation processes on priority issues in order to deliver on the Green Deal, both at the level of local communities and at wider scale. They should establish connection across the diverse participation and deliberation processes across regions and countries up to the European level. They should build on already existing experience and tools, notably open access ones stemming from EU-funded projects such as the [RRI Tools](#) platform¹⁶⁷.

Actions should include several deliberative processes, each of them implemented in a significant number of Member States or associated countries and complemented by a European online multilingual deliberative platform. Specific topics for deliberation should be co-decided with the European Commission services involved in implementing the Green Deal. They should support major EU actions where public participation is key, including but not limited to Horizon Europe Missions, in close cooperation with the respective mission boards, and other R&I initiatives.

A balanced overall coverage of EU and Associated Countries should be sought. Vulnerable and marginalised categories of the population, minorities and various age groups, including both youth and the elder generation, as well as urban, peri-urban and rural areas, should be considered in analysis and included in deliberations. Gender balance should be ensured and gendered issues should receive specific consideration.

¹⁶⁷ <https://www.rri-tools.eu/>

National and local governments and administrations should be closely associated from an early stage, including, to the extent possible, links with existing debates and participatory processes at their levels and taking account of national/local specificities. Clear channels for the take-up of participatory outcomes in decision-making processes should be sought at local, national and/or EU levels and feedback to citizens should be ensured.

Actions should design methodologies for each individual exercise, relying on comparative analysis of international practice and involving people or groups concerned. Depending on their specific objectives, they may either ensure consistency across Member States/Associated Countries for transnational comparability, or select a range of different methodologies to compare their effectiveness.

An advisory board should ensure the robustness, ethical and inclusive character of the planned deliberative processes and vet the methodologies and conditions of implementation of each individual exercise.

Actions should also study each individual exercise, assess and compare their results across the Member States/Associated Countries and provide feedback and recommendations.

Proposals should dedicate resources to engage in coordination and cooperation with the other projects funded under this area, since deliberation and participation are important factors for behavioural change and are closely related to citizen engagement and activism. Such cooperation may encompass setting up a single advisory board per topic to ensure consistency across the projects and/or a single online platform to maximise its reach and impact.

In line with the Union's strategy for international cooperation in research and innovation, international cooperation is encouraged.

Projects under this topic will enable collective design and ownership of the European Green Deal's objectives and means, engagement and change through citizen participation and deliberation processes. Consortia should choose a basket of qualitative and quantitative indicators to measure the impact of their work and are encouraged to make use of MoRRI indicators¹⁶⁸.

The Commission considers that proposals requesting a contribution from the EU of between EUR 3 to 5 million would allow the specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: Successful projects are expected to contribute to specific impacts, including:

- feeling of ownership and engagement through citizen deliberation and participation across Europe;
- participatory identification of solutions contributing to the European Green Deal;

¹⁶⁸ <https://op.europa.eu/s/n7SQ>

- enhanced involvement of citizens in the implementation of the European Green Deal and of the future Horizon Europe missions;
- stronger trust in policy and science institutions among citizens on European Green Deal issues;
- commitment and buy-in from a broad spectrum of social groups across Europe to support the European Green Deal targets and to engage in co-creation and co-implementation of transition pathways, including activation of citizens through social innovation;
- in the longer term, contribution to one or several of the Sustainable Development Goals¹⁶⁹.

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-GD-10-2-2020: Behavioural, social and cultural change for the Green Deal

Specific Challenge: All areas of the European Green Deal, from climate action to zero pollution, require considerable changes in societal practices and in the behaviour of individuals, communities, and public and private organisations. These changes concern, for example, mobility behaviour, minimising traffic-related emissions and energy/resource consumption, protecting or restoring biodiversity, etc. including changes achieved through collective and participatory processes or a sense of environmental citizenship and climate justice.

Several foci of behaviour and mind-set are at play in interconnected ways: concerns for: personal health and well-being; for the planet; for decent work; for fairness and solidarity, etc. Ways of combining individual, collective socio-economic and environmental benefits should be sought wherever possible.

Disadvantaged and vulnerable social groups and groups and communities most affected by the transition need special attention. Their existing practices, for example, may combine environmentally friendly, circular habits with practices that are detrimental to both their own health and to the environment (from dietary choices, mobility and travel behaviour to inappropriate use, reuse and disposing of materials), but to which they see no feasible alternatives. Similarly, differences of perception (in different regions of the EU, among different social groups, across genders and various age groups) of the urgency of the climate change and other environmental issues, on the most appropriate measures needed and hence also on the urgency of related behaviour change, need focused attention. Other categories of actors have to face challenging dilemmas, such as economic agents bearing major additional costs, adaptations or even phasing out of their activities due to Green Deal requirements. In

¹⁶⁹

<http://www.un.org/sustainabledevelopment/sustainable-development-goals/>

such cases, individual change should be addressed in the context of the collective benefits and cost-sharing arrangements of the Green Deal and it should be associated to broader structural measures to support affected groups. Addressing these issues requires research and experimentation on behavioural, social and cultural change across Europe, founded on transdisciplinary expertise and strong ethical and methodological standards. Moreover, these actions should be accompanied with comparative research and feedback to ensure continuous monitoring and learning, foresee robust impact evaluation methods and take account of possible trade-offs, unintended consequences or rebound effects.

Scope: Actions should address behavioural change at individual and collective levels, including public and private organisations, as well as broader changes in social practices related to the European Green Deal. Actions should establish transnational and transdisciplinary networks of experts, researchers, practitioners and relevant civil society organisations on behavioural, social and cultural change. They should jointly analyse social practices and behavioural change processes, including enabling as well as inhibiting factors, share good practice, tools and resources and implement relevant experimentation on priority issues to deliver on the European Green Deal. They should build on existing experience, notably stemming from EU-funded projects.

Actions should include several experimental studies, each implemented in at least four Member States and/or Associated Countries. Specific topics for case studies should be co-decided with the European Commission services involved in implementing the European Green Deal. They should support major EU actions where such change is key, including – but not limited to – Horizon Europe Missions, in close cooperation with the respective mission boards, and other R&I initiatives.

Vulnerable and marginalised people, minorities and various age groups, including both youth and the older generation, as well as various skill and income groups and urban, peri-urban and rural areas, should be considered in analysis and included in experimentation, with methods and tools adapted to the target groups. Gendered issues should receive specific consideration. Change at the workplace and future of work related issues should also be addressed, including teleworking, as well as change in and by collective entities such as the behaviour of businesses and social partners and their shift towards sustainable business models, the behaviour of public services and other organisations – in the context of broader political, social and economic or financial dynamics, where relevant.

A balanced overall coverage of EU Member States and Associated Countries should be sought. National and local governments and administrations should be associated from an early stage, including, to the extent possible, links with similar initiatives at these levels and with their policy and regulatory actions. Actions should also build on bottom-up initiatives stemming from groups of citizens, notably from the younger generation, as well as from various communities and organisations, including social partners and for example those active in the social economy, and seek to expand the agency of individual people and communities.

Actions should design methodologies for each individual exercise, relying on comparative analysis of international best practice, including comprehensive impact evaluation and

involving the people or groups concerned. Depending on their specific objectives, they may either ensure consistency across Member States/Associated Countries for transnational comparability, or select a range of different methodologies to compare their effectiveness.

