Horizon EUROPE - Specific Programme

proposal for a Decision of the Council [ST_8550/19_INIT]

PILLAR II - Global Challenges and European Industrial Competitiveness

CLUSTER 5 – Climate, Energy and Mobility

The EU is confronted by many challenges, some of which are also global challenges. The scale and complexity of the problems are vast, need to be tackled jointly and matched by adequate, properly trained and skilled human resources, by the appropriate amount of financial resources and a proportionate effort in order to find solutions. These are precisely the areas where the EU must work together; smart, flexible and joined-up for the benefit and well-being of all our citizens.

Greater impact can be obtained through aligning actions with other nations and regions of the world within international cooperation along the lines indicated by the United Nations 2030 Agenda for Sustainable Development and the Sustainable Development Goals and the Paris climate agreement. Based on mutual benefit, partners from across the world will be invited to join EU efforts as an integral part of research and innovation for sustainable development.

Research and innovation are key drivers of sustainable and inclusive growth and technological and industrial competitiveness. They will contribute to finding solutions to today's problems, and the problems of tomorrow, in order to reverse as quickly as possible, the negative and dangerous trend that currently links economic development with the growing use of natural resources and growing social challenges. This will turn the challenges into new business opportunities and into rapid benefits for society.

The EU will benefit as user and producer of knowledge, technologies and industries showcasing how modern industrialised, sustainable, inclusive, creative, resilient, open and democratic society and economy can function and develop. The growing economic-environmental-social examples of the sustainable economy of the future will be fostered and boosted, be they for: health and well-being for all; or resilient, creative and inclusive societies; or societies strengthened by civil security; or available clean energy and mobility; or a digitised economy and society; or a transdisciplinary and creative industry; or space-related, marine or land-based solutions; or a well-functioning bioeconomy, including food and nutrition solutions; sustainable use of natural resources, protection of the environment, climate change mitigation and adaptation, all generating wealth in Europe and offering higher quality jobs. Industrial transformation will be crucial, as well as developing EU innovative industrial value chains.

New technologies affect virtually all policy areas. For each separate technology there is often a combination of social and economic opportunities, opportunities for efficiency and quality and improvement of the government, consequences for employment and education, but also possible risks for safety, privacy and ethics. Technology policy therefore necessarily requires an integral weighing of interests, and cross-sectoral cooperation and strategy formulation.

Research and innovation under this pillar of Horizon Europe is grouped into integrated, non-siloed broad clusters of activities. Rather than addressing sectors, the investments aim at systemic changes for our society and economy along a sustainability vector. These will only be achieved if all actors, both private and public, engage in co-designing and co-creating research and innovation; bringing together end-users, scientists, technologists, producers, innovators, businesses, educators, policy-makers, citizens and civil society organisations. Therefore, none of the clusters is intended for only one set of actors and all activities will be implemented primarily by collaborative research and innovation projects selected on the basis of competitive calls for proposals.

In addition to addressing global challenges, activities in the clusters will also develop and apply, key enabling and emerging technologies (either or not digital-based) as part of a common strategy to promote the EU's industrial and social leadership. Where appropriate this will use EU space-enabled data and services. All TRL levels up to 8 will be covered in this pillar of Horizon Europe without prejudice to Union competition law.

Actions will generate new knowledge and develop technological and non-technological solutions, bring technology from lab to market and to develop applications including pilot lines and demonstrators, and include measures to stimulate market uptake and to boost private sector commitment and incentives to standardisation activities within the Union. Technologies require critical mass of European researchers and industry to establish world leading eco-systems, that include state of the art technology infrastructures e.g. for testing. Synergies with other parts of Horizon Europe and the EIT, as well as other programmes will be maximised.

The clusters will boost the quick introduction of first-of-its-kind innovation in the EU through a broad range of embedded activities, including communication, dissemination and exploitation, standardisation as well as support to non-technological innovation and innovative delivery mechanisms, helping create innovation friendly societal, regulatory and market conditions such as the innovation deals. Pipelines of innovative solutions originating from research and innovation actions will be established and targeted to public and private investors as well as other relevant EU and national or regional programmes. Synergies will be developed with the third pillar of Horizon Europe in that perspective.

Gender equality is a crucial factor in order to obtain sustainable economic growth. It is therefore important to integrate a gender perspective in all global challenges.

