Non-paper:
Contents proposal for Horizon Europe Cluster 5 – Climate, energy and mobility

FINLAND

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Purpose of this document

This non-paper aims mainly at communicating the Finnish views and stimulating discussion on the contents of the Horizon Europe, Cluster 5 work programme. General themes are also applicable and could be taken into account in the preparation of partnerships.

Promoting innovative research to reach short- and long-term societal goals and to create new business opportunities

The impact and effects of the output and outcomes of research should be at the core of all Horizon Europe funding, taking note of the urgent need for a systemic transition and research to support the transition. Calls for proposals should be formulated in such a way that allows for different kinds of research settings and the discovery of innovative solutions to achieve the desired societal impact. In practice, this means a technology-neutral approach, and interdisciplinary and transdisciplinary research and cross-sectoral approaches as prerequisites to reach the best possible social, environmental, and economic returns of the publicly funded research. Horizon Europe should also include demonstration and pilot activities in the coming calls for proposals.

Decarbonising the major systems of consumption and production and closing the emissions gap are currently the most pressing societal challenges for which R&D&I support is needed. To close the emissions gap, we need research and further development of all new regulatory and market- and information-based steering mechanisms in different sectors, including the investment sector. Here, understanding what systemic change is and what it requires is crucial. To this end, investigating the interplay between different instruments is critical. The positive effects of switching to sustainable technologies and practices need special attention: how to improve human and environmental wellbeing, how to implement sustainable technologies, and how to identify new business opportunities and create jobs.

The interconnectedness of climate change with other environmental problems such as biodiversity loss and human health problems deserves special attention. In addition to research related to mitigating climate change, we need research on the impacts of climate change on human and environmental resilience and health, on the resilience of infrastructure and economic systems, on natural resources, and on biodiversity. Furthermore, we need research on how biodiversity loss affects our resilience to climate change. We also need to recognise the interconnectedness of and need for integration in the planning of energy, mobility and transport systems, and of land use. Additionally, a key management question in Cluster 5 is how to link this research to support other clusters such as Clusters 1 and 6, which deal with themes intricately linked to climate.

R&D&I activities should provide solutions for reaching both **short- and long-term goals**. Both basic and applied research are necessary to find solutions for a carbon-neutral and, subsequently, carbon-negative society. Sustainability transitions are highly complex and uncertain processes. Systemic transitions typically occur through three stages: the emergence of novel practices or technologies, their diffusion and uptake across society, and the disruption and reconfiguration of established systems.

Given the urgency of the issues at hand, activities that allow a quick transition and that support the diffusion and uptake phase are highly imperative, since we already have clear long-term goals and guidelines. It is important to note that decarbonisation is not merely an issue of technological development and transition, but requires increasing inputs from, for example, socio-economic, behavioural and environmental research.

The role of industry and the private sector, in general, is crucial. There is a need for large-scale investments in the short term into industrial infrastructure in order to reach the EU carbon neutrality goals. All industrial value chains, including energy-intensive sectors, will need to work on reducing their own carbon footprint, while also accelerating the transition by providing affordable, clean technology solutions and by developing new business models. Companies of all sizes and all industrial sectors should be invited and offered incentives to participate in projects financed via the Horizon Europe work programmes.

An essential additional focus is **behavioural change** to accelerate the transition to a carbon neutral society. This is important at the level of individuals, but even more so at the level of governance and economic structures. Steering mechanisms should make climate-friendly choices easier and more accessible. Here, research is needed to increase the understanding of what drives individual (and decision-maker) behaviour. At the same time, research can show us how to create incentives and soft law instruments that allow changes at individual, household, community and regional levels towards more sustainable choices, and that drive the service transformation and the move towards reducing consumption. Future and foresight studies that present and produce alternative future visions, including participative and open foresight activities and collective forms of learning, are important. Furthermore, we need to focus more on the links between climate measures and social, taxation or employment policies to ensure the **acceptability** of the measures and **a just adaptation** between various societal actors.

The city and community level is crucial, as communities are key players in reducing emissions. In addition to the Member State level, assessments of climate change impacts (integrated assessment modeling) and climate change statistics should focus on the sub-regional level. The diversity of communities is an important aspect to keep in mind to allow for place-based innovations and smart specialisation.