All relevant factors of behaviour change should be considered. Actions should therefore propose a transdisciplinary approach to behavioural change, looking at system dynamics and integrating historical, cultural, societal, economic and psychological perspectives, as well as gender studies and intersectional research. For example, disciplines such as anthropology, cultural psychology, cultural studies, semiotics and sociology can shed light on cultural change as one of the crucial preconditions of behavioural change, whereas engaging social and economic psychology may help to establish a more nuanced concept of human behaviour itself. Inequalities related to climate change and the socio-ecological transition should also be considered, as well as the role of science communication, journalism and the media.

Broader institutional (legal, financial, economic) conditions that enable and facilitate behavioural change should be considered and should lead to policy and regulatory recommendations. Actions should address the feedback loops between behavioural change and the evolution of the broader context, including with regard to socio-economic resilience and stability. They should also consider the full impact of behavioural change, including trade-offs, side and rebound effects.

An advisory board should ensure the scientific soundness, ethical and unbiased character of the planned experiments and vet the methodologies and conditions of implementation of each individual exercise.

Actions should also study each individual exercise, assess and compare their results across the Member States/Associated Countries and provide feedback and recommendations.

Proposals should dedicate resources to engage in coordination and cooperation with the other projects funded under this topic and others of this area, since behavioural, social and cultural change are often directly linked with deliberation, engagement and activism. Such cooperation may encompass setting up a single advisory board per topic to ensure consistency across the projects.

In line with the Union's strategy for international cooperation in research and innovation, international cooperation is encouraged.

To succeed, the European Green Deal requires substantial behavioural change at both individual and collective levels. Projects under this topic will enable such change through implementation research on the behavioural change of individuals, private corporations and/or the public sector across the EU. Consortia should choose a basket of qualitative and quantitative indicators to measure the impact of their work and are encouraged to make use of MoRRI indicators¹⁷⁰.

¹⁷⁰ <https://op.europa.eu/s/n7SQ>

The Commission considers that proposals requesting a contribution from the EU of between EUR 3 to 5 million would allow the specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: Successful projects are expected to contribute to specific impacts, including:

- structurally enhanced research and innovation capacities in this area, through structured transdisciplinary expertise, research and practice networks of the highest ethical and methodological standards across Europe;
- more effective and inclusive action on the social and behavioural aspects of the European Green Deal, by achieving a more nuanced view of mindset, incentive structures and social and behavioural change mechanisms, including enabling as well as inhibiting factors for various groups and communities, through the lens of transdisciplinary research that integrates historical, cultural, societal, economic and psychological perspectives;
- behavioural change and long-term commitment, trust, social acceptance and buy-in from people, communities and organisations, through effective new strategies to induce this, including innovative recommendations and incentives that consider differences between EU regions and social groups e.g. in terms of urgency perceptions;
- improved management, *inter alia*, of the uncertainty derived from climate change through bottom-up approaches;
- greater societal resilience against climate change and environmental crises, and as well as contributions to effective just transitions;
- changed behaviour at both individual and collective levels, among citizens, communities, businesses, workplace, decision makers and institutional actors;
- in the longer-term, systemic change at the level of political and economic structures, culture and society and contribution to one or several of the Sustainable Development Goals <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>

Type of Action: Research and Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

LC-GD-10-3-2020: Enabling citizens to act on climate change, for sustainable development and environmental protection through education, citizen science, observation initiatives, and civic engagement

Specific Challenge: The active role of citizens and their direct involvement is essential to address climate change and other human actions harming the environment on land, air and sea. Changes in citizen's and consumer's behaviours towards more sustainable patterns can happen through education, awareness raising, citizen science, observation and monitoring of their environmental impacts, civic engagement and social innovation. It is essential to directly involve citizens and communities in contributing to climate action and protecting the environment, thereby encouraging them to change their personal behaviour and their mindsets, reducing their carbon and environmental footprint and taking action at the individual and collective level. This would lead to a more sustainable lifestyle and relationship to the environment.

A strong emphasis is placed on strengthening environmental awareness of the young generation through education and other forms of youth engagement. Pupils and students have the potential to become ambassadors for climate action, sustainable development and environmental protection by sharing their knowledge, experience and engagement with their families, local communities, public and private decision makers, as well as through communication and the use of social media. As recommended in the European Green Deal Communication¹⁷¹, schools, training institutions and universities are well positioned to engage with pupils, parents and the wider community on the changes needed for a successful transition to a green economy. A European competence framework is needed to help develop and assess knowledge, skills and attitudes on climate change and sustainable development. Related demonstration activities on for example nature-based solutions, biodiversity conservation, waste management, sustainable energy production and consumption, marine science, etc. will support the testing and the implementation of the framework.

Citizen science is a powerful tool for climate action, sustainable development and environmental protection through civic engagement. Citizen science should be understood broadly, covering a range of different levels of participation, from raising public knowledge of science, encouraging citizens to participate in the scientific process by observing, gathering and processing data, right up to setting scientific agenda and co-designing and implementing science-related policies. It could also involve publication of results and teaching science. Citizen science activities should be based on a robust scientific methodology ensuring the quality of the data collected and a fair representation of all stakeholders involved. Citizen science will help to raise awareness, to educate in science, to increase understanding of scientific processes and scientific literacy. It will also provide new tools and data for environmental monitoring, covering a broad European geography. Citizen science can strongly contribute to the delivery of environmental data with a significant potential for

¹⁷¹ https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF

further broad use, including contributing to improving relevant European policies. It will have real-life impact through adaptations in citizen/consumer personal behaviours.

Initiatives should be coherent with the objectives of the European Green Deal, the European Climate Pact¹⁷² and the European Biodiversity Strategy for 2030¹⁷³ to engage citizens and communities in action addressing climate change, sustainable development and environmental protection. The proposed activities will build on existing initiatives and practices that demonstrate at international, European, national, regional and local level innovation in teaching and learning methods and how to engage the wider community in the changes needed for a successful and just transition. For example, experience can be learned from the European Ocean Literacy platform¹⁷⁴, the European Atlas of the Seas¹⁷⁵, the Plastic Pirates initiative¹⁷⁶, the citizen science platform¹⁷⁷, the Horizon 2020 project TeRRIFICA¹⁷⁸, Scientix¹⁷⁹, School Education Gateway¹⁸⁰, resources for nature-based solutions in education¹⁸¹, UNESCO experience in Education for Sustainable Development¹⁸², as well as cultural, creative and artistic activities as a tool for empowering citizens.

Scope: Actions under this topic should address one the following two subtopics:

Subtopic 1: Enabling citizens to act on climate change and for sustainable development through education

Based on the recommendations of the European Green Deal Communication, actions will foster the development and implementation of a multidisciplinary European competence framework within the context of lifelong learning for the development and assessment of knowledge, skills and attitudes of citizens and in particular young people on climate change and sustainable development.

