Horizon 2020 – European Green Deal call

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# **Area 1: Increasing Climate Ambition: Cross sectoral challenges**

## **1.1. 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. More and more EU citizens suffer directly and indirectly from wildfires. Between 2017 and 2020, fires have killed hundreds 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 and water degradation and biodiversity loss.

Moreover, wildfires are among the first contributors to climate change, with up to 20% of total global greenhouse gas emissions per year[[1]](#footnote-1). Furthermore, the large surfaces burnt cannot absorb so much CO2 any longer, reducing the climate 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 more black carbon fall-out on ice/snow and by melting of underlying permafrost.

In addition, large wildfires can increase air pollution over thousands of square kilometres, with a sharp increase in airborne fine particles and gaseous air pollutants.

Climate change, forestry change, 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 fires, new fire-prone regions and more severe fire behaviour. The burnt area in southern Europe during the 21st century would sharply increase - by 50% for a 2 °C global temperature increase scenario, by 100% for a reference climate scenario[[2]](#footnote-2). Extreme wildfire events as in Southern Europe in 2017-2018 and in California, Brazil and Australia in 2019 are likely to become common in Europe.

Scope

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

* Research, demonstration and deployment of innovative means and methods tailored to extreme wildfire behaviour, such as better techniques, models, solutions and capabilities for preventing, predicting, monitoring and fighting wildfires, including better technologies and equipment for first responders.
* Proactive governance, large-scale and community-based risk assessments, awareness and preparedness - where citizens, local communities and the forestry sector play a central role.

The approach should be systemic: encompassing different climate scenarios, biogeographical/socio-economic contexts and means for faster and smarter management of all phases: prevention & preparedness (including forecasting), detection & response (including fire containment, extinction, potential evacuation and recovery) and post-fire restoration[[3]](#footnote-3) & adaptation.

Innovative means and methods need to be developed, integrated and demonstrated on the field and tailored to geographical and socio-economic scenarios, 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) and scales (e.g. local/regional/national/cross-border/EU/international), etc.

**The** **Research & Innovation 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) and closely engaging and coordinating all concerned actors and communities for each phase.

1. **Prevention & Preparedness**

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

* Develop an EU centralised database with socioeconomic and environmental information on wildfire causes and impacts with a focus on extreme wildfire events and the causes of wildfire ignitions (e.g. accidental and criminal causes) and the demographic trends (e.g. rural abandonment, recreational activities).
* Improve fire and landscape management of both public and private lands (including agricultural lands with innovative and sustainable approaches for fuel management, including community-based incentive programs for biomass reduction and new bio-economy value chains that maximise forest services and products whilst improving biodiversity.
* Enhance access to reliable fire danger 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 and advanced cyber technologies.
* Support the integration of wildfire resilience into governance and insurance models.
* Improve the understanding of the link between the smoke exposure from fires and illness or death in local communities.
* Broad Earth System studies for biophysical feedback of global forest fires on climate - leading to new operational forecast climate-vegetation-fires models, using also historical wildfires records and paleoclimate evidence.

Build a common culture on risk prevention and preparedness across EU citizens, including local authorities and schools, through education and training, community involvement and awareness campaigns to encourage self-protection, safety and environmental protection, with special attention to mountainous communities and Wildland Urban Interface areas bordering forestlands.

1. **Detection & 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.

Enhancement of the response capacity for safer and more effective operations can be demonstrated through improved data collection, elaboration and transmission, risk assessment and monitoring, wildfire detection, innovative early warning systems and digital infrastructure, aerial suppression/extinction of wildfires and evacuation planning, in a range of weather conditions and geographical scenarios. Activities can 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, drones, high-volume water bombers, remote sensing systems, wireless sensors and early warning system …) for detection, targeting and/or extinction of fires.
* Enabling night operations, in particular for fire-fighting aircraft.
* More effective modular firefighting units fit for expedition in large cargo transport aircraft.
* More capable fire-fighting helicopters and planes, including tankers/water-bombers.
* Better scooping, tanking, discharging/nebulization systems for water, fire-retardants, etc.
* Develop better firefighter and ground/air vehicles’ location and route management in real time, via space data, to guide and protect fire brigades and to respond efficiently to fires.
* Near real-time high-fidelity fire propagation forecasting (e.g. based on precise cartography, advance sensing of temperatures, winds, combustion modelling, machine-learning and supercomputing).
* Better training, including better flight simulators tailored to new extreme threats.
* Better and more interoperable incident management and communication, coordination and command systems, able to incorporate information from multiple and non-traditional sources (for example social media data) and ensure interoperable communication in non-urban environments and across EU countries e.g. air-to-air, ground-to-ground and air-to-ground, exploiting satellite communication links for near real-time transmissions.
* Better integration of early warning systems, search & rescue and evacuation of persons and animals (protection areas, mobility, etc).
* Higher automation of operations and simultaneous safe operation of different aerial (and non-aerial) platforms in all conditions.
* Advanced personal protective equipment (i.e. smart garments, gear and breathing apparatus) for incident type (e.g. weather, comfort, protection).
* Devices to monitor the physiological signs of emergency responders.
1. **Restoration and Adaptation**
* Evaluate and upscale ecosystem-based restoration solutions and adaptation protocols for resilient wildland-urban interfaces and the opportunities of nature-based solutions.
* Sustainable post-fire restoration solutions of damaged ecosystems, supported by monitoring services and complementary geospatial analysis.
* Support the socio-ecological transition towards more resilient and sustainable communities.
* Define a common EU legal framework for the governance systems and operational activities regarding forest and communities protection from climate-related risks.
* Develop and test public-private cooperation mechanisms to leverage investments from the private sector, including insurance companies to stimulate the development of preventive measures and reduce loss and damages.

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, Brazil, South America, Indonesia, Japan and South Africa to leverage knowledge, resources and best practices, as well as to decrease risks and increase impact worldwide.

Expected Impact

Contribute substantially to the following targets by 2030 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% Natura 2000 protected areas to be fire-resilient.
* 50% reduction in building losses.
* 90% losses from wildfires insured.
* 25% increase in surface area of prescribed fire treatments at EU level.

Activities should go beyond the state of the art and previous R&I activities at EU level[[4]](#footnote-4), cooperate with ongoing relevant Horizon 2020 projects[[5]](#footnote-5) and involve end-users from EU Member States / Associate States. Activities should make best use of existing EU initiatives and services (such as Copernicus’). The most promising results demonstrated may be up-scaled and deployed into:

* National climate change adaptation and disaster risk reduction strategies in line with EU policy guidelines and legislation, including forest and biodiversity-related strategies.
* The 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 Bio-economy.
* Horizon Europe’s Mission on Adaptation to Climate Change including Societal Transformation - with strong focus on citizen engagement.
* Union Civil Protection Mechanism (UCPM) and Emergency Response Coordination Centre (ERCC) [[6]](#footnote-6) .
* 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 [monitoring the intensity of fires](https://atmosphere.copernicus.eu/australian-wildfires-deemed-unprecedented) and forecasting pollutants propagation; Copernicus Security Service e.g. for support to EU external action; the Group on Earth Observations[[7]](#footnote-7),[[8]](#footnote-8) and Galileo Emergency Warning Service.
* EU co-funded regional and interregional initiatives “promoting climate change adaptation, risk prevention and disaster resilience” e.g. to support regional civil protection infrastructures and units to prevent and fight wildfires.
* At international policy level, Sendai Framework for Action 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)[[9]](#footnote-9) among others.

## **1.2. Towards Climate-Neutral and Socially Innovative Cities**

Specific Challenge

The strategic long-term vision[[10]](#footnote-10) 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 Deal, a new growth strategy that aims to preserve the planet for future generations, can be the compass to emerge from the present COVID-19 crisis and an opportunity to bounce forward accelerating our progresses in meeting the climate change objectives.

The European Green Deal[[11]](#footnote-11) sets an ambitious target reduction of 50%-55% 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 raise to 80% by 2050. Cities[[12]](#footnote-12) must play therefore 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 the EU, 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 biggest polluters of the urban and metropolitan area.. It also implies designing incentives promoting investments (e.g. green infrastructure) into cities committed to climate neutrality and the Green Deal objectives. This will help test innovative solutions, technologies and incentives, while listening to the needs of citizens and engaging cities to act, to reach the scale that will make them economically attractive for industry as well as affordable, liveable and inclusive for the local authorities and citizens. It will also necessarily have to frame all the above mentioned elements taking into account the consequences and long-lasting impacts on cities of the current health and economic crisis, affecting for example mobility, transportation, urban planning, digitization, 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 action should develop a one-stop shop platform that would provide 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 action should set up a partnership involving research organisations, academia, industry including social entrepreneurs, the financial sector including impact financiers, investors, philanthropists, NGOs, national and local authorities and citizens. The platform will also be responsible for the management of competitive calls addressed to third parties to fulfil the objectives of this action. This platform should facilitate the coordination of the EU ongoing activities in the area of climate neutrality and 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 platforms[[13]](#footnote-13), experience already matured by the Covenant of Mayors[[14]](#footnote-14) 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 Declaration[[15]](#footnote-15).

It should address all of the following four activities:

Activity 1: Climate action plans and Green Deal innovation:

* Develop a science-based set of indicators[[16]](#footnote-16) enabling the assessment of the climate, environmental and socio-economic impact of cities’ climate neutral action plan in terms of greenhouse gas emissions reduction within the framework of the European Green Deal
* Develop innovative urban greening assessment methodologies for planning[[17]](#footnote-17) and monitoring GHG emissions reduction to meet the Green Deal ambitious targets.
* Provide harmonised specifications for inter-operable and comparable cities evidence repositories 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;
* Design, in close collaboration with the cities, and the European Commission a concept for a climate neutral city contract coherently with the corresponding climate action plans, including 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 local governance—and where appropriate capacity building—necessary for implementing systematic and integrated climate neutral policies, building also on existing experiences developed by local networks[[18]](#footnote-18);
* Coordinate the “climate neutral cities signatories group”: 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 the setting up and mainstreaming of co-creation processes engaging all relevant actors regarding the framing, deployment and assessment of their vision, strategy, and action plan to reach climate neutrality while ensuring their shared ownership;

Activity 2: Financial engineering:

* Identify strategies and financing solutions for cities to reach climate neutrality, taking account and building 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 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 EU R&I; this will entail a matching of cities’ and local communities needs to R&I results through various means, e.g., match-making and brokerage hubs, and knowledge to identify possible solutions, as well as the support to test them at local level;
* Combine existing results of EU R&I with social innovation, and take advantage of the digital transformation and 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. This will 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, though all these channels, helping cities move closer to climate neutrality.

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

* Once the platform is established, it will launch open call(s) 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 for climate transition, taking stock of existing best practises and solutions already available . These calls will be evaluated through external independent peer review process.
* In order to facilitate the upscaling of these solutions and their replicability, support for each lead city and/or district, the twinning with and mentoring of at least 2 other cities and/or districts from different 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.

These actions aim at a rapid, full-scale deployment at city or district level of systemic and integrated climate actions in order to reach climate neutrality by 2030. They should be integrated in 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, in the specific city context and the set timeline.