Cluster 6: 'Climate, Energy and Mobility'

5.1 Rationale

The intersection of research and innovation on climate, energy and mobility will address in a highly integrated and effective way, one of the most important global challenges for the sustainability and future of our environment, economy and way of life.

To meet the objectives of the Paris Agreement the EU will need to transition to climate neutral, resource-efficient and resilient economies and societies. This will entail profound changes in technology, processes, products and services, to the ways in which businesses and consumers behave. The transformation of the energy market will take place through interaction of technology, infrastructure, the market as well as policy and regulatory frameworks, including new forms of governance. Pursuing efforts to limit the temperature increase to 1.5°C, requires rapid progress in decarbonising the energy, transport, buildings, industrial and agriculture sectors. New impetus is needed to accelerate the pace of developing next-generation breakthroughs as well as demonstrating and deploying cost-efficient innovative technologies and solutions, using also the opportunities provided by digital, bio and space technologies, as well as key enabling technologies and advanced materials. This will be pursued through an integrated approach encompassing decarbonisation, resource efficiency, improved recovery, reuse and recycling, reduction of air pollution, access to raw materials and circular economy in Horizon Europe.

Progress in these sectors - but also across the spectrum of EU industry including energy infrastructures, transport, agriculture and forestry, tourism, buildings, industrial processes and product use, waste management and recycling15 - will require continued efforts to better understand the mechanisms and dynamics of climate change and the associated impacts across the economy and society, exploiting synergies with regional and national activities, other EU types of actions and international cooperation, including through Mission Innovation.

Over the past decades, considerable advances have been made in climate science, in particular in observations and data assimilation and climate modelling. However, the complexity of the climate-system and the need to support implementation of the Paris Agreement, the Sustainable Development Goals and EU policies necessitate a reinforced effort to fill the remaining knowledge gaps, further enhance spatial and temporal granularity of climate science while ensuring adequate interaction with citizens and other stakeholders.

The EU has established a comprehensive policy framework in the Energy Union strategy, with binding targets, legislative acts and research and innovation activities aiming to lead in developing and deploying efficient energy production systems based on renewable and alternative energy16.

Transport, including vehicles, ensures the mobility of people and goods necessary for an integrated European single market, territorial cohesion and an open and inclusive society. At the same time, transport can have significant effects on human health, congestion, land, water, climate, air quality and noise, as well as safety resulting in numerous premature deaths and increased socio-economic costs. Demand for goods and mobility will continue to grow. Therefore, innovation will have to bridge

growing demand with cleaner and more efficient mobility and transport systems that need to be also safe, smart, secure, silent, reliable, accessible, inclusive and affordable, offering a seamless integrated door-to-door service to all.

Both sectors are major drivers of Europe's economic competitiveness and growth. Transport is a fundamental sector for and of the economy with the EU being a world leader in vehicle, rail, aircraft and vessel design and manufacturing. It embraces a complex network of around 1.2 million private and public companies in the EU, employing around 10.5 million people. The sector is also important for the EU's international trade: in 2016, 17.2% of the EU's total exports of services were transport related. At the same time, the EU has upwards of 2 million people working in the field of renewables and energy efficiency, while patenting of innovative clean energy technologies, places the EU in second place worldwide.

The issues faced by the energy and transport sectors go therefore beyond the need for emission reduction. Effective solutions are needed to respond to changes in user behaviour and mobility patterns, globalisation, increasing international competition and an older, more urban and increasingly diverse, population. At the same time, the increasing penetration of digital and space-based technologies, automated vehicles, Artificial Intelligence, robotics, new market entrants, disruptive business models and the need for increased system resilience against multifaceted hazards (including cyber threats) bring substantive transformation and create challenges and opportunities for the competitiveness of the European transport and energy sectors.

Cities' ability to function will become dependent on technology and the liveability of cities will evolve around mobility, energy and resource efficiency, spatial planning and competition in space use. Developments will also be posing a challenge to the sustainability of existing social models and social participation, aspects of inclusion and accessibility as well as affordability.