This framework shall be built on the best available research and rooted in the Council Recommendation on Key Competences for lifelong learning¹⁸³, especially natural science, technology, mathematics, as well as social, personal, entrepreneurial, citizenship and digital competences. The participation of natural scientists, technology specialists, citizen science professionals and social sciences and humanities researchers is essential for the development of the framework. Taking into account the natural resistance to individual behavioural changes and to collective changes in social practices, as well as the gender gap observed in

¹⁷² https://ec.europa.eu/clima/policies/eu-climate-action/pact_en

¹⁷³ https://eur-lex.europa.eu/resource.html?uri=cellar:a3c806a6-9ab3-11ea-9d2d-01aa75ed71a1.0001.02/DOC_1&format=PDF

¹⁷⁴ <https://webgate.ec.europa.eu/maritimeforum/en/node/4484>

¹⁷⁵ <https://webgate.ec.europa.eu/fpfis/wikis/display/AtlasOfSeas/>

¹⁷⁶ <https://bmbf-plastik.de/en/plasticpirates>

¹⁷⁷ <https://eu-citizen.science/>

¹⁷⁸ <https://cordis.europa.eu/project/id/824489>

¹⁷⁹ <http://scientix.eu/>

¹⁸⁰ <https://www.schooleducationgateway.eu/>

¹⁸¹ <https://oppla.eu/>

¹⁸² https://www.unesco.de/sites/default/files/2018-08/unesco_education_for_sustainable_development_goals.pdf

¹⁸³ https://ec.europa.eu/education/education-in-the-eu/council-recommendation-on-key-competences-for-lifelong-learning_en

attitudes towards ecology and sustainable practices, contributions and practical knowledge provided by non-academic practitioners, NGOs and stakeholders, and international best practices, will be important.

The European competence framework will be tested and validated through demonstration activities, in particular in schools, training institutions and universities, as for example through the implementation of nature-based solutions (e.g. green walls, green ponds for natural water filtering, green roofs, air quality sensors, green mobility, etc.), actions for biodiversity conservation, education on natural disasters, waste management including marine and riverside litter, sustainable energy and food production and consumption, educational activities supporting the refurbishment of school buildings, etc.

Under this subtopic, clustering activities among the selected projects should be ensured through regular exchanges (e.g. meetings, peer-learning and peer-counselling activities, etc.) in order to share the educational outcomes on the competence framework, best practices and results of the different demonstration sites. To this end, proposals should earmark the appropriate resources for coordination activities accordingly. Each proposal should also reflect a balanced geographical representation of the demonstration sites covering different regions in Europe.

The Commission considers that proposals requesting a contribution from the European Union in the range of EUR 3 to 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Subtopic 2: Enabling citizens to act on climate change and for sustainable development through better monitoring and observing of the environment and their environmental impacts

Actions in this subtopic will target the involvement of citizens in climate- and environment-related issues and domains, such as biodiversity, marine and freshwater pollution, water scarcity and sustainable transport and food production. They will focus on the active participation of citizens through citizen science, environmental observation and civic consortia. Projects should be conducted on a broad scale, i.e. in cooperation with businesses, civil society organisations, public authorities and existing initiatives (such as the Climate Adapt platform¹⁸⁴ and the Covenant of Mayors¹⁸⁵), to ensure that these actions will lead to examples on how to engage the wider community in the effective behavioural changes and changes in social practices needed for a successful and just transition. The key component of this subtopic is to raise awareness, engage and empower citizens and consumers with concrete tools to monitor their impacts on the environment, to collect information enabling them to change their behaviour and to reduce their personal carbon and environmental footprint as user and consumer through individual and social innovation. Actions should include the development and/or improvement of devices (low-cost sensors, consumer apps, such as

¹⁸⁴ <https://climate-adapt.eea.europa.eu/>
¹⁸⁵ <https://www.covenantofmayors.eu/>

wearable sensors, a trusted user-friendly app with robust carbon footprint calculations, extreme weather community app, for the purposes of early warning, marine and freshwater litter watch) taking into account the interoperability and exchange of future and existing data collected. Attention should be paid to promoting gender-equal participation and deconstructing gender stereotypes.

The Commission considers that proposals requesting a contribution from the European Union in the range of EUR 3 to 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Grants will be awarded to proposals according to the ranking list. However, in order to ensure a balanced portfolio of supported actions, at least the highest-ranking proposal per subtopic will be funded, provided it attains all thresholds.

Expected Impact: The project results are expected to contribute to:

Subtopic 1:

- a multidisciplinary European competence framework within the context of lifelong learning that will serve as a reference tool for the Member States, the public and private sector, stakeholders, and NGOs to help citizens to become engaged actors in the green transformation of society;
- The ability to assess the knowledge, skills and attitudes of citizens and in particular young people on climate change, sustainable development and environmental protection;
- specific educational programmes, school curricula, trainings, networking activities and exchange of good practices in the area of climate change and education for sustainable development;
- enhanced engagement of the wider community, including with the use of digital media, to make the behavioural changes needed for a successful transition by undertaking consultations, testing and implementation of this framework in schools, universities, training institutions, municipalities, public authorities in cooperation with the private sector, teachers, trainers, students, pupils, parents;
- the large participation of pupils and students, supported by scientists, educators and practitioners, in intergenerational dialogues and exchanges on climate action, environmental protection and behavioural changes for sustainable development;
- the broad testing, dissemination and use of the European competence framework at concrete demonstration sites (e.g. in schools, universities and identified education communities) and in innovative activities (e.g. incubators for citizen participation, informal youth city councils, use of social media and digital tools...).

Subtopic 2:

- the development or strengthening of citizen science initiatives to engage citizens in the active collection of environmental and socio-economic data through individual new or improved devices;
- the provision of personalized information to citizens and consumers about their environmental impact;
- a better monitoring of the environment (land, sea, air, etc.);
- behavioural change processes on the part of citizens, consumers and communities towards more sustainable patterns in reducing their carbon and environmental footprint, changing their consumption and lifestyle choices to achieve goals of a climate-neutral, sustainable Europe through concrete and targeted advice.

Type of Action: Innovation action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Conditions for the Call - Building a low-carbon, climate resilient future: Research and innovation in support of the European Green Deal

Opening date(s), deadline(s), indicative budget(s):¹⁸⁶

Topics (Type of Action)	Budgets (EUR million)	Deadlines
	2020	
Opening: 22 Sep 2020		
LC-GD-1-2-2020 (RIA)	53.00 ¹⁸⁷	26 Jan 2021
LC-GD-1-3-2020 (IA)	42.00 ¹⁸⁸	
LC-GD-1-3-2020 (CSA)	3.00 ¹⁸⁹	
LC-GD-9-2-2020 (RIA)	25.00 ¹⁹⁰	

¹⁸⁶ The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.

The Director-General responsible may delay the deadline(s) by up to two months.

All deadlines are at 17.00.00 Brussels local time.

The implementation is subject to the availability of the appropriations provided for in the general budget of the Union for years 2019 and 2020.

¹⁸⁷ of which EUR 53.00 million from the 'Climate action, environment, resource efficiency and raw materials' WP part.

¹⁸⁸ of which EUR 42.00 million from the 'Climate action, environment, resource efficiency and raw materials' WP part.

¹⁸⁹ of which EUR 3.00 million from the 'Climate action, environment, resource efficiency and raw materials' WP part.

¹⁹⁰ of which EUR 25.00 million from the 'Climate action, environment, resource efficiency and raw materials' WP part.