Participating cities and/or local communities 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 selection of the third parties to be supported under the grant will be based on an external independent peer review of their proposed work.

The calls to be launched within the grant for the selection of third parties should respect 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 must possess, among others, good knowledge and expertise in EU 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, EU 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.).

The Commission considers that proposals requesting a typical contribution from the EU between EUR XX and XX million would allow this specific area to be addressed appropriately, of which at least X million should be allocated to activities covered under Activity 4. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. Only one proposal will be selected under this area.

Expected Impact:

* Comprehensive methodology, including selecting criteria, and model for cities that want to achieve climate neutrality by 2030 covering cross-sectoral governance, citizens participations, social innovation and social entrepreneurship impact, financing and policy approaches, and an urban digital platform;
* Establish a EU level structure offering support to and promotion of systemic transformation of cities towards climate neutrality;
* Empower cities and local communities through social innovation to cross social tipping points and enable the implementation of the Green Deal;
* Mobilise the demand (citizens’ needs) and showcase testing of innovative solutions drawing from European R&I through a socially inclusive mechanism to lead the transition to climate neutrality.
* Put in place measures allowing climate neutrality by 2030 for the participating leading cities and districts;
* Put in place measures towards climate neutrality by 2030 in European cities that will demonstrate visible substantial reduction of greenhouse gas emissions and air pollution as part of an agreed pathway to Climate Neutrality by 2050 or sooner;
* Improved modal share of sustainable and active transport modes. Reducing the negative externalities of urban and peri-urban transportation: congestion, pollution and road collisions. Enhanced multimodality and facilitating the use of sustainable and clean modes of transport.
* Ensure through twinning activities and other means to maximise impact and without leaving no one behind and that an appropriate geographical balance is achieved by demonstrating commitment of cooperation with at least 1 city per country.

Type of Action: Research and Innovation action (RIA)

## **1.3. Climate-resilient Innovation Packages for EU regions**

Specific Challenge

Every half-degree of global warming may inflict a new order of magnitude of harmful consequences on planetary health, 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 worldwide[[19]](#footnote-19). 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 systems[[20]](#footnote-20). We 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. Though the challenge is to scale up and demonstrate at large scale systemic solutions to trigger behavioral change and new ways of decision-making. Multidisciplinary approaches that integrate technological, digital, business, governance, environmental dimensions with social innovation are needed for the development of Green Deal consistent adaptation pathways tailored to support the regions and communities most exposed to climate change impacts.

Scope

The Horizon Europe Mission on Adaptation to Climate Change, including Societal Transformation will test, evaluate and scale-up a range of adaptation solutions with the aim to trigger societal transformations among key community systems 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.

Proposals should address only one of the following action areas:

**Area 1: Innovation Packages for transformational adaptation of European regions** **and communities**

This action should aim at **enabling rapid and far-reaching change** through the development of region-specific portfolios of solutions (mature enough for demonstration), which may include nature-based solutions, insurance and governance, and behavioural change. The innovation packages should cover several systems (e.g., health, agriculture, water, environment including biodiversity and infrastructure including energy) and comprise the adaptation solutions and pathways deemed essential for climate 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:

* prioritise the key systems that most urgently need to be protected from climate impacts and risks,
* target regions with the highest exposure (e.g. coastal and low-lying areas) and/or least adaptive capacity to climate change impacts,
* lead to transformational adaptation while minimising the trade-offs between 1.5°C-consistent mitigation pathways and sustainable development goals. Hence ensuring a fair transition and environmental justice,
* rely on wide citizen and stakeholder engagement,take stock of existing best practises and solutions already available from other programmes, such as EIT KICs, LIFE+ Programme, the EIB, the EBRD and at national, regional, local and private level.

**Area 2: Support the design, testing and upscale of Innovation Packages**

The action should provide the operational support for the activities under area 1.

In particular this action area will include:

* Citizens and regions engagement
	+ ensure the wide deployment and integration of Innovation Packages through educational and training activities across relevant sectors,

ensure that targeted regions and communities are involved and benefit from the Innovation Packages through early multi-stakeholder dialogue and citizens engagement and surveys,

* + engage with pan-European regional and cities networks from the beginning, e.g. European Committee of the Regions and Covenant of Mayors for Climate and Energy,
	+ 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.
* Monitoring and assessment:
	+ develop a set of indicators, in collaboration with the activities carried out under area 1, enabling the monitoring and assessment of the performance and efficiency of multi-level Innovation Packages towards addressing the resilience of the region and coherence with Green Deal pathways,
	+ address issues of replicability across scale and sustainability over time for the cross-sectoral solutions and pathways,
* Portfolio of Solutions
	+ support the preparation of the portfolio of solutions,
	+ support the regions in identifying, mapping and leveraging EU and national funding and financing programmes to support the deployment of the Innovation Packages
	+ foster an enabling environment so the activties under area 1 can thrive (e.g. digital services; engagement, education and capacity building; business models, insurance and resource leveraging; innovative coordination approaches, etc).

Expected Impact

* Accelerate the economic restart from the Covid 19 crisis and foster transformative change across all regions and sectors of society to increase climate resilience.
* Massive increase of community resilience and capacities to cope with unavoidable effects of climate change. Performance indicators shall include for instance reduction of the climate protection gap, increase in Green investments, etc.,
* Fully functioning online and free-access platform with user-friendly information on Innovation Packages covering all relevant aspects (financial, social, technological and regulatory) and all relevant areas (health, agriculture, water, environment including biodiversity, and infrastructure including energy, etc.); synergies and/or integration with Climate-ADAPT, Copernicus services and other existing Pan-European platforms will be prioritised,
* 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.

Type of Action: Area 1 Innovation Action, Area 2 Coordinaiton and Support Action

# **Area 2: Clean, affordable and secure energy**

## **2.1. Demonstration of innovative critical technologies to enable future large-scale deployment of offshore renewable energy technologies and their integration into the energy system**

Specific challenge

The European Green Deal expects to transform the EU 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, clean renewable power production must become the main source of energy, while keeping the stability and resilience of the EU Power System.

The Commission’s long-term strategy, *A Clean planet for all*, identifies in offshore renewable technologies 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. 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, 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.

Scope

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

* Offshore renewable energy power generating systems: innovative large scale integrated systems, floaters and substructures, mooring and anchoring systems specifically conceived for floating offshore considering the varied subsea conditions.
* Grid infrastructure: innovative Direct Current (DC), AC/DC hybrid technologies and systems as a supporting step towards large offshore HVDC grids (e.g.multi-vendor Multi-Terminal HVDC (MT HVDC) systems, grid forming converter, HVDC diode rectifiers, Modula Multilevel Converters (MMC), DC Circuit Breaker (DCCB); DC/DC converter and DC/power hub) and their control and management syste;  for floating renewable energy technologies: innovative dynamic inter-device/inter-array cables and connections to converter stations at sea or offshore hubs.
* Power to X /storage systems: innovative offshore storage and/or power to X systems to maximise the use of offshore resources.

Proposals shall address at least the offshore renewable power generating systems and the related energy system integration requirements, and may address grid infrastructure and/or power to X/storage systems. Multi-functional platforms can be considered.

Proposals shall address also the following:

* Industrial design and manufacturing processes, installation methods, transport, operation & maintenance, supply chains and the related digital infrastructures.
* Circularity, 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.

Projects are requested to demonstrate the technologies at sea while respecting existing environmental regulatory framework. The project should demonstrate that permits for the demonstration actions are already obtained or will be retrieved soon. The project should also present an environmental monitoring plan that to be implemented during the demonstration action. The project should also demonstrate how it will get a financial close for the whole action.

The project shall 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 array. A committee of independent experts will assess all deliverables and will give advice for the go/no-go decision.

The project shall bring the demonstrated technologies to TRL 7.

Impact

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. The project should demonstrate how it contributes to the Sustainable Development Goals of the United Nations.

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

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

Specific challenge

The European long term decarbonisation strategy “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. Hydrogen, if produced from renewable electricity through electrolysis, can also be a basis for Power to X (power to multiple end use applications), and Power to Liquids (synthetic and drop in fuels based on hydrogen).

Energy System Integration, as currently developed by the European Commission aims at reinforcing synergies between economy sectors to make them work more efficiently, reduce overall CO2 footprint and dependence on fossil fuels, and integrate renewables into the energy system, so as to contribute to achieve climate neutrality by 2050.

To contribute to 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 modules of 4-5 MW (or larger) 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. 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 a real life conditions, operating flexibly to harvest maximum renewable power and provide grid-balancing services and supplying renewable hydrogen to a commercial/industrial application. The hydrogen purity should meet the hydrogen market requirements. The output pressure shall 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 issued addressed.

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

* **The main activity will consist of** development, installation and operation a 100 MW electrolyser for managing and using efficiently power (electricity and heat), 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 biorefinery or other industries injecting in NG transmission grid type of application.
* 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 and environmental assessments:**

* Demonstration of future economic viability of the technology depending on cost of electricity and hours of operation of electrolyser;
* Reduce footprint and address 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;
* Project should ensure 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 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

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 electrolysers using a European value chain, consisting of 4-5MW 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 1A/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 €480/kW and €700/kW for Alkaline and PEM electrolysers respectively, meeting the Fuel Cells and Hydrogen Joint Undertaking targets for 2024;
* Improve the maturity of technologies being tested through demonstrations in real life environment, taking into account constraints from real operations;
* Improving durability of the membranes and components.
* Improve the overall efficiency valorising also by-product heat (e.g. for space heating).

**Operational and environmental impacts:**

* Demonstrating feasible operation of 100MW-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 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.

**Knowledge sharing within the EU and competitiveness impacts:**

- through mandatory knowledge sharing activities, transfer of know-how, and spill over of knowledge at EU level, through workshops beyond industry players, involving European decision makers and energy stakeholders

**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 €40/MWh (renewable sources), achieve a cost of green H2 below €2.5/kg and aim for further reductions by generating income from the provision of electricity grid balancing services.

**Additional end study impacts addressed directly to the European Commission:**

* Assessment of the legislative and 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.

**Co- Funding**

EC support would amount to EUR XX million while a total budget of EUR XX million would be envisaged for the development of the electrolyser and its BoP (about 50% of total budget), for civil works, connection to the grid or RES site(s), hydrogen buffer storage, possible compression station and H2 storage/injection/refuelling facilities.

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.

Given the very risky character of this demonstration and its first of the kind pathway for large demonstration, it is expected that financial institutions will not take this risk on their own, but will expect either EU support, or national support for de-risking.

Financing plan (own resources and resources planned to be drawn from the international financial organisations need to be appended to the application).

**Type of action**: Innovation Action

# **Area 3: Industry for a clean and circular economy**

## **3.1. 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[[21]](#footnote-21) by using 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 to reduce by over 50% the current 370Mt of CO2 emissions per annum[[22]](#footnote-22) related to the chemical industry. 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.