Finding new ways to accelerate the deployment of renewable energy-based and energy efficient technologies (including through intermediate carriers such as power-to-gas and hydrogen) and other non-technological solutions for the decarbonisation of the European economy requires also increased demand for innovation. This can be stimulated through the empowerment of citizens, greening of public procurement as well as socio-economic and public sector innovation and will lead to approaches broader than technology-driven innovation. Socio-economic research covering inter alia user needs and patterns, foresight activities, environmental, regulatory, economic, social, cultural and behavioural aspects, business cases and models and pre-normative research for standard setting and market uptake innovation, will also facilitate actions fostering regulatory, financing and social innovation, skills, as well as engagement and empowerment of market players, consumers and citizens. A better coordination, complementarity and synergy between national and European research and innovation efforts by promoting information exchange and cooperation among EU countries, industries and research institutions will build on the achievements of e.g. the SET-Plan and the Strategic Transport Research and Innovation Agenda (STRIA). Complementarity between this cluster and the EU ETS Innovation Fund will be ensured.
Activities under this Cluster contribute in particular to the goals of the Energy Union, the Paris Agreement commitments as well as to those of the Digital Single Market, the Jobs, Growth and Investment agenda, the strengthening of the EU as a global actor, the new EU Industrial Policy Strategy,

the Bioeconomy Strategy, the Circular Economy Action Plan, the European Battery Alliance Initiative, the Raw Materials Initiative, the Security Union and the Urban Agenda, as well as the Common Agricultural Policy of the EU as well as EU legal provisions to reduce noise and air pollution.

Activities will contribute directly to the following Sustainable Development Goals (SDGs) in particular: **SDG 6** - Clean water and sanitation; **SDG 7** - Affordable and Clean Energy; **SDG 9** - Industry, Innovation and Infrastructure; **SDG 11** - Sustainable Cities and Communities; **SDG 12** – Responsible consumption and production; **SDG 13** - Climate Action.

5.2 Areas of Intervention

5.2.1 Climate Science and Solutions

Effective implementation of the Paris Agreement has to be based on science, requiring continuously improving of our knowledge on the climate-earth system, as well as the mitigation and adaptations options available, allowing for a systemic and comprehensive picture of challenges and climate-responsible opportunities for the EU's economy and society. On this basis, science-based solutions for a cost-effective transition to a climate neutral, climate-resilient and resource-efficient society will be developed, considering behavioural, regulatory, socio-economic and governance aspects.

BROAD LINES:

- Knowledge base on the current functioning and future evolution of the earth-climate and living system, as well as associated impacts, risks, and climate-responsible opportunities; effectiveness of different climate mitigation and adaptation solutions;
- Integrated climate neutral pathways, mitigation actions and policies covering all sectors of the economy, compatible with Earth system analyses, the Paris Agreement and the United Nations Sustainable Development Goals;
- Climate models, projections and techniques aiming to improve predictive capacity and climate services for businesses, public authorities and citizens, including cross-cutting aspects with air quality improvement;
- Adaptation pathways and support policies for vulnerable ecosystems, urban areas, critical economic sectors and infrastructure in the EU (local/regional/national), including improved risk assessment tools; water cycle and adaptation to climate change, such as flooding and water scarcity.

5.2.2 Energy Supply

The EU aims to be world leader in affordable, secure and sustainable energy technologies improving its competitiveness in global value chains and its position in growth markets. Diverse climatic, geographical, environmental and socio-economic conditions in the EU as well as the need to ensure climate resilience, energy security and access to raw materials, dictate a broad portfolio of energy solutions, including of non-technical nature. As regards renewable energy technologies, costs need to decrease further, performance must improve, integration into the energy system must be improved, breakthrough technologies need to be developed, benefiting also from advances in photonics, and hybrid solutions (e.g. for desalination) should be explored. As regards fossil fuels, decarbonising their usage is essential to meet the climate objectives.

BROAD LINES:

- Renewable energy and energy conservation technologies and solutions for power generation, heating and cooling, sustainable transport fuels and intermediate carriers, at various scales and development stages, adapted to geographic and socio-economic conditions and markets, both within the EU and worldwide;
- Disruptive renewable energy technologies for both existing and new applications and for breakthrough solutions including their environmental, economic and social impact;
- Technologies and solutions to reduce greenhouse gas emissions from fossil fuel-based as well as from bio- and waste-to-energy-based approaches producing power, heating, cooling or biofuels including via carbon capture, utilisation and storage (CCUS) and studies of socio-economic and ecological feasibility.