Horizon 2020 - Work Programme 2018-2020
Cross-cutting activities

LC-GD-9-1-2020 (RIA)	28.00 ¹⁹¹	26 Jan 2021
LC-GD-2-1-2020 (RIA)	18.00 ¹⁹²	26 Jan 2021
LC-GD-2-1-2020 (IA)	68.00 ¹⁹³	
LC-GD-2-2-2020 (IA)	60.00 ¹⁹⁴	
LC-GD-2-3-2020 (IA)	40.00 ¹⁹⁵	
LC-GD-5-1-2020 (IA)	100.00 ¹⁹⁶	
LC-GD-4-1-2020 (IA)	60.00 ¹⁹⁷	26 Jan 2021
LC-GD-3-1-2020 (IA)	80.00 ¹⁹⁸	26 Jan 2021
LC-GD-1-1-2020 (IA)	72.00 ¹⁹⁹	26 Jan 2021
LC-GD-1-1-2020 (CSA)	3.00 ²⁰⁰	
LC-GD-10-3-2020 (IA)	25.00 ²⁰¹	
LC-GD-3-2-2020 (IA)	60.00 ²⁰²	
LC-GD-7-1-2020 (IA)	80.00 ²⁰³	
LC-GD-8-1-2020 (RIA)	40.00 ²⁰⁴	
LC-GD-8-2-2020 (RIA)	20.00 ²⁰⁵	

¹⁹¹ of which EUR 28.00 million from the 'European research infrastructures (including e-Infrastructures)' WP part.

¹⁹² of which EUR 18.00 million from the 'Secure, clean and efficient energy' WP part.

¹⁹³ of which EUR 3.00 million from the 'Secure, clean and efficient energy' WP part, EUR 65.00 million from the 'Secure, clean and efficient energy' WP part.

¹⁹⁴ of which EUR 60.00 million from the 'Secure, clean and efficient energy' WP part.

¹⁹⁵ of which EUR 40.00 million from the 'Secure, clean and efficient energy' WP part.

¹⁹⁶ of which EUR 34.00 million from the 'Smart, green and integrated transport' WP part, EUR 66.00 million from the 'Smart, green and integrated transport' WP part.

¹⁹⁷ of which EUR 60.00 million from the 'Secure, clean and efficient energy' WP part.

¹⁹⁸ of which EUR 80.00 million from the 'Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing' WP part.

¹⁹⁹ of which EUR 72.00 million from the 'Climate action, environment, resource efficiency and raw materials' WP part.

²⁰⁰ of which EUR 3.00 million from the 'Climate action, environment, resource efficiency and raw materials' WP part.

²⁰¹ of which EUR 25.00 million from the 'Climate action, environment, resource efficiency and raw materials' WP part.

²⁰² of which EUR 60.00 million from the 'Climate action, environment, resource efficiency and raw materials' WP part.

²⁰³ of which EUR 80.00 million from the 'Climate action, environment, resource efficiency and raw materials' WP part.

²⁰⁴ of which EUR 40.00 million from the 'Climate action, environment, resource efficiency and raw materials' WP part.

²⁰⁵ of which EUR 20.00 million from the 'Climate action, environment, resource efficiency and raw materials' WP part.

LC-GD-10-1-2020 (RIA)	10.00 ²⁰⁶	26 Jan 2021
LC-GD-10-2-2020 (RIA)	10.00 ²⁰⁷	
LC-GD-6-1-2020 (IA)	74.00 ²⁰⁸	
LC-GD-9-3-2020 (IA)	12.00 ²⁰⁹	
Overall indicative budget		983.00

Indicative timetable for evaluation and grant agreement signature:

For single stage procedure:

- Information on the outcome of the evaluation: Maximum 5 months from the final date for submission; and
- Indicative date for the signing of grant agreements: Maximum 8 months from the final date for submission.

Exceptional funding rates:

LC-GD-2-2-2020	Due to the nature of the supported developments that undertake innovation activities in a market environment funding rate is reduced to 50%
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Eligibility and admissibility conditions: The conditions are described in General Annexes B and C of the work programme. The following exceptions apply:

LC-GD-2-3-2020	At least two partners from at least one African country must be part of the consortium.
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Exceptional page limits to proposals/applications:

LC-GD-4-1-2020	The page limit for a full proposal is 100 pages.
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Evaluation criteria, scoring and threshold: The criteria, scoring and threshold are described in General Annex H of the work programme. The following exceptions apply:

²⁰⁶ of which EUR 10.00 million from the 'Europe in a changing world – Inclusive, innovative and reflective societies' WP part.

²⁰⁷ of which EUR 10.00 million from the 'Europe in a changing world – Inclusive, innovative and reflective societies' WP part.

²⁰⁸ of which EUR 24.30 million from the 'Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy' WP part, EUR 49.70 million from the 'Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy' WP part.

²⁰⁹ of which EUR 12.00 million from the 'Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy' WP part.

LC-GD-9-1-2020	For the criterion ‘ Excellence ’, in addition to its standard sub-criteria, the following aspect will also be taken into account for subtopic (a) : the extent to which the Access Activities (Trans-national Access and/or Virtual activities) will offer access to state-of-the-art infrastructures, high quality services, and will enable users to conduct excellent research.
LC-GD-10-3-2020, LC-GD-9-1-2020	Grants will be awarded to proposals according to the ranking list. However, in order to ensure a balanced portfolio of supported actions, at least the highest-ranking proposal per subtopic will be funded, provided it attains all thresholds.
LC-GD-7-1-2020	Grants will be awarded to proposals according to the ranking list. However, in order to ensure a balanced portfolio of supported actions, at least the two highest-ranked proposals covering terrestrial and/or freshwater ecosystems, and covering coastal and/or marine ecosystems will be funded provided that they attain all thresholds.
LC-GD-6-1-2020	Grants will be awarded to proposals according to the ranking list. However, in order to ensure a balanced portfolio of supported activities, at least the highest-ranked proposal per scope (A), (B), (C), (D), (E), or (F) will be funded provided that it attains all thresholds.
LC-GD-5-1-2020	Grants will be awarded to proposals according to the overall ranking list. However, in order to ensure a balanced portfolio of supported actions, at least the two highest-ranked proposals in each area will be funded (i.e. two proposals for area A) Green Airports and another two for area B) Green Ports), provided they attain all thresholds.
LC-GD-2-1-2020	<p>Subtopic 2.1 .1: In order to ensure a balanced portfolio, at least the highest ranking proposal addressing CHP and DHC will be funded, provided it attains all thresholds</p> <p>Subtopic 2.1.2: In order to ensure a balanced portfolio, at least the highest ranking proposal addressing Offshore renewable energy power generating systems and the highest ranking proposal addressing Grid infrastructure will be funded, provided it attains all thresholds. This condition to ensure a balanced portfolio will also be considered to be met if one project addressing both aspects will be funded.</p>

LC-GD-1-2-2020	For the evaluation criterion ' Quality and efficiency of the implementation ': in addition to its standard sub-criteria, the following aspect shall constitute a major element: The Quality of the proposed financial support mechanism to third parties (re-granting), notably in view of assuring fair, European-wide access for potential applicants.
LC-GD-1-1-2020, LC-GD-2-1-2020, LC-GD-2-3-2020, LC-GD-3-1-2020, LC-GD-7-1-2020	For the criterion ' Quality and efficiency of the implementation ', in addition to its standard sub-criteria , the following aspect shall constitute a major element: Proven access to necessary land and / or permits for operation at the time of application and / or convincing risk management regarding delayed availability of land or permits. Risk management can include go / no-go decisions at mid-term.

Evaluation Procedure: The procedure for setting a priority order for proposals with the same score is given in General Annex H of the work programme.

The full evaluation procedure is described in the relevant [guide](#) published on the Funding & Tenders Portal.