Scope:

1. Develop and deploy highly innovative catalytic material systems to facilitate the production of synthetic fuels and chemicals from industrial CO2 (including CO and H2) flue gas emissions, aiming at 50% increase in the overall efficiency compared to the State-of-the-Art.
2. Develop innovative, renewable energy driven, catalytic processes, to produce synthetic fuels and chemicals, at a sufficiently large scale to demonstrate its cost effectiveness.
3. Demonstrate the full value chain for industrial production of synthetic fuels and chemicals, whilst reducing greenhouse gas emissions.
4. Address financial, regulatory, environmental, land and raw material constraints, as well as public acceptance issues 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 XX million and with a duration of up to 5 years would allow this specific challenge to be addressed appropriately.

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 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.
* 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 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 actions (IA) (min. 2 projects funded)

Cross-cutting Priorities: International cooperation

## **3.2. Demonstration of systemic solutions for the territorial deployment of the circular economy**

Specific Challenge:

Boosting circularity can be part of the policy response to address systemic crisis such as climate change and the recovery from the COVID-19 pandemic by providing circular systemic solutions for sustainable growth and economic recovery. In the context of an increasing global consumption and growing pressure on resources, there is an urgent need to decouple economic growth from resource use and to increase Europe’s resilience to uncertainty in raw material supply and increase security of value chains. A sustainable, regenerative, inclusive and just circular economy can significantly help our economies to reconcile with the limits and 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 an inclusive and just transition ensuring environmental sustainability, jobs and social inclusion. A just transition framework for the circular economy can identify opportunities that reduce resource consumption and waste generation, stimulate product innovation, and contribute positively to sustainable human development. It is essential to ensure that the transition to a resource-efficient and circular economic model also delivers on social objectives.[[23]](#footnote-23) 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 community-based participatory 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. The EU added value can be obtained where territorial circular systemic solutions will be demonstrated in a certain territory and replicated in other areas within and beyond Europe. This process of demonstration and replication will multiply the territorial contribution to achieve the policy targets of the European Green Deal, the Circular Economy Action Plan and the Bioeconomy Strategy.

The implementation of circular systemic solutions will be carried out in close cooperation with the European Commission’s ‘Circular Cities and Regions Initiative’,[[24]](#footnote-24) part of the new EU circular economy action plan and aimed at supporting the concrete implementation of sustainable, regenerative, inclusive and just circular economy solutions at local and regional level.

Scope:

Proposals must implement and demonstrate concrete systemic solutions for the territorial deployment of the circular economy (including circular bioeconomy) in at least three territorial clusters. Systemic solutions shall demonstrate the role of the territorial circular economy to reconcile our economies with the limits and boundaries of our planet, to respond to citizen concerns in the wake of systemic crisis such as climate change, biodiversity loss and the COVID19 pandemic, to increase resilience and to provide concrete and sustainable solutions for the socio-economic recovery of a specific territory. Special attention should be given to vulnerable people and SMEs. Sustainability, inclusiveness, health and social justice must be at the core of each systemic and cross-sectoral solution. Special attention shall be paid to avoid and tackle social, gender and intergenerational inequalities. The replicability and scalability potential of the clusters’ systemic solutions and their business models is essential.

A circular territorial cluster (hereinafter referred to as ‘cluster’) is a ‘circular economy basin’, a socio‑economic and environmental system composed of relevant and complementary territorial actors to implement, demonstrate and facilitate the replication of at least one circular systemic solution (hereinafter referred to as ‘systemic solution’) i.e. a large-scale demonstration project, programme, initiative for the territorial deployment of the circular economy. Examples of actors are administrations, industry (including small and medium enterprises - SMEs), scientific community, financial intermediaries, non-governmental organisations and civil society. Each cluster should include a geographically cohesive territory (e.g. a group of neighbouring cities) or territories representing components of specific value chains. The composition and dimension of each cluster must be clearly explained and justified by the proposals. The totality of the territorial clusters should reflect a geographical spread within Europe – i.e. at least one cluster per each area of Europe: (i) northern‑west Europe, (ii) central and eastern Europe, and (iii) Mediterranean Europe – and include cities and/or regions of different sizes and socio-economic structures to the largest extent possible. The proof of formal commitments of the involved local and/or regional authorities at the proposal stage is a precondition.

Systemic solutions shall be cross-cutting among different sectors and include science, technology, governance, economic, social and environmental dimensions and components. A systemic solution should address one or more economic sectors/value chains/technological processes to increase their circularity, involve circular participative governance models, demonstrate sustainable products and/or services’ business models, involve one or more social and community‑based innovation schemes (such as local repairing schemes for products), address environmental, behavioural and cultural aspects, and provide specific training, education and knowledge sharing services for local stakeholders.

The economic sector addressed by each systemic solution should be selected according to local and regional circular economy potential and smart specialisation priorities, while also taking into account, if relevant, global dimension with regards to value and supply chains. This selection must be clearly justified and explained in the proposals. One or more of the following sectors should be covered: waste (including bio- and plastic waste), water, food, feed, organic and waste-based fertilisers, wood, terrestrial and aquatic bio-based value chains, packaging, textile, plastics, mobility, logistics, renewable energy use and storage, electrical and electronic equipment, composites, urban planning and use of spaces, building materials, construction and buildings. The totality of the systemic solutions presented by all clusters are expected to address several economic sectors and value chains and involve diverse social and community‑based innovation schemes in order to provide the policy-makers not participating to the proposals with a wide spectrum of concrete systemic solutions to be replicated and adapted in other areas. A systemic territorial approach involving several economic sectors and its inclusion in a local or regional circular economy action plan would be an added value.

Each systemic solution must see the active participation of all relevant cluster’s stakeholders. It must be based on a detailed analysis of the cluster’s circular needs, its current potential, and challenges to be tackled. It shall include project development assistance (PDA) services to build the cluster’s technical, economic and legal expertise needed for leading to concrete bankable investments its territorial circular economy projects. PDA is a fundamental service to bridge the gap between circular ideas/plans and the concrete investments for the launch and implementation of the respective projects. PDA should include feasibility studies, stakeholder and community mobilisation, financial engineering, business plans, technical specifications, procurement procedures, etc. Proposals shall justify the budget for the PDA provided to each cluster’s systemic solution based on the expected amount of investments to be triggered and the respective leverage factor to be achieved.[[25]](#footnote-25)

Proposals shall explore synergies with other EU funds, including Cohesion Policy funds, Just Transition Fund and InvestEU, hereby showing pathways to market up take.

Systemic solutions should support an effective, safe and sustainable symbiosis within and between economic sectors, foster cooperation along and/or across value chains and sectors to identify common challenges/solutions and to help to create critical mass and facilitate public and private investments, include criteria of industrial ecology and eco-(safe by)-design, increase the integration between production, services and consumers, facilitate technology deployment, with special attention to more efficient and sustainable technologies (e.g. advanced and efficient manufacturing processes that enable decreasing the use of energy, raw materials and other natural resources, increasing the use of recycling materials, closing the industrial water, energy and materials loops and reducing GHG emissions and pollution).

Key enabling technologies are part of the deployment of the circular economy and important to address challenges in the implementation of safe and sustainable circular economy solutions. Digital technologies should be used to improve transparency of value flows/circles, ensure data security and boost new scalable business models for circularity.

Each systemic solution must monitor and evaluate the cluster’s transition towards a circular economy, identify its strengths and weaknesses as well as their causes, analyse regulatory obstacles and drivers and provide clear and precise policy recommendations to improve related EU regulation (including inputs on standardisation and certification), analyse existing financial schemes and propose concrete options for their improvement. Externalities must be addressed and life cycle assessment (LCA) included in each systemic solutions. Benchmark cost and environmental footprint of each systemic solution must be compared with equivalent linear solutions.

Proposals should ensure the exchange of relevant information and experiences within and across clusters as well as with actors not involved in the proposals. Setting up twinning exercises between the clusters can be efficient ways to facilitate the exchange of good practices and experiences.

The technology readiness level (TRL) at the end of the project should be 8. Proposals should clearly state the starting and end TRL of the key technology or technologies targeted in the project.

Proposals must demonstrate a deep knowledge on relevant EU projects and initiatives on territorial circular economy and circular bioeconomy in order to ensure complementarity and cooperation and avoid overlapping and repetitions.

Expected impact:

Demonstrate systemic solutions for the territorial deployment of the circular economy at the level of governance closest to citizens:

* demonstrate the technical and economic feasibility of at least one circular systemic solution per territorial cluster;
* identify the economic, social and environmental benefits and challenges of each circular systemic solution;
* contribute to overcome market failures, testing public-private partnership models, interregional cooperation mechanisms and/or multilevel funding synergies useful for de risking business investments;
* contribute to connect different stakeholders of specific value chains, including key actors of the regional innovation ecosystems and final users;
* provide policy-makers and public and private investors with concrete examples of effective and sustainable systemic circular solutions to be replicated in other areas.

Socio-economic and environmental impact:

* create jobs and new sustainable business opportunities;
* demonstrate contribution to key pathways towards long-term environment and climate goals;
* increase circularity of clusters’ economic sectors and social and community-based innovation schemes;
* promote the role of ecosystems services in the circular economy;
* increase the clusters’ overall ecosystem, sustainable management of local resources, and reduce GHG emissions;
* promote the use of natural capital accounting into business strategy and decision making to optimise the circular economy;
* promote decoupling economic activity from the consumption of finite resources;
* promote eco-design in businesses and value chains based on local resources.

Replication and scalability of systemic solutions in order to multiply the economic, social and environmental benefits to achieve policy targets of the European Green Deal, EU Circular Economy Action Plan and EU Bioeconomy Strategy at regional, national, European and international level:

* ensure replicability, scalability and visibility of successful systemic solutions;
* facilitate industrial exploitation of demonstrated research results;
* contribute to address bottlenecks such as certification and labelling issues, standardisation and data exploitation;
* contribute to connect SMEs to large companies value chains;
* contribute to connect and upgrade open access circular demonstration facilities across Europe.

# **Area 4: Energy and resource efficient buildings**

## **4.1. 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-pollution, positive energy powerhouses within sustainable green neighborhoods (districts). There are two major components of this transition. **Firstly**, a transition in design and construction of buildings to reduce their embodied emissions and to increase the energy efficiency of their operation; also the retrofitting of 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 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 (incorporating thermal design and orientation), including those that are adapted to their local environments (climatic conditions) and use. The multiplication of such buildings allows the creation of green neighborhoods “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 large-scale, real-life demonstrations of promising technology and social innovations based on:

* Scalability design of green, positive energy neighborhoods 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 through to 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, in order to reduce the embodied energy of buildings;
	+ Proving high replicability, reduced maintenance costs and long-term performance as well as and socio-environmental performance (e.g. air quality/natural ventilation, natural lighting, etc.);
	+ Minimizing disruption for building occupants and the time spent on site;
	+ Delivering post-construction / renovation monitoring of operational energy performance, durability of the construction/renovation components.
* Sustainable and highly energy-efficient building designs (incorporating thermal design and orientation), adapted to local environments and climatic conditions; active-passive solutions for the building envelope, with:
	+ Digital methods of design and construction (e.g. building information modelling);
	+ Innovative and more energy efficient Building Integrated Photovoltaics (BIPV) converting structural elements/surfaces (e.g. facades, windows, roofs, etc.) into electricity-producing surfaces while satisfying building functions in addition to architectural and aesthetic considerations.
* Innovative and more energy efficient RES electricity generation in the buildings and at district level combined with urban service facilities (e.g. charging facilities) and highly energy efficient and cost effective RES heating and cooling solutions:
	+ PV (BAPV where BIPV is not an option);
	+ Reversible heat pumps with refrigerants, which 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) without limiting the use of living space (e.g. neighborhoods 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 for monitoring yield, energy system flexibility (matching demand to generation) and “peak shaving” at neighborhoods scale, as well as digital solutions to increase energy efficiency of building systems’ and appliances’ secure operation ensuring optimal comfort for users:
	+ Optimal dynamic matching of on-site renewable energy generation and building consumption;
	+ Smart home services, advanced automated controls, i.e., smart meters, smart water control, smart EV charging, smart elevators, smart security etc.; understanding the occupants preferred usage of the building and harmonise the buildings’ interaction with its occupants;
	+ Integration between building energy management systems / building automation control systems, renewable electricity/energy generation, storage, urban service facilities and the grid;
	+ 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, as well as, 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 for efficiency of buildings and HVAC technologies.