5.2.3 Energy Systems and Grids

The expected growth of variable electricity production and shift towards more electric heating, cooling and transport dictates the need for new approaches to manage energy grids. Next to decarbonisation, the goal is to ensure energy affordability, security, climate resilience, and stability of supply, achieved through investments in innovative network infrastructure technologies, increased flexibility of dispatchable power generation, notably from renewable sources and innovative system management as well as by facilitating actions fostering regulatory and social innovation, skills, and engaging and empowering market players, consumers and communities. Energy storage in different forms will play a key role in providing services to the grid, also improving and reinforcing network capacities and system flexibility. Exploiting synergies between different networks (e.g. electricity grids, heating and cooling networks, gas networks, transport recharging and refuelling infrastructure, hydrogen, including its infrastructure, and telecom networks) and actors (e.g. industrial sites, network operators, data centres, self-producers, consumers, renewable energy communities) as well as demand-response and developing and integrating European and international standards will be crucial for enabling the smart, integrated operation of the relevant infrastructures.

BROAD LINES:

- Technologies and tools for networks to integrate renewables, storage solutions and new loads such as electro-mobility and heat pumps as well as the electrification of industrial processes;
- Multidisciplinary approaches to regionally dependent climate change related impact to energy security, including adaptation of existing technologies, as well as transition into the new energy supply paradigms;
- Pan-European energy network approaches to reliable energy supply, transmission and distribution;
- Integrated approaches to match renewable energy production and consumption at local level including on islands or remote regions, based on new services and community initiatives;
- Generation and network flexibility, interoperability and synergies between the different energy sources, networks, infrastructures and actors, also exploiting specific technologies;
- Technologies, services and solutions empowering consumer to be an active market player.

5.2.4 Buildings and Industrial Facilities in Energy Transition

Buildings and industry installations play an increasingly active role in their interaction with the energy system. Therefore, they are crucial elements in the transition to a carbon-neutral society based on renewable energy and increased energy efficiency.

Buildings are an important factor for quality of life of citizens. Integrating different technologies, appliances and systems and linking various energy uses, buildings as well as their inhabitants and users represent a very high potential for climate change mitigation, energy generation, energy savings, storage, system flexibility and efficiency improvements.

Industries, and especially those that are energy-intensive, could further improve energy efficiency, reduce their energy consumption and favour the integration of renewable energy sources. Industrial facilities' role in the energy system is changing, due to the need to reduce emissions, based on direct or indirect electrification, also a source of materials for production processes (e.g. hydrogen). Industrial and manufacturing complexes where many different processes take place near to each other can optimise the exchange of flows of energy and other resources (raw materials) between them.

BROAD LINES:

- Improve sector coupling : Processes, systems and business models supporting flexibility and efficiency of electricity and heat flows between an industrial plant or industrial clusters and the energy as well as transport system;
- Tools and infrastructure for process control of production plants to optimise energy flows and materials in interaction with the energy system;
- Relevant processes, design and materials, including low- and zero- emission industrial processes;
- Flexibility and efficiency of electricity, feedstock and heat in industrial plants and the energy system;
- Improved or new processes, design and materials to efficiently use, produce or store energy (including heat and cold) in sectors not covered by the "Digital, Industry and Space" cluster;
- Strategies and low emission technologies for revitalising coal- and carbon-intensive areas in transition;
- Smart buildings and large mobility hubs (ports, airports, logistic centres) as active elements of wider energy networks and of innovative mobility solutions;
- Buildings life-cycle design, construction, operation, including heating and cooling, and dismantling, taking into account circularity, energy and environmental performance, as well as indoor environmental quality, for energy and resource efficiency, for well-being and health impact on the inhabitants, climate resilience, carbon footprint and recycling; development and optimization of novel advanced materials to increase the energy, carbon and environmental performances of buildings over the life cycle;;
- New business models, approaches and services for renovation financing, enhancement of construction skills, engagement of buildings occupants and other market actors, addressing energy poverty and prenormative activities;
- Energy performance of buildings monitoring and control technologies for optimising energy consumption and production of building as well as their interaction with the overall energy system;
- Tools and smart appliances for energy efficiency gains in buildings;

- Renovation processes of existing buildings towards 'Nearly Zero Energy Buildings' and innovative technologies, including social aspects, e.g. citizen empowerment, and consumer awareness and engagement.