Grant Conditions:

LC-GD-9-1-2020	For grants awarded under this topic capitalised and operating costs of ‘large research infrastructures’ as defined in the Article 6.2.D.4 of the Model Grant Agreement are not eligible.
LC-GD-9-1-2020	For grants awarded under this topic the depreciation costs of equipment, infrastructure or other assets for providing trans-national or virtual access to research infrastructure will be ineligible costs. The respective option of Art. 6.2.D.2 of the Model Grant Agreement will be applied.
LC-GD-9-1-2020	For grants awarded under this topic beneficiaries being ‘access providers’ must provide virtual access to research infrastructures or installations. The respective options of Article 16.2 and Article 16.3 of the Model Grant Agreement will be applied.
LC-GD-9-1-2020	For grants awarded under this topic beneficiaries being ‘access providers’ must provide trans-national access to research infrastructures or installations. The respective options of Article 16.1, Article 16.3, Article 25.5 and Article 31.6 of the Model Grant Agreement will be applied.
LC-GD-8-1-2020, LC-	All chemical monitoring data resulting from the projects must be

GD-8-2-2020	<p>shared via Information Platform for Chemical Monitoring IPCHEM (https://ipchem.jrc.ec.europa.eu/RDSIdiscovery/ipchem/index.html). For human biomonitoring activities procedures and the network of reference laboratories established by HBM4EU (https://www.hbm4eu.eu) should be used when relevant and possible.</p>
LC-GD-1-1-2020, LC-GD-1-2-2020, LC-GD-1-3-2020, LC-GD-10-1-2020, LC-GD-10-2-2020, LC-GD-10-3-2020, LC-GD-2-1-2020, LC-GD-2-2-2020, LC-GD-2-3-2020, LC-GD-3-1-2020, LC-GD-3-2-2020, LC-GD-4-1-2020, LC-GD-5-1-2020, LC-GD-6-1-2020, LC-GD-7-1-2020, LC-GD-8-1-2020, LC-GD-8-2-2020, LC-GD-9-1-2020, LC-GD-9-2-2020, LC-GD-9-3-2020	<p>Applicants are reminded that the purchase or lease of land with the purpose of later buying does not constitute eligible costs for the project. Cost for renting of land (for example for provision of a particular ecosystem service to the public benefit) can be eligible during the project's duration provided they fulfil the eligibility conditions of Article 6.1(a) MGA and the specific eligibility conditions of Article 10.</p>
LC-GD-1-1-2020, LC-GD-1-2-2020, LC-GD-1-3-2020, LC-GD-10-1-2020, LC-GD-10-2-2020, LC-GD-10-3-2020, LC-GD-2-1-2020, LC-GD-2-2-2020, LC-GD-2-3-2020, LC-GD-3-1-2020, LC-GD-3-2-2020, LC-GD-4-1-2020, LC-GD-5-1-2020, LC-GD-6-1-2020, LC-GD-7-1-2020, LC-GD-8-1-2020, LC-GD-8-2-2020, LC-GD-9-1-2020, LC-GD-9-2-2020, LC-GD-9-3-2020	<p>Grants awarded under these topics will be subject to the following additional dissemination obligations:</p> <p>The European Commission intends to establish network activities for the funded projects in the areas of the European Green Deal Call (see ‘other actions’). Supported projects are requested to contribute to the networking and experience sharing activities.</p> <p>Applicants must acknowledge and integrate these obligations in their proposal. The respective option of Article 29.1 of the Model Grant Agreement will be applied.</p>

2020, LC-GD-9-1-	
2020, LC-GD-9-2-	
2020, LC-GD-9-3-	
2020	

Consortium agreement:

LC-GD-1-1-2020, LC-GD-1-2-2020, LC-GD-1-3-2020, LC-GD-10-1-2020, LC-GD-10-2-2020, LC-GD-10-3-2020, LC-GD-2-1-2020, LC-GD-2-2-2020, LC-GD-2-3-2020, LC-GD-3-1-2020, LC-GD-3-2-2020, LC-GD-4-1-2020, LC-GD-5-1-2020, LC-GD-6-1-2020, LC-GD-7-1-2020, LC-GD-8-1-2020, LC-GD-8-2-2020, LC-GD-9-1-2020, LC-GD-9-2-2020, LC-GD-9-3-2020	Members of consortium are required to conclude a consortium agreement, in principle prior to the signature of the grant agreement.
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Other conditions:

LC-GD-2-2-2020	The project has to include a clear go/no go decision point ahead of entering the deployment phase. Before this go/no go decision point, the project has to deliver detailed engineering plans, a complete business and implementation plan and all the required permits for the deployment of the project. A committee of independent experts will assess all deliverables and will give advice on the go/no decision.
LC-GD-2-2-2020	Cross border dimension and knowledge sharing within Europe: as part of mandatory activities, organise 3 workshops, out of which at least 2 in European countries, outside of the beneficiary's main implantation, involving policy makers and energy stakeholders, to share knowledge on experience gathered

	and replication of experiences.
LC-GD-1-2-2020	At least 60% of the foreseen EU contribution should be allocated to activities covered under Activity 4 for the financial support to third parties.
LC-GD-3-2-2020	<p>Proposals funded under this topic, and their circular systemic solutions, will form part of the demonstration projects for the implementation of the European Commission's Circular Cities and Regions Initiative (CCRI), which will be implemented in the coming months²¹⁰. This means that:</p> <ul style="list-style-type: none"> • Proposals must achieve deep cooperation between them by means of specific activities which must be included in one of their work-packages; • Proposals must cooperate with CCRI by means of sharing with this initiative knowledge and experiences developed during the implementation and demonstration of the circular systemic solutions. • Proposals are expected to participate to the CCRI's events. <p>Applicants must acknowledge and integrate these obligations in their proposal.</p>

²¹⁰

<https://ec.europa.eu/research/environment/index.cfm?pg=circular>

Other Actions²¹¹

1. Support for the coordination of and synergies between projects under the H2020 Green Deal Call

The Green Deal Call (GDC) is supporting a wide variety of important topics and respective projects. To increase impact, coordination among the different topics and projects is needed. This activity will for example support:

- Collaboration of GDC projects with clear common interests to fully develop synergies also across topics;
- Elaboration, analysis and evidence base for R&I policies produced in the GDC projects;
- Creation and management of topic specific project clusters and their link to the other clusters;
- Networking with similar actions from member states and/or associated countries;
- Effective widespread unified dissemination/communication of Green Deal call achievements (beyond project individual communication);

The creation of a large scale, long-term support for the projects under the Green Deal call will provide a stable governance and will guarantee that best use is made of results covering the period of 2021 to 2026. It will maximise positive impact of the GDC on the longer term at European scale.

Type of Action: Public Procurement - Direct Service Contract

Indicative timetable: 4th quarter 2020

Indicative budget: EUR 6.00 million from the 2020 budget²¹²

2. Delivery of knowledge for climate adaptation and mitigation through the GEOSS infrastructure (Global Earth Observation System of Systems)²¹³

The current GEOSS portal is the user interface of the GEOSS infrastructure enabling the users to access worldwide Earth observation data and information. ESA is the official and unique

²¹¹ The budget amounts for the 2020 budget are subject to the availability of the appropriations provided for in the draft budget for 2020 after the adoption of the budget 2020 by the budgetary authority or, if the budget is not adopted, as provided for in the system of provisional twelfths.

²¹² of which EUR 6.00 million from the 'Climate action, environment, resource efficiency and raw materials' WP part.

²¹³ This grant will be awarded without call for proposals in line with Article 195(e) of the Financial Regulation, Regulation (EU, Euratom) No 1046/2018 and Article 11(2) of the Rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)", Regulation (EU) No 1290/2013. This grant to ESA as an identified beneficiary is justified because GEO designated ESA as the single provider of the user interface to the GEOSS infrastructure.