The objective is to test, in view of scaling up and wide replication, those innovations across the whole value chain (from planning and design through manufacture and construction to end use including all relevant players, governance and financing institutions, planners, owners, architects, engineers, contractors, facility managers, tenants, etc.). Consequently adapt this value chain to new operation patterns resulting from the innovations (new business models and services, new usages, changed behaviour). The validation of the market and consumer uptake potential should be carried out in the form of real life “living-labs” and under regulatory conditions that are open to innovation. For this purpose, the project will set up (or use existing) innovation clusters in several different parts 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) able 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 to TRL 7 at the end of the project.

**Expected Impact:** when compared to state of the art the innovative developed solutions 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);
* High energy performance (nearly zero-energy level within the meaning of Directive 2010/31/EU) / positive energy buildings;
* 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;
* Contribute to the development and implementation of zero-GHG approaches in the building sector.

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

**Type of Action**: Innovation Action (IA)

# **Area 5: Sustainable and smart mobility**

## **5.1. Green airports and ports as 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 double by 2050 and the sector is already generating 15% of the global GHG emissions from transport. At the same time, waterborne transport is accounting for approximately 90% of global trade and 2.5% of global 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 and commercial sites, linking with other transport modes, hinterland connections and integrated with cities. As such, green airports and ports, as hubs for sustainable and smart mobility have a great potential to immediately drive the transition to GHG neutral aviation, shipping and wider multimodal mobility already by 2025. This topic addresses innovative concepts and solutions for airports and ports communities, in order to urgently reduce transport GHG emissions and improve their resilience to climate change.

**Scope:** Building on best practices, ongoing projects and planned initiatives in European airports and ports, proposals 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**

Perform large-scale, real-life high TRL demonstrations of green airports, addressing all of the following aspects, in the context of the following airport dimensions:

1. Transport

1. From city to the airport (access and multimodal connections)
2. From the airport to the aircraft (airside)
3. At the airport landside (logistics, ground handlings and operations, as well as green energy production of sustainable alternative fuels or electricity)
* Demonstrate low-emission energy use (electrification or sustainable alternative fuels) for aircrafts, airports, other / connected and automated vehicles operating at airports (e.g. road vehicles, drones), as well as for public transport and carpooling, with re-charging/re-fuelling stations and use of incentives;
* Showcase the use of innovative green de-icing and anti-icing procedures and infrastructures;
* Apply innovative digital solutions, including new tools and traffic optimisation mechanisms for multimodal access, passenger and freight flows into / out of airports, facilitating access and reducing traffic from / to the city;
* Promote infrastructure solutions for small and medium airports, scalable to large airports, to allow a critical mass of airports to deploy sustainable alternative fuels – addressing also distribution, fuel handling logistics and blending operations;
* Promote the development of sustainable alternative fuels production facilities on-site (or close to) the airport, to facilitate the conversion of airport waste to sustainable alternative fuels and the delivery of the fuels to the airport (e.g. by pipeline);
* Develop and implement a new EU Clearing House for Sustainable Kerosene (EU-CHSK), to undertake testing for new value chains of renewable kerosene in Europe. The EU-CHSK should select laboratories for the actual analyses of the fuels, as well as facilities that can carry out the actual testing in jet engines, in compliance with either existing or newly developed ASTM standards

2. Terminal

* Demonstrate integration of new solutions with operations, green and smart logistics and infrastructures;
* Develop the green built environment (construction/demolition) and procurement processes;
* Improve the energy efficiency of buildings; optimise services such as lighting, heating, ventilation, air conditioning, water / energy usage and efficiency;
* Enhance biodiversity, green land planning and use, as well as circular economy and recycling.

3. Energy

* Address the entire energy value chain from supply to use: demonstrate energy efficient facilities for green energy production (e.g. electricity, advanced biofuels, green hydrogen) to power / electrify the built environment and infrastructure, transport and airport operations;
* Pilot waste-based biofuels refineries or retooling of existing ones, as a means of generating heat, power or producing sustainable alternative fuels;
* Identify effective incentives to address challenges in the sustainable alternative fuels system (e.g. fuel producers, fuel distributors, airport operators, airline operators) and to promote the penetration of sustainable alternative fuels within the aviation sector;
* Assess 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 (airlines).

4. Cross-cutting aspects:

* Air quality (indoor, outdoor, cabin) and noise trade-off;
* Safety & security assurance for all innovative solutions;
* Circular economy and aircraft decommissioning;
* Eco-labelling and certifications (robust certification and green standards setting) and Measurement, Reporting and Verification (MRV);
* ICT to effectively manage resources and assets, including management of information and production of knowledge;
* Sustainable evolution of airports, including institutional and governance, ownership, regulation, performance indicators, balance of force between regulators, airlines and airport operators, in order to accelerate the production and use of sustainable energy;
* 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;
* Non-technological framework conditions, new multi-actor governance and investment analyses.

**Area B: Green Ports**

Perform large-scale, real-life high TRL demonstrations of green maritime and inland ports, addressing all of the following aspects:

* Demonstrate integrated low-emission energy supply and production at ports (e.g. electricity, green hydrogen, ammonia) and on-shore supply systems, with storage, distribution and power / re-charging / sustainable alternative fuel re-fuelling infrastructure for ships and other vehicles;
* Demonstrate sustainability and innovation beyond energy supply and demand at ports, particularly the integration with green and smart logistics and port operations, energy-efficient buildings, innovative construction, dredging and infrastructure activities, effective and green land use;
* Demonstrate seamless and highly efficient logistics operations, for integrated port-hinterland connections (e.g. with rail and road), to enable modal shifts and system-wide door-to-door multimodal passenger mobility and freight transport;
* Perform pilot activities to showcase the positive environmental effects of digitalisation in ports, particularly with 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 logistics chains and multimodal inter-connections;
* Deliver new tools and optimisation mechanisms for passenger and freight flows into and out of the port, facilitating port access and reducing traffic from / to the city;
* Assess 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 principle and port market share effects);
* Develop and promote new multi-actor governance arrangements that address the interactions between all port-related stakeholders, including port authorities, ship owners, local communities and city planning departments, in order to accelerate the production and use of sustainable energy;
* Deliver 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 transport modes, the hinterland, cities and urban mobility;
	+ Solutions with the highest potential for emission reduction at ports, focusing on CO2 and other emissions (SOX, NOX and particulates), as well as improving biodiversity, noise, the soil and the marine environment;
	+ Analysis of the various alternatives for the provision of on-shore power supply at the port, such as fixed energy grid vs. mobile storage, barges or trucks bringing energy/batteries, etc.;
	+ Assessment whether existing fossil fuel, LNG or other / chemical infrastructures at ports could be used to facilitate the transition towards bunkering of carbon neutral fuels;
	+ A holistic green 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;
	+ A handbook on how to move from planning, to implementation, replication and scaling-up the deployment of the successful demonstrated solutions for different sizes and locations of ports across Europe.

In relation to both areas (Green Airports and Green Ports), proposals addressing all of the above aspects should incorporate field performance monitoring of at least 6 months before the innovative solutions are applied, followed by a period of at least 1 year within the project duration, in order to allow a comparison of the effectiveness of the deployable solutions.

Proposals 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.

Each consortium should be led by one “Lighthouse” airport or port, which will demonstrate the novel concepts and solutions and a further two “Fellow” airports or ports that will follow closely the demonstration actions and are committed to implementing the best practices identified in the project. The consortium should also include academic and other partners. All participating airports or ports must be from different EU Member States or Countries associated to Horizon 2020.

The Commission considers that proposals requesting a contribution from the EU of EUR [X] million 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. At least 15% of the requested EU contribution should be for the Fellow airports or ports.

Eligible costs are primarily those that concern the innovative elements of the project needed to:

* Foster innovative overall energy systems integration;
* Demonstrate effective integration of transport modes within and around the airport or port;
* Foster wider use of electrification and sustainable alternative fuels at airports or ports.

Costs of commercial technologies are not eligible, for example:

* Buildings: purchase, construction, retrofitting and maintenance;
* Electric vehicles and charging stations: purchase, installation and maintenance;
* ICT platforms: purchase, development and maintenance.

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 in the area of A) Green Airports and B) Green Ports will be funded, provided that they attain all thresholds.

**Expected Impact:**

* Accelerated deployment of sustainable alternative fuels (including advanced biofuels, green hydrogen, ammonia) and electromobility in transport, as well as energy storage and waste heat recovery in airports and ports;
* On-site clean energy / fuel production and distribution (particularly green hydrogen and electricity) and increased alternative (bio-) fuel supply, with re-fuelling and re-charging capabilities;
* Zero-emission airport and port operations by 2030;
* Reduced aviation, waterborne and other transport emissions, as well as improved air quality, biodiversity, circular economy and reduction of noise at airports and ports;
* Energy-efficient and smart airport and port operations and buildings, green and smart logistics, integration with other low-emission transport modes;
* 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 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 EU transport sector.

**Type of Action:** Innovation Action

# **Area 6: Farm to Fork**

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

Specific Challenge:

European food is famous for 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 starting, it remains a big challenge to feed a fast-growing world population and bring food systems within a safe and just operating space - encompassing planetary health, economic viability and social welfare, and including human health. Current production practices and consumption patterns still result in air, water and soil pollution, contribute to the loss of biodiversity and to climate change, 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 diseases such as cancer. Here are some of the facts:

* About 20% of the food produced in the EU is being wasted;
* Globally, food systems are responsible for about 29% of total GHG emissions.;
* Nitrogen and phosphorus cycles exceed their safe operating space, respectively by a factor of 3.3 and 2[[26]](#footnote-26) resulting in diffuse pollution of terrestrial, aquatic and atmospheric ecosystems;
* One in five EU adults are obese. Many Europeans die prematurely, or suffer from illnesses due to diet related diseases.

In addition, the COVID19 pandemic highlighted the importance of 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 made possible. It requires and builds on innovative systemic solutions that can be scaled up, such as smart agro-ecological practices, new protein sources other than meat, sustainable food from the oceans and aquaculture, and personalised advice relating to sustainable healthy diets. Concerted efforts are needed to test and demonstrate such solutions and target impact in this decade.