5.2.5 Communities and Cities

It is estimated that by 2050, more than 80% of the EU's population will live in urban areas, consuming the lion's share of available resources, including energy, and being areas particularly vulnerable to the adverse meteorological change impacts worsen by climate change and natural disasters already now and increasingly in the future. A key challenge is to significantly increase the overall energy and resource efficiency as well as climate-resilience of Europe's communities and cities in a systematic and holistic approach, targeting the building stock, energy systems, mobility, climate change, migration, as well as water, soil, air quality, waste and noise, taking into account Europe's cultural heritage, sustainable tourism management, social sciences, humanities and arts aspects, including lifestyle. Synergies with ERDF-funded urban policy and actions should be investigated and exploited.

BROAD LINES:

- City/district energy/mobility systems towards the EU-wide deployment of carbon neutral, Positive Energy Districts and zero-emission mobility and logistics by 2050, boosting the global competitiveness of integrated EU solutions;
- Systemic urban planning, infrastructures systems and services including mutual interfaces and interoperability, standardisation, nature-based solutions and the use of digital technologies and space based services and data, taking into account the effects of projected climate change and integrate climate resilience and the influence on air and water quality;
- Quality of life for the citizens, safe, flexible, accessible and affordable energy and multi-modal mobility, urban social innovation and citizen engagement, cities' circular and regenerative capacity, urban metabolism and reduced environmental footprint and pollution;
- Global cities research agenda; mitigation, adaptation and resilience strategy development, spatial planning and other relevant planning processes.

5.2.6 Industrial Competitiveness in Transport

The shift towards clean technologies, connectivity and automation will depend on the timely design and manufacture of aircraft, vehicles, and vessels developing new breakthrough technologies and concepts, integrating different technologies and accelerating their introduction and marketability. Increasing comfort, efficiency, affordability, while minimising lifecycle impact on the environment, human health and on energy use remain objectives of paramount importance. Innovative, highly capable transport infrastructure is essential for the proper functioning of all transport modes in view of increased mobility demand and rapidly changing technology regimes. An integrated approach to infrastructure and vehicle/vessel/aircraft development deserves particular attention also in order to provide high quality mobility services and to minimise energy environmental, economic and social impact.

BROAD LINES:

- Merging of physical and digital vehicle/vessel/aircraft design, development and demonstration, manufacturing, operations, standardisation, certification and regulations and integration (including integration between digital design and digital manufacturing);
- Vehicle/vessel/aircraft concepts and designs, including their spare parts and software and technology updates, software solutions; using improved materials and structures, recycling/reusing materials; efficiency, energy storage and recovery, safety and security features considering users' needs, with less impact on climate, environment and health, including noise and air quality;
- On-board technologies and sub-systems, including automated functions, for all modes of transport taking account of relevant infrastructure interface needs and exploring; technological synergies between modes; multi-modal transport systems; safety/accidence avoidance systems and enhancing cybersecurity; leveraging progress in information technologies, and in artificial intelligence; developing the human-machine interface;
- New materials, techniques and methods of construction, operations and maintenance of infrastructures, ensuring reliable network availability, intermodal interfaces and multimodal interoperability, workforce safety, and full life-cycle approach;
- Addressing issues of merging physical and digital infrastructure design and development, infrastructure maintenance, regeneration and upgrading transport integration, interoperability and intermodality, resilience to extreme weather events, including adaptation to climate change.

5.2.7 Clean, Safe and Accessible Transport and Mobility

For the EU to reach its air quality, climate, and energy goals, including reaching net-zero emissions by 2050 as well as noise reduction, will require rethinking the whole mobility system including users' needs and behaviours, vehicles, fuels, infrastructures as well as new mobility solutions. It will also require the deployment of low-emission alternative energies and market uptake of zero-emission vehicles/vessels/aircrafts. In addition to the effects of greenhouse gas emissions, transport contributes significantly to poor air quality and noise in Europe with negative consequences for the health of citizens and ecosystems. Building on progress with electrification and the use of batteries and fuel cells for cars, buses and light duty vehicles, accompanied by adequate standards, it is essential to accelerate research and innovation low-emission solutions for other road applications (long distance coaches, heavy freight vehicles and lorries) and other transport sectors such as aviation, rail, maritime and inland navigation. Transport safety research aims at reducing accident rates, fatalities and casualties in each mode and in the whole transport system by furthering knowledge and awareness and by developing technologies, products services and solutions that reconcile safety, efficiency, user-friendliness and climate change.