GEOSS portal provider ensuring the short and medium term operational development of the system.

Through this grant, ESA, as the official GEOSS web portal provider, will further contribute to the development of the current GEOSS infrastructure so that it becomes fully operational and includes all the functionalities required by the users to access tailor-made information and actionable knowledge.

The GEOSS web portal medium term evolution should therefore enable services to non-specialists in the domain of adaptation to extreme climatic events and to changes in climatic conditions. The selection of the most critical services should be driven by the lessons-learned from the evaluation of the implementation of the EU Strategy on Adaptation to climate change (COM(2018)738)), the priorities identified under the European Green Deal and the requirements expressed by the Mission on Adaptation to Climate Change including Societal Transformation.

The project should further improve the ESA GEOSS web portal functionalities and enable the full exploitation of the GEOSS infrastructure as to further integrate all its components. The project should be implemented in close collaboration with the GEO partners involved in the development of the GEOSS infrastructure.

This grant will be a contribution to the working arrangement recently signed between ESA and the European Commission.

The standard evaluation criteria, thresholds, weighting for award criteria and the maximum rate of co-financing for this type of action are provided in parts D and H of the General Annexes.

Legal entities:

ESA/ESRIN, Via Galileo Galilei Casella Postale 64, 00044 Frascati (Roma), Italy

Type of Action: Grant to identified beneficiary - Coordination and support actions

Indicative timetable: 4th Quarter 2020

Indicative budget: EUR 2.50 million from the 2020 budget²¹⁴

3. Study in support of scaling-up the financing of innovative Nature-based Solutions²¹⁵

Nature-based solutions (NBS) are solutions that are inspired and supported by nature. They are effective, long-term, cost-efficient, globally scalable and represent a holistic, people-centred response to the ecological crisis.

²¹⁴ of which EUR 2.50 million from the 'Climate action, environment, resource efficiency and raw materials' WP part.

²¹⁵ This grant will be awarded without call for proposals in line with Article 195(e) of the Financial Regulation, Regulation (EU, Euratom) No 1046/2018 and Article 11(2) of the Rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)", Regulation (EU) No 1290/2013

NBS are a fundamental part of action for climate and biodiversity. Authoritative research²¹⁶ indicates they can provide over one-third of the cost-effective climate mitigation needed between now and 2030 to stabilize warming to below 2 °C. NBS underpin the Sustainable Development Goals: they support vital ecosystem services, biodiversity, and access to fresh water, improved livelihoods, healthy diets and food security from sustainable food systems. Adequate investment in Nature-Based Solutions can also help reduce consequences of climate change, contribute to the creation of new jobs, to building climate resilience and to reducing poverty, offering significant opportunities in the context of the post COVID-19 recovery phase and as outlined in the EU Biodiversity Strategy for 2030²¹⁷ that forms an integral part of the European Green Deal.

NBS are already being delivered, not least via a suite of Horizon 2020 projects²¹⁸, and could be exponentially scaled-up if they receive proper investment. There are many examples of best practices and many emerging initiatives are ready for extension and intensification, but their financing remains very limited despite growing interest from investors. This is due to, among others, high variety of NBS and their context-specific nature strongly affecting their performance and making it difficult to predict reliably the commercial prospects, relatively small size of projects, high levels of risk, inexperience of project holders to develop viable business plans and bankable projects, making it difficult to build an investable pipeline. In addition, many of the NBS benefits are public goods that produce limited revenue streams, which may accrue to different stakeholder groups.

The objective of the study is to analyse access-to-finance conditions for innovative NBS and biodiversity projects, identify barriers and bottlenecks, and to formulate recommendations on innovative financing solutions (if necessary sector-specific) to accelerate market-uptake. The study should analyse the characteristics of NBS projects and their associated financing needs, identify opportunities and best practices amongst (potential) project promoters, and provide advice on how to improve the bankability of projects and build a pipeline of investable projects, including via advisory services, awareness raising, capacity and coalition building among stakeholders. The study should also look at the potential for maximizing the co-benefits of climate finance for biodiversity.

The study should aim at maximising the use of existing EU-level financing instruments, and, formulate recommendations for improved and/or new EIB financial instruments for NBS and biodiversity projects, building on the experience from Natural Capital Funding Facility, InvestEU, InnovFin Energy Demonstration Projects, and European Innovation Council. It should also contribute to capacity building at InnovFin Advisory in regard of NBS financing, helping to disseminate information more effectively, and potentially laying the ground for a dedicated service.

²¹⁶ IPBES (2019): Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

²¹⁷ COM(2020) 380 final

²¹⁸ <https://oppla.eu/nbs/brazil>

The standard evaluation criteria, thresholds, weighting for award criteria and the maximum rate of co-financing for this type of action are provided in General Annexes D and H of the work programme.

[Amendment to the Framework Partnership Agreement between the EC and the EIB and first specific grant agreement launching Innovfin Advisory services for the specific action described above]

Type of Action: Contribution agreement with an implementing entity (indirect management)

Indicative timetable: 4th quarter 2020

Indicative budget: EUR 0.40 million from the 2020 budget²¹⁹

4. Piloting tools for assessing the potential impact of innovation in achieving net-zero emission objectives by 2050 and improving project readiness for green financing

The aim of the action is to pilot decision making tools for investment based on the potential impact of innovation in achieving net-zero emission objectives by 2050 and other market ratings criteria for green financing.

Keeping in mind the European Commission's 2050 climate-neutral strategy and the new benchmark regulation on low carbon and positive carbon impact benchmarks for investors²²⁰, it is important to evaluate the potential impact of technologies and solutions in avoiding greenhouse gas (GHG) emissions and their alignment with an IPCC 1.5°C trajectory (Net-Zero Compatible Innovations). Additionally, with the recently regulation requiring institutional investors and asset managers to disclose their integration of environmental, social and governance (ESG) factors into their risk management processes²²¹, and the use of ESG disclosure in the upcoming EU Taxonomy²²², companies need to be prepared to undergo ESG assessments in order to improve their attractiveness to green investors, whose number is increasing but also their requirements.

The innovative solutions developed by high TRL IAs under the Green Deal Call²²³ and a limited number of Horizon 2020 IA projects and EIC projects from the Horizon 2020 pilot close to completion will be assessed according to their avoided greenhouse gas emission mitigation potential and their alignment to the 1.5°C trajectory. This assessment will be done by a minimum of two robust and verified methodologies. These methodologies must be fully transparent, replicable and open access. Interaction with each IA project will be necessary for the collection of information and data.

²¹⁹ of which EUR 0.40 million from the 'Climate action, environment, resource efficiency and raw materials' WP part.

²²⁰ Regulation (EU) 2019/2089 as regards EU Climate Transition Benchmarks, EU Paris-aligned Benchmarks and sustainability-related disclosures for benchmarks.

²²¹ Regulation (EU) 2019/2088 on sustainability- related disclosures in the financial services sector.

²²² Taxonomy Technical Report (2019).

²²³ Call areas 1-5: Area 1: Increasing Climate Ambition; Area 2: Clean, affordable and secure energy; Area 3: Industry for a clean and circular economy; Area 4: Energy and resource efficient buildings; Area 5: Sustainable and smart mobility.

The project developers will also undergo a customized Green Deal ESG assessment taking opportunity of the 1st EU Taxonomy adopted end of 2020 on climate change mitigation and adaptation. For the Green Deal Call the assessment will be performed at the beginning of the project (in order to identify potential gaps, risks, and weaknesses from an investment perspective) and at the end of the project in order to measure the progress.