Scope:

Projects shall test, pilot and demonstrate innovative systemic solutions (TRL 5-8) to one of the following five urgent and pressing food systems’ challenges:

1. Achieving climate neutral farms (on land, water and sea) by reducing GHG emissions and by increasing farm-based carbon sequestration and storage;
2. Achieving climate neutral food businesses by mitigating climate change, reducing energy use and increasing energy efficiency in processing, distribution, conservation and preparation of food;
3. Reducing the dependence on contentious pesticides and antibiotics; reducing the use and increasing the efficiency of fertilisers; reducing the losses of nutrients from fertilisers, towards zero pollution;
4. Reducing food losses and waste, while avoiding unsustainable packaging;
5. Shifting to sustainable healthy diets[[27]](#footnote-27), sourced from land, water and sea, and accessible to all EU citizens, including the most deprived and vulnerable groups.

Successful projects should go well beyond technological solutions. They should focus on systemic innovations that maximise synergies such as with animal welfare and minimise trade-offs to deliver on the three dimensions of sustainability (social/health, climate/environmental and economic), that increase resilience of food systems to shock and stresses, bring them back in a safe and just operating space and contribute to sufficient, safe, nutritious, and affordable food for all.

Projects should pay particular attention to:

* Applying system thinking/systems approaches to define the challenge, including in-depth systemic analyses of its drivers and root causes; to identify possible innovative systemic solutions; to develop approaches and roadmaps to promote their uptake and upscaling in the EU; 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 and the objectives outlined in the Farm to Fork Strategy and the Green Deal.
* Adopting a multi-actor and cross-sectoral approach engaging practitioners (primary producers, processors, retailers, consumers), public and private institutions (NGO and governmental institutions) and citizens from farm to fork to co-create, test and demonstrate solutions in practice, on a European scale but with attention for geographic and sectoral needs and contexts. Foster collaboration, building bridges and breaking silos between actors of the food chain and between primary sectors as well as collective action. Take specific care to engage young professionals (e.g., young farmers, young fishers, young researchers, young entrepreneurs, etc.), SMEs and citizens.
* Including the most appropriate mix of innovations, such as novel and digital technologies, new business and supply chain models, new governance models, ecological and social innovations while taking into account geographic and sectoral contexts (including environmental) and needs, both for production and consumption. The projects shall focus on upscaling innovations (TRL level 5-8), 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.
* Where appropriate, federating 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. Projects may link with other relevant European and national programmes, where appropriate.

Expected Impact: Projects are expected to:

* Test, pilot and demonstrate, across different geographical and sectoral contexts, innovative systemic solutions that lead to :
	+ Climate neutrality
	+ Reduced food losses and waste
	+ Decreased dependency on the use of contentious pesticides, antimicrobials; reduced fertiliser use and nutrient loss;
	+ Significant shift to healthy sustainable diets, including among the most deprived and vulnerable groups.
* Improve understanding of:
	+ The potential to scale up and out these solutions by 2030 on an EU level; the enablers and barriers, including the behaviour and motivations of actors.
	+ The impact of these solutions on the three dimensions of sustainability (social/health, climate/environmental and economic), on the capacity of food systems to operative in a safe and just operating space, on the resilience of food systems to shocks and stresses, and on the objective of providing sufficient, safe, nutritious, and affordable food for all.
* Explain and quantify, using Key Performance Indicators (KPIs), how the solutions will deliver on the expected impacts.

Type of Action: Innovation Action

# **Area 7: Ecosystems and Biodiversity**

## **7.1. Restoring biodiversity and ecosystem services**

Specific Challenge: This European Green Deal call should be pivotal in demonstrating and promoting systemic solutions on restoring biodiversity and ecosystem services, and deliver tangible benefits for biodiversity and climate change mitigation and adaptation. The European Green Deal and its Biodiversity Strategy request urgent up-scaling restoration efforts for damaged ecosystems at sea and on land to increase biodiversity and deliver a wide range of ecosystem services. Underpinned by knowledge in the latest IPCC and IPBES reports, large-scale ecosystem restoration is urgent – the window of opportunity is closing as we speak. It needs a systemic approach to deliver on the Green Deal actions for climate (mitigation and adaptation), biodiversity, zero pollution and sustainable food systems (from farm to fork). Whilst solutions are available now, they are neither up-scaled nor integrated enough in today’s governance, investment or policy support landscapes. The environmental urgency highlights the limits of current management approaches and calls for investment in innovative restoration approaches that could trigger the necessary and urgent transformational changes we need. The global biodiversity post-2020 framework seeks voluntary commitments by business and stakeholders to invest in biodiversity. These topics need large financial support to test new approaches to speed up actions in the UN decade for restoration.

Resilient ecosystems are natural sinks for CO2 from the atmosphere and can support adaptation to the locked-in climate change. Aside from being an essential carbon sink, oxygen source, and delivering a wide range of services (climate change adaptation, health and well-being, food, feed, fibre or fuel provision across the bioeconomy, recreation, water retention and purification, air quality, nutrient cycling), ecosystems are of relevance in a wide range of sectors, which impact the everyday life of Europe’s citizens. Yet, biodiversity is being lost, and ecosystems are degrading at an alarming rate. Pressures on biodiversity increase at a faster rate than the efforts to protect it[[28]](#footnote-28). 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 an urgent need to strengthen their resilience against environmental and climate stressors while integrating the local socio-economic specificities. This call seeks answers on how to frame transformational change, which supports a just transition – to show how investing in nature restoration can explicitly help vulnerable regions and communities to improve their resilience when rapid changes in climate and environment, economies and social conditions occur.

This call topic therefore responds to the urgent double challenge of (i) accelerating transformative change through (ii) upscaling restoration of ecosystems at sea and on land.

Specific Objective: To provide large-scale demonstrators on how systemic upscaling and replication of best practice ecosystem restoration[[29]](#footnote-29) can be deployed at regional, national and cross-border levels, focusing on heavily degraded terrestrial, freshwater and marine ecosystems, responding to restoration goals enhancing biodiversity. Innovative methods on upscaling restoration need to be adapted, integrated and demonstrated in practice, for specific ecosystems and land/sea uses – recognising that conditions at sea can considerably differ from the ones on land, that speed of change and disturbance might differ, and that solutions to reverse biodiversity decline are context-specific. To demonstrate and test how restoration activities and socio-ecological management of ecosystems enable sustainable, climate-neutral and -resilient, inclusive, transformative approaches. To support the development of specific demand and supply chains in restoring ecosystems. To explore whether incentive-based mechanisms for restoration across the bioeconomy (agriculture, forestry, marine and innovative bio-based sectors), could trigger additional emission reductions, similar to how the EU’s Emission Trading System (ETS) has incentivised the industrial and power sectors. To address barriers to implementation for systemic nature-based solutions focussing on restoration. This call should show how to upscale the restoration of ecosystems at the necessary large scale which will help human communities to adapt to changing conditions at their local level. It should also demonstrate in practice 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 IPCC and IPBES). It should show how restoration activities enable a shift of social and behavioural patterns towards increased benefits for biodiversity. Demonstrating all these benefits at a large scale requires a sound monitoring and assessment. This call shall generate knowledge on how restoration can accelerate transformative change beneficial for biodiversity and climate change, and bring this information to UN programmes, as well as to IPCC and IPBES[[30]](#footnote-30), processes.

Scope: This project will demonstrate how restoration (in structure, function and connectivity) of biodiversity and ecosystem services can be scaled up[[31]](#footnote-31) in regions with severe biodiversity loss, so that opportunities for substantial biodiversity and ecosystem services gains will be realised, which in turn deliver social and economic benefits. This could pilot the integration of nature-based solutions focussed on restoration across economic sectors. This pilot is a Green Deal enabler and can be used as a testbed for further infrastructure investment by the European Climate Bank (EIB), for LIFE SNAPs, and relevant further budget lines in the next Multiannual Financing Framework. Appropriate budget for cooperation with previous projects on restoration and nature-based solutions[[32]](#footnote-32), and with Horizon Europe activities such as the Partnerships should be envisaged. This project aims at integrating systemic transformations through restoration in governance, policy making, financing, public procurement, economic development, infrastructure and regional strategic planning. It will test and evaluate approaches to create value with the human communities affected by transformative change, in innovative ways and by avoiding negative externalities through improving their living conditions by restoring their terrestrial and/or marine environment.

The project will develop a scalability plan, diffusion of solutions, and a process for commitments in adopting large-scale restoration within existing governance and financing systems, so relevant communities can replicate the upscaling across the EU and internationally. It should seek guarantees for the non-reversibility of restoration activities after the end of the project.

Activities of this project related to improving ecosystem condition must be integrated into best practice monitoring activities within respective monitoring governance schemes (no new restoration monitoring approaches should be developed within this project). This project must explicitly foresee deliverables which allow further monitoring schemes to apply (or test, if necessary) on efficiency and output indicators related to restoration, its benefits and trade-offs.

This project should respond to the urgency for addressing upscaling restoration challenges, restoration potential of degraded ecosystems, significance of research for supporting EU policy needs and contribution to the international biodiversity agenda, technical and economic feasibility of proposed actions, EU added value, co-benefits across multiple sectors, addressing identified knowledge gaps, and synergies/complementarity with R&I Partnerships and Missions, and with MFF programmes.

International cooperation in adapting restoration upscaling approaches when demonstrating their use for European conditions, and to apply the developed upscaling approaches internationally, is encouraged.

Expected impact: This action shows how transformational change through restoration delivers at large scale, delivering first visible results and examples on land and sea casesby 2024, with benefits increasing in the long-term. Results of this action will enhance natural carbon sinks and reduce greenhouse gas emissions, locally reverse the degradation of ecosystems, increase connectivity, and improve the delivery of a range of ecosystem services[[33]](#footnote-33). The call will provide testing at large scale of support actions to the EU commitment to reduce emission by 50-55% by 2030 and become net carbon-neutral by 2050 (European Green Deal), the EU Biodiversity Strategy and the EU Nature Directives, the Farm-to-Fork Strategy, the Climate Law, the Bioeconomy Strategy and Action Plan, the EU Covenant of Mayors, EU Adaptation Strategy (2013), the UN Decade of Restoration and the UN Sustainable Development Goals. It will pilot and identify urgent, suitable innovative systems and methodologies for the ecological restoration of carbon sinks, with a view to significantly reducing the carbon and environmental footprint of Europe whilst helping with the implementation of EU climate, energy, biodiversity, agricultural, forestry and fisheries policies. It will create opportunities for public-private partnerships and (voluntary) market-based incentives for business and individuals within restoration initiatives. Trans-disciplinary research and stakeholder engagement shall ensure co-funding for long-term maintenance. It will demonstrate the empowerment, involvement and reconnection of citizens with nature. Massive restoration action would clearly deliver on public spending for public good and could be highly engaging and visible to citizens. It will develop answers on how to frame transformational change, which supports a just transition by investing in nature, to explicitly help vulnerable regions and communities to improve their resilience when rapid changes in climate and environment, economies and social conditions occur.