BROAD LINES:

- Electrification of all transport modes including new battery, fuel cell and hybrid technologies for vehicle/vessel/aircraft powertrains and auxiliary systems, fast charging/refuelling, energy harvesting and user-friendly and easily accessible interfaces with the charging/refuelling infrastructure, ensuring interoperability and seamless services provision; development and deployment of competitive, safe, high-performing and sustainable batteries for low and zero-emission vehicles considering all the conditions of using and during the different phases of its life cycle; development and deployment of competitive, safe, high-performing and sustainable batteries for low and zero-emission vehicles;

- Use of new and alternative sustainable fuels, including advanced bio-fuels and new, safe and smart vehicles/vessels/aircraft for existing and future mobility patterns and supporting infrastructure with reduced impact on the environment and public health; niche components and systems for environmentally friendly solutions (e.g. advanced data gathering systems, etc.) technologies and user-based solutions for interoperability and seamless services provision;
- Safe, accessible, inclusive and affordable mobility, reducing the harmful whilst enhancing the positive impact of mobility on social cohesion, the environment and human health, including shift to less polluting modes of transport and sharing schemes; Quality of life for the citizens, urban social innovation; the interest to reduce or to eliminate accidents and injuries in road transport.
- Climate resilient mobility systems, including infrastructures and logistics, to assure better connectivity for persons and goods, both on short and long haul distances;
- Systemic analysis of new mobility patterns and their impact on transport and citizens.

5.2.8 Smart Mobility

Smart mobility will help ensure the efficiency, safety and resilience of door-to-door mobility and all its components, in particular by using digital technologies, advanced satellite navigation (EGNOS/Galileo), and artificial intelligence. New technologies will help to optimise the use and efficiency of transport infrastructure and networks, improving multi-modality and connectivity and creating more efficient freight transport and logistic supply chain that will strengthen EU competitiveness. New technologies will also contribute to increasing reliability, optimising traffic management and enable innovative transport solutions and services, thus reducing congestion and negative environmental impacts, providing better mobility and logistics services for citizens and businesses improving accessibility and social inclusion. Connected and automated mobility together with the enabling infrastructure will improve efficiency and safety in all transport modes.

BROAD LINES:

- Digital network-and traffic management: advanced decision support systems; next generation traffic management (including multi-modal network and traffic management); contributing to seamless, multimodal and interconnected mobility for passengers and freight; use and limitations of big data; use of innovative satellite positioning/navigation (EGNOS/Galileo);
- Single European Sky: on-board and on-the-ground solutions for simultaneously higher degrees of automation, connectivity, safety, interoperability, performance, emission reduction and service;
- Rail technologies and operations for a high-capacity, silent, interoperable, and automated railway system;
- Smart shipping solutions for safer, more efficient waterborne operations;
- Large mobility hubs (e.g. railway stations, ports, airports, logistic centres) as active elements of innovative mobility solutions;
- Waterborne technologies and operations for safe and automated transport systems seizing the opportunities provided by waterborne transport;
- Connected, cooperative, interoperable and automated mobility systems and services, including technological solutions and non-technological issues, such as changes in user behaviour and mobility patterns.

5.2.9 Energy Storage

Massive, smart, concentrated and decentralised storage solutions (comprising chemical, electrochemical, electrical, mechanical and thermal and new disruptive technologies) for the energy system will increase efficiency, flexibility, technology independence and accessibility as well as the security of supply. Low-emission, decarbonised transport will require a growing share of electrical and/or other alternatively fuelled vehicles, with better-performing and cheaper, lighter, highly recyclable and reusable batteries with a low environmental impact, as well as local provision of alternative/renewable fuels such as hydrogen, including renewable based hydrogen, and innovative solutions for on-site storage. Options for the sustainable and cost efficient large scale energy storage solutions are essential to optimize and balance the energy system in all sectors of production, infrastructure up to end-user applications. Attention should be paid to the risks of energy storage and other unwanted side effects.

BROAD LINES:

- Technologies including liquid and gaseous renewable fuels and their associated value chains, as well as disruptive technologies, for daily to seasonal energy storage needs, including their impacts on the environment and climate;
- Smart, sustainable and durable batteries and the EU value chain, including the use of advanced material solutions, design, energy-efficient large-scale battery cell production technologies, reuse and recycling methods as well as efficient operation at low temperatures and standardisation needs;
- Hydrogen, in particular low carbon and renewable based hydrogen, including fuel cells, and the EU value chain from the design to end use across various applications.