This additional information will benefit to the project developers who will be better prepared at the completion of their grants for the next round of substantial investment needed, in particular from the private, to move their innovative technologies and solutions to the market.

This action is expected to lead to

- Pilot tools for evidenced based policy making and for assessing the potential impact of innovation in achieving net-zero emission objectives by 2050
- Assessing tools to improve projects readiness and access to green financing to increase the pipeline of investment projects aligned with the European Green Deal
- Increase project participants knowledge about their short and long term impacts as well as influencing factors such as market replication, rebound effects, supply and distribution chain in order to adjust their business strategy accordingly

Type of Action: Public Procurement - Direct Service Contract

Indicative timetable: 4th quarter 2020

Indicative budget: EUR 0.90 million from the 2020 budget²²⁴

5. Support monitoring of industrial R&D&I investment data in the context of the Green Deal/Sustainable Development Goals and in the context of economic and technologic competitiveness of green-tech industries

The current Industrial R&D Investment Scoreboard already provides a number of indicators and baseline analyses on corporate R&D intensity, type of invested technologies and economic strength.

The objective of this action is to add a number of specific indicators and analyses to the baseline ones that are part of the current administrative agreement between the JRC and DG R&I], focussing on climate and environment relevant industries and technologies and their sustainable competitiveness. Overall, the action will aim for a more systematic monitoring of industrial R&I agendas and investments relevant to achieve the Green Deal goals. The extra indicators will address a more in depth analysis of green tech providers and user companies' economic and technologic competitiveness, innovation networks and value chains, as well as their fitness to address SDGs targets and in general the adoption of sustainable solutions by industry sectors and eco-systems. Based on the above, the action will as well provide

²²⁴ of which EUR 0.90 million from the 'Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing' WP part.

dedicated statistical and qualitative analysis of Industrial R&D&I investment in view of addressing evolving policy needs with regard to deploying and measuring impact of R&D&I support actions. Apart from sustainable competitiveness issues, analysis will also address strategic autonomy and industrial leadership in value chains and eco-systems relevant for achieving the Green Deal goals.

Furthermore, for a complete picture, the above indicators will supply more information in particular to measure performance of step-change innovation and emerging KETS, start-ups and smaller companies, and give insight into the market for technologies feeding into the R&D process. As we rely on new and key enabling technologies to address global challenges, also technological sovereignty deserves attention in the analysis of strategic green tech areas and value chains.

Type of Action: Public Procurement - Framework Contract

Indicative timetable: 4th quarter 2020

Indicative budget: EUR 2.00 million from the 2020 budget²²⁵

6. Support for biodiversity related projects with a focus on the links between human health and biodiversity, including zoonotic and infectious diseases

As part of the EU response to the COVID-19 pandemic, for activities specifically linked to COVID-19, additional funding may be awarded in ongoing grant agreements to cover additional activities specifically linked to COVID-19, without a call for proposals, according to the Financial Regulation 2018/1046, Article 195(b). The additional activities required for this funding will show how some of the needs to address the challenges of the COVID-19 crisis can be addressed. Given the emergency situation, time is of essence, which justifies this use of the exception as per Article 195(b), as this is the fastest solution to carry out such activities.

Given that the objectives of the projects:

1. **BIODIV-AFREID** (*Biodiversity changes in African Forests and Emerging Infectious Diseases: Should we worry*) and **BioRodDis** (*Managing BIOdiversity in forests and urban green spaces: Dilution and amplification effects on RODent microbiomes and rodent-borne DISeases*) funded under the *BiodivERsA3 (Consolidating the European Research Area on biodiversity and ecosystem services) ERA-NET co-fund*
2. and **EKLIPSE** (*Establishing a European Knowledge and Learning Mechanism to Improve the Policy-Science-Society Interface on Biodiversity and Ecosystem Services*)

are fully in line with these objectives and crucially important for building of future societal resistance including to pandemics ; given the fact that these projects have already in place a fast and efficient mechanism to deliver scientific results and identify the most pressing

²²⁵ of which EUR 2.00 million from the 'Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing' WP part.

research needs to respond to the COVID-19 pandemic and given the fact that these projects have already gone through the H2020 evaluation process of the Commission, therefore confirming their expertise in addressing the challenges at stake, these projects are considered appropriate candidate to carry out such activities. Providing such additional funding to ongoing grants that can support pertinent short- and mid-term research or innovation efforts to confront the COVID-19 crisis will allow us to address the current situation with the appropriate urgency.

Specific derogations and additional conditions may be announced or communicated to the beneficiaries which would like to receive additional funding to the grant agreements.

Such conditions will include additional exploitation obligations, to ensure that the resulting products will be available and accessible as soon as possible including an obligation to license on a non-exclusive basis and at fair and reasonable conditions, additional dissemination obligations, such as open access for research data needed to address the public health emergency, and the right of the Commission to object to the transfer or licensing of the results. It may also include justified derogations from the standard limits to financial support to third parties. Where applicable, the relevant grant agreement options will be applied.

In particular, additional funding can be awarded to the following *on-going projects*:

1. **ID: 642420, BiodivERsA3 ERA-NET.** Top up amount of EUR 880,000 for the following projects originating from BiodivERsA3's calls:
 - a. **BIODIV-AFREID** (*Biodiversity changes in African Forests and Emerging Infectious Diseases: Should we worry*), to intensify the investigations on how biodiversity conditions (dis)favour transmissions of infectious agents from small mammals into human populations in African forests and to identify ways for preventing the emergence of harmful viruses.
 - b. **BioRodDis** (*Managing BIOdiversity in forests and urban green spaces: Dilution and amplification effects on RODent microbiomes and rodent-borne DISeases*) to improve the understanding of the relation between biodiversity and zoonotic infectious diseases with specific efforts to target coronaviruses.
2. **ID: 690474, EKLIPSE** (*Establishing a European Knowledge and Learning Mechanism to Improve the Policy-Science-Society Interface on Biodiversity and Ecosystem Services*) to carry out knowledge syntheses and knowledge needs assessment related to the links between human health (including the risks to health posed by COVID-19 and similar diseases) and biodiversity. Top up amount: EUR 120,000.

The standard eligibility and admissibility criteria, evaluation criteria, thresholds, weighting for award criteria, maximum rate of co-financing and conditions for providing financial support to third parties, are provided in the General Annexes and, with reference to the specific project mentioned, in the conditions defined in the respective calls for proposals from which the projects have been selected.

Type of Action: RIA and ERA-NET - Grants awarded without a Call for Proposals (Article 195 (b) of the Financial Regulation)

Indicative timetable: 4th quarter 2020

Indicative budget: EUR 1.00 million from the 2020 budget²²⁶

7. Support circular economy solutions at local and regional scale

The circular economy concept should be a central component in local and regional economies, which have a suitable scale for closing resources loops, creating sustainable circular ecosystems and designing participatory community-based innovation schemes. An increasing number of cities, regions, industries and businesses are engaged in testing and improving circularity in their territories, economic sectors, value chains and services. Nevertheless, the concrete implementation of systemic solutions for the territorial deployment of the circular economy still needs to be demonstrated and replicated in other areas. In particular, a major challenge is to apply effectively the circular economy concept in urban and regional policy areas beyond traditional resource recovery in waste and water sectors.