Type of action: Research and innovation actions

# **Area 8: Zero-pollution, toxic free environment**

## **8.1. 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. 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 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, food contact materials and cosmetics) and to which citizens 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 will increase over time, creating additional risks for human health and ecosystems. There are examples of contamination from PFAS of water and soil in most EU countries, which are costly to remediate. The overall costs to society are estimated to be € 52-84bn across Europe, 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. This is of concern considering the current COVID-19 pandemic.

Scope:

This call topic aims at demonstrating innovative solutions to protect health, environment and natural resources from persistent and mobile chemicals, such as PFAS. Selected projects are expected to advance our knowledge on health impacts and environmental effects and to address a specific pollution problem of contamination of environmental resources (such as soil and drinking water). The solutions should lead to cost-effective mitigation or elimination of the issues (e.g. mitigation or remediation efforts in particularly affected geographic areas), and prevent and better understand negative impacts of the persistent and mobile chemicals on humans and the environment throughout their entire lifecycle. The projects may include appropriate technologies, business, governance and social innovation aspects and cover all innovation deployment phases up to the realisation of innovative solutions in the real life conditions (the first market applications, TRL 7-8). In particular, projects may consider analytical methods, enabling to quantify entire groups of persistent and mobile chemicals such as all PFAS in food or drinking water. This would allow achieving a higher level of consumer protection than regulating individual substances, as such ‘group’ methods are essential for enforcement of the entire group of harmful substances.

The successful projects shall include elements, such as research and development of (bio)remediation technologies of contaminated soil and water for persistent and mobile substances, including sources of drinking water for persistent and mobile chemicals; development of new cost-effective high-resolution methods to measure and separate persistent and mobile chemicals in different media; environmental and human (bio)monitoring[[34]](#footnote-34) of persistent and mobile chemicals; gathering of toxicity and toxico-kinetic information in order to allow characterising all risks to human health, arising from the exposure to the entire group of these substances, including effects on the immune system; development of best practices for the management of waste containing persistent and mobile substances; and detection and identification of specific pollution problems. Proposed solutions should be cost-effective and easily implementable to encourage their uptake. Therefore, close consultation with potential end-users during the project life-time is recommended.

Expected impact:

* Better understanding of emerging and a persistent pollution problem of human and environmental health relevance
* Support the aims of the new [Circular Economy Action Plan](https://eur-lex.europa.eu/resource.html?uri=cellar:9903b325-6388-11ea-b735-01aa75ed71a1.0017.02/DOC_1&format=PDF) calling for methodologies to minimise the presence of substances that pose problems to health or the environment in recycled materials
* Solutions for better (bio)remediation and detection technologies, including real time monitoring approaches
* Improved risk assessment to facilitate optimal risk management
* Harmonisation of hazard and exposure data and databases
* Data of regulatory relevance accessible to policy makers and for risk communication

Type of action: Research and innovation action

## **8.2. Fostering regulatory science to address chemical and pharmaceutical mixtures: 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 environment and several knowledge gaps are identified in EU Strategic Approach to Pharmaceuticals in the Environment[[35]](#footnote-35).

Humans, wildlife and domestic animals are in general exposed to mixtures of different chemicals via air, water (including the marine environment), food, consumer products, materials and goods. The scientific understanding of mixture effects has progressed in recent years and approaches are available how to better regulate combined exposures to chemicals.

In parallel with the development and implementation of regulatory approaches to better protect human health and the environment from risks of chemical mixtures, there is a need to continuously improve the scientific knowledge base. Current knowledge shows that combined exposures pose risks to ecosystems and human health, and that these risks are not sufficiently managed under existing regulations. Accordingly, there is a need to advance [regulatory] science, thereby providing policy-makers and risk assessors with methods and tools. It is also important to study the effectiveness and efficiency of different policy approaches, and to continue exploring human and environmental exposure to mixtures and associated effects.

Scope:

This topic calls for applied research studies, demonstrating how regulatory science can apply new tools and methodological approaches based on the latest scientific evidence, to quantify and prevent harmful co-exposures to industrial chemicals and pharmaceuticals.

The applicants can address some or all of the following:

1. Evidence-based solid case studies of which safety margins would actually protect people, including vulnerable groups, and ecosystems, while taking accumulated exposure into account over a longer time scale;
2. Develop and apply modelling, statistical approaches and other relevant methods to study the impacts of chemical mixtures on human populations and the environment, e.g. through linking particular cases identified and effects on the wider population and on ecosystems;
3. The possible effects on humans of (chronic) exposure to low levels of pharmaceuticals via the environment, taking account of the potential for combined effects from multiple substances, and of vulnerable sub-populations
4. Improvement of models for (chronic) exposure to mixtures, which can be applied in a premarket stage (risk assessment, authorisation and restriction of chemicals), and possibly already at the design phase of chemicals and materials, to predict contribution to combined and overall exposure/risk/toxicity;
5. Validation of models for (chronic) exposure to mixtures through actual testing and sampling;
6. Estimations of the degree to which current regulatory practices/approaches underestimate (or possibly occasionally overestimate) risks related to chemicals exposure (based on particular case studies, modelling and overall estimations);
7. Comparisons of different possible regulatory approaches to manage chemical mixtures with current situation, including regarding effectiveness (improved protection of health and the environment), workability, cost-effective methods and benefits to society and business;
8. Improvement of the knowledge base on mixtures and their health and environmental impact, to underpin and support regulatory action

Expected impact:

* Implementation of existing and new risk assessment and risk management approaches to reduce the most critical exposures, including the setting of limit values and the introduction of new regulatory approaches such as, e.g. Mixture Assessment Factors
* Scientific evidence to enable mitigation of pharmaceutical and other chemicals (mixtures) in the environment

Type of Action: Research and Innovation action

# **Area 9: Strengthening our knowledge in support of the EGD**

## **9.1. 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 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 boostthe 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 IAGOS[[36]](#footnote-36) 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 constraint 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 gases[[37]](#footnote-37) and nanoparticles (with still unknown potential health damage) are lacking.

Scope: Proposals will address one of the following sub-topics:

***(a) Support EU leadership in clean energy storage technologies***

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.

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, such as the Battery Alliance, 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 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](https://ec.europa.eu/research/infrastructures/pdf/2016_charterforaccessto-ris.pdf). 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 X million would allow this topic to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.*

***(b) European research infrastructures and monitoring networks for greenhouse gases observing, air quality and citizens’ health in cities***

The proposals will address one of the two objectives b1) or b2). All proposals should propose a roadmap for upscaling (section b3).

**(b1)** Enhancing European research infrastructures for greenhouse gases observation

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; (2) plans for the efficient curation, preservation and provision of access to 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.
* Pilot implementation in 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 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 as well as with air quality monitoring networks as well as coordination with European observational programmes and initiatives, such as Copernicus[[38]](#footnote-38).

**(b2)** Enhancing city air quality monitoring networks

The action should enhance urban air quality monitoring networks in measuring air pollutants such as particles (both in mass and particles number concentrations, including specific nanoparticles data at traffic and airport sites). Engagement of the health community 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:

* 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 one representative site, 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, citizens’ observatories.

The action should explore, at all stages, synergies and interoperability with European research infrastructures as well as among air quality monitoring networks.

(**b3**) Roadmap for upscaling

The actions should propose the optimal design of well-coordinated, inter-operable, large city scale networks building on existing European research infrastructures and city air quality monitoring networks and on the relevant work done respectively under b1) and b2).

The actions should propose strategies to engage stakeholders, including citizens, to build commitment at local, national and European level and promote long-term sustainability.

The actions should engage in networking and training and promote interoperability, , dissemination and exchange of experience and practices.

The actions should propose appropriate framework to coordinate with or contribute to key relevant European initiatives such as COPERNICUS, EOSC, and support global initiatives such as COP21 Paris Agreement, 2030 Agenda for Sustainable Development Goals. It should also ensure relevance to the Mission on Climate Neutral Cities by 2030.

The actions 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 X million for greenhouse gases observation and up to EUR X million for air quality monitoring 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 EU leadership in clean energy technologies.*** This activitiy 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 40% 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) European research infrastructures and monitoring networks for greenhouse gases observing, air quality and citizens’ health in cities.*** This activity 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; to facilitate the engagement of citizens;
* strengthen and sustained COPERNICUS in-situ component and improve air quality monitoring;
* strengthen the technological development capacity and effectiveness as well as the scientific performance, efficiency and attractiveness of the European Research Area.

Type of actions: Research and Innovation Action

## **9.2. 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 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 climate adaptation and mitigation practical solutions and information to reach the end users and helping 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 inform 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 shall be tackled for the most relevant sectors and deliver solutions towards meeting the decarbonisation goals of the European Green Deal as well as adaptation options for dealing with climate change impacts.

The scope of activities under this topic should cover:

* 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. Identified barriers to the predictive potential of climate 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 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 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 and/or mobile applications).

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.
* 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.
* Improve quality of data, and information and knowledge on climate adaptation and mitigation.
* Support the development of the European Service sector regrading end-user climate services.

Type of Action: [Research & ]Innovation action

## **9.3. A transparent & accessible ocean: Towards a Digital Twin of the Ocean**

Specific Challenge

Fit for purpose and sustained ocean observations are an essential part of worldwide efforts to understand and protect marine social-ecological systems whilst benefiting from their ecosystem services. Observations can be samples collected on ships, measurements from instruments on fixed platforms, autonomous and drifting systems, submersible platforms, ships at sea or remote observing systems such as satellites and aircrafts.

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. Ocean forecasting was a research activity. In two decades, the European Union invested in policies and infrastructures to make knowledge of the ocean central to environmental and climate policies as well as the blue economy. Its Member States, together with neighbours, have created an unrivalled marine data and forecasting infrastructure. Working together and the principles of free and open access, interoperability, and “measure once, use many times”, largely promoted through, Copernicus, the European Research Framework Programmes FP7 and Horizon 2020, and EMODnet activities have demonstrated clear value.

The Digital Twin of the Ocean is the next step, filling the need to integrate a wide range of data sources, to transform data into knowledge and to connect, engage, and empower citizens, governments and industries by providing them with the capacity to inform their decisions. It will empower a shared responsibility to monitor, preserve and enhance marine habitats, and support a sustainable blue economy (fishing, aquaculture, transport, offshore energy, etc.). It should allow assessment of the state of ecosystems, habitats and the impact of human activities; forecasts of their short and long-term changes; development of biodiversity conservation strategies; management of sustainable economic activities; assessment of infrastructure vulnerability; development of mitigation, adaptation and replacement plans to deal with climate risks and optimisation of emergency responses to severe events such as storm surges.

It will contribute to the development of digital interactive high-resolution models of the oceans, as part of the Commission’s Green Deal and Digital Package commitments to develop a very high precision digital model of the Earth (Destination Earth initiative). Building on the integration of existing EU leading-edge capacities in ocean observation (such as Eurofleets+, EuroArgo, Jerico, EMBRC, etc), data infrastructures and forecasting services (Copernicus, EMODnet, Blue Cloud, ERICs, -) through innovative IT technology, it will bring together infrastructures and communities in support to the EU Green Deal and to societal transitions.

Scope

This topic supports the development of interoperable pilot digital twins, addressing concrete cases in local or regional sea basins (connecting freshwater, coastal and marine ecosystems), and demonstrating their usefulness with regard to several of the Green Deal priorities. They should allow continuous, timely, persistent and autonomous monitoring (from the coast to deep sea and from the surface to the seabed), identification and testing of the most efficient solutions. Proposals should cover the whole knowledge value chain, from data acquisition (from multiple sources: research, monitoring, industrial and citizen data) to users’ services, for example and if relevant:

* the integration of new automated sensors and autonomous platforms allowing measurements with increased frequency and lower cost;
* technologies to incorporate structured and unstructured data, e.g. from alternative sources such as citizen science or historic data collected before the digital age, and allowing for the application of big data and artificial intelligence technologies and improving data sharing and modelling capacity;
* development of what-if scenarios, taking into account uncertainties on modelling as well as on assessment of the ecosystem status & environmental stressors, and EU-national coupled-modelling capacities to analyse impact of preventive measures to adapt and mitigate climate risks at regional and local scale;
* co-creation and inter-disciplinary approaches and frameworks (cloud-based, digital, i.e. BlueCloud and Wekeo) between natural sciences, humanities and social sciences for the co-construction of expertise towards decision making with local authorities, scientists, private sector to develop shared applications to support resilience to climate change, disaster risk management, maritime spatial planning, environmental reporting or sustainable economic activity;
* development of close cooperation between leading European data infrastructures and e-infrastructures, and international counterparts to facilitate common access to data on wider sea-basins and global scales and a digital ocean twin that also aligns with the digital atmosphere and biosphere and objectives of the UN Decade of Ocean Science for Sustainable Development;
* delivering information to citizens through new generation reporting of ocean health - how it is changing and how it might change in the future through interactive on-line tools including data, data visualisation, images, text and video on issues such as sea-level rise, species shifts, ecosystem change, conservation status.

Expected impact

The action will deliver interactive virtual tools of the ocean in a unified digital environment to:

* contribute to significantly increase the capacity to observe coastal and marine waters, the sharing, availability, visualisation and use of data;
* reinforce conservation and ecosystem-based management of marine habitats/green infrastructure, planning of marine areas, and safeguard productivity and biodiversity of marine ecosystems
* increase citizen engagement through increased awareness and understanding of the dynamics, interactions and evolution of seas and oceans and their role in our well-being and survival;
* encourage and enable the infusion of ‘non-scientific data streams’ through citizens engaged 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;
* allow for knowledge-based decision-making, reduce risk and increase efficiency of coastal and marine economic activities and implementation of legal requirements (MSFD, Water Directive, etc…)
* encourage industry to look for business opportunities in ocean data and related services.

Type of Action: Innovation Action

*Select projects are expected to collaborate between themselves, with all other relevant H2020 projects, and with relevant projects from the ESA Ocean Science Cluster (*[*https://eo4society.esa.int*](https://eo4society.esa.int) *and* [*https://eo4society.esa.int/communities/scientists/esa-ocean-science-cluster*](https://eo4society.esa.int/communities/scientists/esa-ocean-science-cluster)*)*

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

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

***Collective level action***

Specific Challenge

All areas of the 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. 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 Green Deal.

Such processes may include a large spectrum of co-creation activities and events based on dialogue and information exchange. 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.

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. Projects retained will establish transnational networks of experts, researchers, practitioners and relevant civil society organisations specialised on 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 will 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 networks, experience and tools, notably stemming from EU-funded projects such as the [RRI Tools](https://www.rri-tools.eu/) platform.

Provision will be made for [x] deliberative processes, each of them implemented in an average of [y] Member States or associated countries and complemented by a European online multilingual deliberative platform. Specific topics for deliberation will be co-decided with the EC services involved in implementing the Green Deal. They will 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 will be sought. Vulnerable and marginalised categories of the population, minorities and various age groups, including both youth and the elder generation, as well as both urban and rural areas, will be considered and included. Gender balance will be ensured and gendered issues will receive specific consideration.

National and local governments and administrations will be closely associated, including, to the extent possible, links with existing debates and participatory processes at their levels. Clear channels for the take-up of participatory outcomes in decision making processes will be sought at local, national and/or EU levels and feedback to citizens will be ensured.

Participatory experts will design methodologies for each individual exercise, relying on comparative analysis of international best practice and involving people or groups concerned. Depending on specific objectives, they may either ensure consistency across Member States for transnational comparability, or select a range of different methodologies to compare their effectiveness.

An advisory board will ensure the robustness, ethical and inclusive character of the planned deliberative processes and vet the methodologies and conditions of implementation of each individual exercise.

Research teams on participatory and deliberation processes will study each individual exercise, assess and compare their results across the Member States and provide feedback and recommendations.

Coordination and cooperation will be expected between funded projects under this topic and others of this area, since deliberation and participation are important factors for behaviour change and are closely related to citizen engagement and activism. This may encompass limiting features such as the advisory board to a single one to advise and ensure consistency across the projects, and/or the online platform to a single one to maximise its reach and impact.

Expected Impact

Projects under this topic will enable collective design and ownership of Green Deal objectives and means, engagement and change through citizen participation and deliberation processes. Consortia should choose a basket of indicators to measure the impact of their work. For example, they are expected to contribute to one or several of the Sustainable Development Goals[[39]](#footnote-39).

Specific impacts include:

* Feeling of ownership and engagement through citizen deliberation and participation across Europe
* 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 Green Deal issues.
* Long-term commitment and buy-in from a broad spectre of social groups across Europe to support the Green Deal targets in the long term and to engage in co-creation and co-implementation of transition pathways.

Action type: RIA

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

***Collective level action***

Specific Challenge

All areas of the Green Deal, from climate action to zero pollution, require considerable changes in the behaviour of individuals, communities and public and private organisations. These changes concern, for example, mobility behaviours, minimising traffic-related emissions and resource consumption, etc.

Several foci of behaviour and mindset are at play in interconnected ways: concern for one’s health, concern for the planet, ethical concerns such as fairness and solidarity, etc. Ways of combining individual, collective and environmental benefits should be sought wherever possible.

Disadvantaged social groups 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, but to which they see no feasible alternatives (from dietary choices to inappropriate use, reuse and disposing of materials). Similarly, differences of perceptions (in different regions of the EU, among different social groups, across genders) of the urgency of the climate change and other environmental issues, and thus the urgency of related behaviour change, need focused attention.

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 must be accompanied with comparative research and feedback to ensure continuous monitoring and learning.

Scope

This topic covers behavioural change at individual and collective levels, including public and private organisations. Projects retained will establish transnational and transdisciplinary networks of experts, researchers, practitioners and relevant civil society organisations on behavioural, social and cultural change. They will jointly analyse social and behavioural change processes, share good practice, tools and resources and implement behavioural experimentation on priority issues to deliver on the Green Deal. They should build on already existing networks and experience, notably stemming from EU-funded projects.

Provision will be made for [x] case studies (experimentation) on behavioural, social and cultural change, each implemented in an average of [y] Member States or associated countries. Specific topics for case studies will be co-decided with the EC services involved in implementing the Green Deal. They will 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 elder generation, as well as both urban and rural areas, will be considered and included. Gendered issues will receive specific consideration. Change at the workplace will also be addressed, as well as from collective entities such as the behaviour of businesses, public services and other organisations.

A balanced overall coverage of EU and associated countries will be sought. National and local governments and administrations will be associated, including, to the extent possible, links with similar initiatives at their levels and with their policy and regulatory action. Experimentations should also build on the bottom-up initiatives stemming from groups of citizens, notably from the younger generation, as well as from various communities and organisations.

Experts will design methodologies for each individual exercise, relying on comparative analysis of international best practice and involving people or groups concerned. Depending on specific objectives, they may either ensure consistency across Member States for transnational comparability, or select a range of different methodologies to compare their effectiveness.

All relevant factors of behaviour change need to be considered. Successful proposal should thus propose a transdisciplinary approach to behaviour change, looking at system dynamics and integrating historical, cultural, societal, economic and psychological perspectives. Disciplines such as anthropology, cultural psychology, cultural studies, semiotics and sociology, as well as gender studies and intersectional research, should be included to pay due attention to cultural change as one of the crucial preconditions of behaviour change, whereas engaging social and economic psychology will be necessary to establish a more nuanced concept on the 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 behaviour change will be considered and may lead to policy and regulatory recommendations. Projects should address the feedback-loops between behaviour change and evolutions of the broader context.

An advisory board will ensure the scientific soundness, ethical and unbiased character of the planned experiments, and they will vet the methodologies and conditions of implementation of each individual exercise.

Research teams will study each individual exercise, assess and compare their results across the Member States and provide feedback and recommendations.

Coordination and cooperation will be expected between funded projects under this topic and others of this area, since behavioural, social and cultural change are often directly linked with deliberation, engagement and activism. This may encompass limiting features such as the advisory board to a single one to advise and ensure consistency across the projects.

Expected Impact

To succeed, the Green Deal requires substantial behaviour 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 indicators to measure the impact of their work. For example, they are expected to contribute to one or several of the Sustainable Development Goals[[40]](#footnote-40).

Specific impacts include:

* Structured transdisciplinary expertise, research and practice networks of the highest ethical and methodological standards across Europe on the above.
* A more nuanced view of mindset and behavioural change mechanisms through the lens of transdisciplinary research that integrates historical, cultural, societal, economic and psychological perspectives
* New strategies to induce behaviour change and long-term commitment, trust and buy-in from people, communities and organisations.
* Innovative recommendations and incentives that consider differences between EU regions and social groups e.g. in terms of urgency perceptions
* Bottom-up approaches to manage, inter alia, the uncertainty derived from climate change.
* Greater societal resilience against climate change and environmental crises
* Behaviour change at both individual and collective levels, among citizens, communities, workplace, decision makers and institutional actors, also contributing to systemic change at the level of political and economic structures, culture and society.

Action type: RIA

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

***Individual level action***

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 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, and civic involvement**. 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**, 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, by promoting biodiversity protection, nature-based solutions for climate resilience, sustainable energy consumption, waste management, etc.

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 and environmental protection by sharing their knowledge, experience and engagement with their families, local communities, and with public and private decision makers. As recommended in the **European Green Deal Communication**, 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.

**Citizen science** is a powerful tool for climate action and environmental protection through civic involvement. 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 and to educate in science. 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 further broad use. 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 and of the European Climate Pact to engage citizens and communities in action addressing climate change and environmental protection. The proposed activities will build on existing initiatives and practices that demonstrate innovation teaching and learning methods and how to engage the wider community in the changes needed for a successful and just transition, as for example the European Ocean Literacy platform[[41]](#footnote-41), the European Atlas of the Seas[[42]](#footnote-42), the citizen science platform[[43]](#footnote-43), the Horizon 2020 project TeRRIFICA[[44]](#footnote-44), EUSchoolnet[[45]](#footnote-45), Scientix[[46]](#footnote-46), resources for nature-based solutions in education[[47]](#footnote-47), 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 areas:

1. **Area 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 learning[[48]](#footnote-48), especially natural science, technology, mathematics, as well as social, entrepreneurial and citizenship 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 our natural resistance to behavioural changes, as well as the gender gap observed in attitudes towards ecology and sustainable practices, contributions and practical knowledge provided by non-academic stakeholders, and international best practices, will be important.