The Circular Cities and Regions Initiative (CCRI) is part of the European Circular Economy Action Plan and aims to support circular solutions for the transition towards a sustainable, regenerative, inclusive and just circular economy at local and regional scale. The CCRI's activities will contribute to the implementation of the European Green Deal, the Circular Economy Action Plan and the Bioeconomy Strategy.

The objective of this other action is to set-up the coordination and support service for the implementation of the CCRI. It will also ensure the cooperation among its projects covered under the Green Deal Call and Horizon Europe. This other action will complement the Horizon 2020 SC2 WP 2020 Other Action 2, being both used to implement the activities of the coordination and support service for the implementation of the CCRI via the signature of specific contracts under the framework contract established under Horizon 2020 SC2 WP 2020 Other Action 2.

Type of Action: Public Procurement - One framework contract and several specific contracts signed under that framework contract

Indicative timetable: 4th quarter 2020

Indicative budget: EUR 2.40 million from the 2020 budget²²⁷

²²⁶ of which EUR 1.00 million from the 'Climate action, environment, resource efficiency and raw materials' WP part.

²²⁷ of which EUR 2.40 million from the 'Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy' WP part.

8. High Level Expert Group to assess the needs, potential, feasibility and approach for International Platform for Food Systems Science (IPFSS)

The FOOD 2030 initiative is an EU R&I policy framework to better structure, connect and scale-up Research and Innovation for Food and Nutrition Security, in Europe, and with global outreach. It is an important contributor to EU policies, in particular the European Farm-to-Fork Strategy and the European Green Deal, which rely on research, innovation, technology and investments as a key enabler to reach policy objectives and targets by 2030 and beyond and improve the sustainability and resilience of food systems in the EU. It will also contribute to the international debate on the future of our food systems and nutrition, in particular during the UN World Food Systems Summit, which is scheduled to take place in 2021.

The Expert Group will advise the European Commission on the idea of an International Platform for Food Systems Science (IPFSS). The IPFSS would act as a network of high-level scientific experts from a wide diversity of relevant disciplines that gathers and analyses the state of the art in food systems science, and provides the necessary evidence based decision-making tools. The network would further mobilize larger communities of related scientists from all strands of food, nutrition and agriculture research in a farm to fork platform, including related fields of health, biodiversity and social sciences. This platform would provide structured and transparent peer review processes contributing to the clarification of key food systems issues.

The Expert Group's task will be to assess the needs for and the potential impact of an IPFSS on food systems and their governance. Furthermore, it will examine its feasibility and advise on the approach to follow for its realisation and governance.

The activities carried out by the group will be essential in the context of the FOOD 2030 R&I mandate supporting the Farm to Fork Strategy and wider Green Deal policy priorities.

The Commission will use the final output of this group as one of the sources of inspiration for informing the debate on how to enhance the governance of food systems in the EU and internationally, including at the UN World Food Systems Summit scheduled for end 2021, and for setting up priorities for the next Framework Programme.

The experts will be highly qualified, specialised and independent, selected on the basis of objective criteria, following a call for applications published in accordance with Article 10 of Decision C(2016)3301. A special allowance of EUR 450/day for each full working day spent assisting the Commission in terms of Article 21 of Decision C(2016)3301 will be paid to the experts appointed in their personal capacity who act independently and in the public interest. This amount is considered to be proportionate to the specific tasks to be assigned to the experts, including the number of meetings to be attended and possible preparatory work.

Type of Action: Expert Contracts

Indicative timetable: 1st quarter to 4th quarter of 2021

Indicative budget: EUR 0.30 million from the 2020 budget²²⁸

9. Support to the engagement of European Citizens in the transition to the European Green Deal (EGD)

This action will facilitate the elaboration of a roadmap for the required transitions across all EU countries with the active participation of citizens. The action would organize specific events bringing together authorities, research and education communities and civil society organisations from several EU countries (designed in such a way to reach a full coverage of the EU) in order to analyse the EGD objectives and the necessary transitions over the next years from different perspectives; analyse the impact of relevant EU initiatives and policies; identify the critical elements required to ensure a Just Transition in different geographical and social contexts; contribute to the creation of a solid engagement of the citizens across the EU.

The action should take into consideration other relevant EU initiatives such as the Climate Pact and the Just Transition Platform.

Type of Action: Public Procurement - Direct Service Contract

Indicative timetable: 4th quarter of 2020

Indicative budget: EUR 1.50 million from the 2020 budget²²⁹

²²⁸ of which EUR 0.30 million from the 'Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy' WP part.

²²⁹ of which EUR 1.50 million from the 'Climate action, environment, resource efficiency and raw materials' WP part.

Budget²³⁰

	Budget line(s)	2019 Budget (EUR million)	2020 Budget (EUR million)
Calls			
H2020-LC-BAT-2019-2020		114.00	132.00
	<i>from 08.020303</i>	44.00	30.00
	<i>from 08.020304</i>	70.00	60.00
	<i>from 09.040101</i>		42.00
H2020-LOW-CARBON-CIRCULAR-INDUSTRIES-2020			230.50
	<i>from 02.040301</i>		68.00
	<i>from 08.020201</i>		118.50
	<i>from 08.020303</i>		15.00
	<i>from 08.020305</i>		15.00
	<i>from 32.040301</i>		14.00
H2020-LC-GD-2020			983.00
	<i>from 05.090301</i>		24.30
	<i>from 06.030301</i>		66.00
	<i>from</i>		28.00

²³⁰

The budget figures given in this table are rounded to two decimal places.

The implementation is subject to the availability of the appropriations provided for in the general budget of the Union for years 2019 and 2020.

Horizon 2020 - Work Programme 2018-2020
Cross-cutting activities

	08.020103		
	<i>from</i> 08.020201		80.00
	<i>from</i> 08.020302		61.70
	<i>from</i> 08.020303		121.00
	<i>from</i> 08.020304		34.00
	<i>from</i> 08.020305		423.00
	<i>from</i> 08.020306		20.00
	<i>from</i> 32.040301		125.00
Other actions			
Public Procurement			See footnote ²³¹
	<i>from</i> 08.020305		7.50
	<i>from</i> 08.020201		2.90
	<i>from</i> 08.020302		2.40
Grant to Identified beneficiary			See footnote ²³²
	<i>from</i> 08.020305		2.50
Contribution agreement with an			See footnote ²³³

²³¹ To which EUR 7.50 million from the 'Climate action, environment, resource efficiency and raw materials' WP part and EUR 2.90 million from the 'Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing' WP part and EUR 2.40 million from the 'Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy' WP part will be added making a total of EUR 12.80 million for these actions.

²³² To which EUR 2.50 million from the 'Climate action, environment, resource efficiency and raw materials' WP part will be added making a total of EUR 2.50 million for these actions.

Horizon 2020 - Work Programme 2018-2020
Cross-cutting activities

implementing entity (indirect management)	<i>from</i> 08.020305		0.40
RIA and ERA-NET - Grants awarded without a Call for Proposals (Article 195 (b) of the Financial Regulation)			See footnote ²³⁴
	<i>from</i> 08.020305		1.00
Expert Contracts			See footnote ²³⁵
Estimated total budget		114.00	1362.50

²³³ To which EUR 0.40 million from the 'Climate action, environment, resource efficiency and raw materials' WP part will be added making a total of EUR 0.40 million for these actions.

²³⁴ To which EUR 1.00 million from the 'Climate action, environment, resource efficiency and raw materials' WP part will be added making a total of EUR 1.00 million for these actions.

²³⁵ To which EUR 0.30 million from the 'Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy' WP part will be added making a total of EUR 0.30 million for these actions.