1. **Area 2: Enabling citizens to act on climate change through better monitoring and observing of the environment and their environmental impacts**

Actions in this area will target the involvement of citizens in climate- and environment-related issues and domains, such as biodiversity, marine and freshwater pollution and sustainable food. 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, in cooperation with businesses, civil society organisations and public authorities to ensure that these actions will lead to examples on how to engage the wider community in the effective behavioural changes needed for a successful and just transition. The key component of this area 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**. Actions should include the **development and/or improvement of devices** (low-cost sensors, consumer apps, etc.) 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.

Expected Impact:

Area 1:

* a multidisciplinary **European competence framework** within the context of lifelong learning for the development and assessment of the knowledge, skills and attitudes of citizens and in particular young people on climate change, sustainable development and environmental protection;
* the framework will serve as a **reference tool** for the Member States, stakeholders and NGOs to help citizens to become engaged actors in the green transformation of society;
* based on the framework, the development of **specific educational programmes, curricula, trainings, networking activities and exchange of good practices**;
* by undertaking a process of consultation and **implementation of this framework by schools, universities, municipalities**, public authorities in cooperation with the private sector, teachers, trainers, students, pupils, parents and the wider community will engage and realise the **behavioural changes** needed for a successful transition;
* the participation of pupils and students, supported by scientists and educators, in **intergenerational dialogues and exchanges** on climate action, environmental protection and behavioural changes for sustainable development;
* testing of the framework at **concrete demonstration sites** (e.g. in schools, universities and identified education communities) and in **innovative activities** (e.g. incubators for citizen, informal youth city councils…).

Type of Action: Research and innovation action

Area 2:

The project results are expected to contribute to:

* 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** (such as 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, etc.);
* 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 and consumers 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

# **Area 11: International cooperation**

## **11.1. Accelerating the green transition and energy access Partnership with Africa**

Specific challenge:

As recognised in the Joint Communication for a Comprehensive Strategy with Africa (adopted on 9/3/2020), 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 based and inefficient technologies. The present R&I Partnership on Climate Change and Sustainable Energy of the EU/AU High-Level Policy Dialogue on Science, Technology and Innovation is expected to strongly contribute to Action 1 of the Comprehensive Strategy with Africa.

The African continent has an enormous renewable energy potential that it has just began to successfully harness. The adoption of innovative, affordable, efficient and renewable energy solutions will support Africa achieving sustainable development growth and economic transformation. This will also help Africa addressing the urgency of climate change actions and mitigating its effects.

As Africa still faces major challenges related to (ensuring access to sustainable energy for all, and the development of its industrial base to create much needed jobs. In line with the Africa-Europe Alliance for sustainable investment and jobs, the EU-AU R&I Partnership on Climate Change and Sustainable Energy wants to support the development of sustainable energy solutions adequate to the African context that would address those challenges.

Experience has shown that existing innovative solutions and technologies developed for developed markets need to be adapted, tailored and demonstrated to the multi-faceted context of Africa to bring not only economic, but also environmental and health benefits. For facilitating market uptake and sustained deployment of technologies, R&I policies need to be coupled with capacity building and appropriate financing solutions. Additional considerations towards affordability, distribution channels as well as meaningful engagement of civil society in the implementation of research proposals are also key for the success of possible technology solutions. Attracting private investors towards sustainable energy solutions will contribute to a sustainable economic development benefitting 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:

The proposals to be funded under this topic will cover the demonstration of innovative climate adaptation, climate mitigation and sustainable energy solutions, in the African social, economic and environmental contexts. The solutions could address developments in the areas of renewable energy sources and their integration into existing energy system, energy efficiency in particular in urbanised contexts, the water-energy-food nexus, with the aim of providing sustainable energy access (electricity/cooking) or creating economic wealth and jobs (productive use of energy/energy efficiency).

Beside the activities related to the design, construction, commissioning and operation of the demonstration installation, the proposals are expected to 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, local workforce with the objective to assure local sustainable economic development. The latter should also include the identification of technical, vocational and educational needs of the workforce and propose relevant training and qualification activities. The proposals are also expected to define its market strategy and its business strategy to ensure a quick and viable commercial take up of the technological solution demonstrated.

Proposals shall include a life cycle analysis showing the impacts of the proposed solutions on the environment, on climate change targets, and on the social and the economic dimensions, from a cradle to grave viewpoint. Where relevant, proposals will consider adopting a circular economy approach, aligned with the EU Green Deal priorities.

In addition, proposals will need to demonstrate the benefits of the proposed solutions with particular regard to the Sustainable Development Goals 4, 5, 7, 8, 11, 12, 13.

Funded proposals will participate and contribute to the EU/AU Partnership on Climate Change and Sustainable Energy.

Expected impacts:

The short-term impact of the proposals will be to provide evidence of technological reliability, economic viability, and of the environmental, climate, social and economic impacts of its renewable energy solutions. They are expected to contribute to the strengthening of the joint EU-AU Climate Change and Sustainable Energy Partnership efforts, with emphasis of improving the visibility of EU Science Diplomacy actions in Africa.

The medium term impact will be in the creation of new markets opportunities for both European and African companies in the African continent and technological uptake to accelerate the achievements of the targets of the Paris Agreement for both continents, in line with Europe’s Green Deal ambition of climate neutrality, and its external dimensions.

Economic growths and job creation, both in the EU and in African third countries are also expected in the longer term.

1. 7–16 Gt CO2-eq per year <https://www.sciencedirect.com/science/article/pii/S1674927818300376> [↑](#footnote-ref-1)
2. JRC’s PESETA II Project: Climate Impacts in Europe (2014). [↑](#footnote-ref-2)
3. Based on CBD guidance on ecosystem restoration https://www.cbd.int/doc/decisions/cop-14/cop-14-dec-05-en.pdf [↑](#footnote-ref-3)
4. 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 [↑](#footnote-ref-4)
5. such as from calls LC-CLA-15-2020 and H2020 SU-DRS02-2018-2019-2020 [↑](#footnote-ref-5)
6. https://ec.europa.eu/echo/what-we-do/civil-protection/forest-fires\_en [↑](#footnote-ref-6)
7. <http://www.earthobservations.org/documents/gwp20_22/GWIS.pdf> [↑](#footnote-ref-7)
8. <http://www.earthobservations.org/documents/gwp20_22/SPACE-SECURITY.pdf> [↑](#footnote-ref-8)
9. <https://www.internationalresponderforum.org> [↑](#footnote-ref-9)
10. https://ec.europa.eu/clima/policies/strategies/2050\_en [↑](#footnote-ref-10)
11. https://ec.europa.eu/commission/sites/beta-political/files/political-guidelines-next-commission\_en.pdf [↑](#footnote-ref-11)
12. 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). [↑](#footnote-ref-12)
13. E.g. Smart Cities Marketplace and its Matchmaking facility: <https://eu-smartcities.eu> [↑](#footnote-ref-13)
14. https://www.covenantofmayors.eu [↑](#footnote-ref-14)
15. https://ec.europa.eu/digital-single-market/en/news/join-boost-sustain-european-way-digital-transformation-cities-and-communities [↑](#footnote-ref-15)
16. 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 [↑](#footnote-ref-16)
17. including Sustainable Urban Mobility Plans (see https://www.eltis.org/) [↑](#footnote-ref-17)
18. e.g. CIVINETS: <https://civitas.eu/civinet> [↑](#footnote-ref-18)
19. World Economic Forum 2019 - Global Risks Report [↑](#footnote-ref-19)
20. IPCC 2018 - Special Report on Global Warming of 1.5 ºC [↑](#footnote-ref-20)
21. 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 [↑](#footnote-ref-21)
22. Low carbon energy and feedstock for the European chemical industry, DECHEMA 2017 [↑](#footnote-ref-22)
23. <https://www.chathamhouse.org/publication/promoting-just-transition-inclusive-circular-economy> [↑](#footnote-ref-23)
24. <https://ec.europa.eu/research/environment/index.cfm> [↑](#footnote-ref-24)
25. i.e. amount of investments in each circular systemic solution triggered per each EUR of Horizon 2020 PDA support. [↑](#footnote-ref-25)
26. [↑](#footnote-ref-26)
27. “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) [↑](#footnote-ref-27)
28. See SOER 2020, IPBES (2018, 2019) [↑](#footnote-ref-28)
29. Based on CBD guidance on ecosystem restoration [↑](#footnote-ref-29)
30. In particular assessments in preparation, policy tools and capacity building. [↑](#footnote-ref-30)
31. “Up-scaling” means here substantial increase in area of restored ecosystem, whether in size or number of measures per area. [↑](#footnote-ref-31)
32. See SC5-27-2020, CLA-11-2020, SC5-13-2018-2019, SCC-02-2016-2017, Oppla, NetworkNature. [↑](#footnote-ref-32)
33. For socio-economic benefits restoration to improving ecosystem services, see e.g. SWD(2019)305 final [↑](#footnote-ref-33)
34. 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. [↑](#footnote-ref-34)
35. Section 5.6 of the Commission Communication on the EU strategic approach to pharmaceuticals in the environment COM(2019) 128 final, 11.03.2019. [↑](#footnote-ref-35)
36. [ICOS](https://www.icos-ri.eu/) Integrated Carbon Observation System; [ACTRIS](https://www.actris.eu/) Aerosols, Clouds and Trace gases Research Infrastructure; [IAGOS](https://www.iagos.org/) In-Service Aircraft for a Global Observing System. [↑](#footnote-ref-36)
37. [CO2 Green Report 2019](https://www.copernicus.eu/en/news/news/new-co2-green-report-2019-published) [↑](#footnote-ref-37)
38. such as COPERNICUS (including the CO2 monitoring Task Force), GEOSS and IG3IS framework of WMO. [↑](#footnote-ref-38)
39. <http://www.un.org/sustainabledevelopment/sustainable-development-goals/> [↑](#footnote-ref-39)
40. <http://www.un.org/sustainabledevelopment/sustainable-development-goals/> [↑](#footnote-ref-40)
41. <https://webgate.ec.europa.eu/maritimeforum/en/node/4484> [↑](#footnote-ref-41)
42. <https://webgate.ec.europa.eu/fpfis/wikis/display/AtlasOfSeas/> [↑](#footnote-ref-42)
43. https://eu-citizen.science/ [↑](#footnote-ref-43)
44. https://cordis.europa.eu/project/id/824489 [↑](#footnote-ref-44)
45. http://www.eun.org/ [↑](#footnote-ref-45)
46. http://scientix.eu/ [↑](#footnote-ref-46)
47. https://oppla.eu/ [↑](#footnote-ref-47)
48. <https://ec.europa.eu/education/education-in-the-eu/council-recommendation-on-key-competences-for-lifelong-learning_en> [↑](#footnote-ref-48)