Knowledge for a carbon-neutral and carbon-negative world

We need an overall understanding of climate change in the coming decades and in a carbon-negative world. This requires not only basic research on climate and climate change, but also applied research on the impacts of climate change on human and environmental health, on infrastructure and economic systems that provide our basic needs (e.g. food, energy, mobility), on natural resources, and on biodiversity. These impacts are context specific and vary across ecosystems, economies and societies. Key factors are vulnerability and resilience. We also need to look at carbon sinks, carbon storage, and how ecosystem functioning and bioenergy sources will change as the levels of atmospheric carbon dioxide are reduced.

Climate change, biodiversity loss, and other environmental and human health problems are interconnected. Any mitigation strategy that focuses on one part of this nexus without considering its interconnections risks serious unintended consequences. Nexus thinking requires investigating several environmental issues such as air quality, greenhouse gas emissions, biodiversity, and climate change together through an interdisciplinary and transdisciplinary approach. **Nature-based solutions** provide multiple benefits across the nexus from mitigation to bioremediation and human wellbeing and health. The idea of no-net loss in the integrity of ecosystems should be the basis for all solutions.

A multifaceted and interoperable knowledge base is necessary. We need continuous emissions monitoring and modelling; for instance, in climate services and projections, in developing tools for stakeholders, in integrated assessment modelling (IAM) and in research on transition pathways. We should also develop methods for comprehensive impact assessments across climate measures in different sectors from health to energy, transport, and climate investments. Long-term monitoring efforts are necessary to detect possible rebound effects. Digitalisation is a key component in achieving interoperability of information: the smooth linking of information systems on different scales and fields.

Information on the socio-economic aspects of climate change. We need information about the economic and social costs of adaptation and about the uncertainty related to both. What are acceptable risks for the society? We also need to understand the costs of doing nothing: remediation of climate change-related damage to the economy and culture and harm to health and the environment and compensation for the losses. This includes the direct and indirect effects of climate change on water availability and water safety and those of biodiversity loss on ecosystem services. A particular focus should be on the positive economic effects of discontinuing the use of current technologies: new jobs and new business opportunities.

Adaptation. We need information about the costs of adaptation measures compared to those of mitigation and of inaction. Nature-based solutions as part of adaptation solutions need more research, as work proceeds under the UNFCCC Green Climate Fund and the implementation of the EU Nature-Based Solutions programme. What kind of criteria and safeguards do they require, and how do the mechanisms work in relation to climate adaptation and mitigation? Successful adaptation requires integrating different types of knowledge into decision-making from indigenous knowledge to people's experiences and science. It is also important to understand the role played by the hydrological cycle and water resources management in climate change adaptation.

Systemic approach to a smart and fast energy transition

As the main source of greenhouse gas emissions, the energy sector plays a key role also in solving the problem. In addition to cutting down emissions related to power and heat, we need **low-carbon energy carriers** in sectors that are particularly difficult to decarbonize. These include heavy industry and long-haul transport.

The target setting in the EU is clear: the decoupling of economic growth from resource use and carbon neutrality by 2050. What we need now are guidelines for **geographically diverse solutions**, holistically streamlined in order to avoid misdirected incentives and partial solutions. A **holistic approach** is crucial also in order to embed all three cornerstones of energy: decarbonisation, energy security, and availability.

The Commission vision [COM/2018/773] highlights the target of Europe leading the race on renewable energy sources. The EU is broadly on track to achieve its 2020 greenhouse gas, renewable energy and energy efficiency targets. It is important to **boost energy innovations** to deploy much more clean energy in the future. To integrate clean energy successfully, we need to focus also on digitalisation and cybersecurity in the energy sector, on energy storage technologies and power-to-X technologies as well as on circular economy. In order to enable a cost-efficient and quick transition to a low-carbon society, nurturing technology implementation by **pilot and demonstration projects** is imperative.

In addition to focussing on energy production and conversion, we need to pay special attention to retaining **the global competiveness** of the European industry. Accordingly, the European industrial strategy [COM (2020) 102 final] highlights the role of clean and affordable energy as an enabler in the industrial green transformation.

Furthermore, we need to look for opportunities to **integrate across sectors**, developing both power-to-X and circular solutions at the same time. This is especially important in fields that are difficult to decarbonise, such as cement, iron and steel, and the chemical industry. There are specific possibilities in forestry in relation to carbon-negative solutions.

Towards sustainable mobility services through a holistic and user-centred approach

Horizon Europe should support a **systemic transition of the transport sector into sustainable mobility services combining all transport modes**. A holistic and user-centred approach is needed to answer the societal challenges, and to make the most of the opportunities related to the transition. Such a transition is not only an issue of technological development, but requires increasing inputs from, for example, socio-economic, behavioural and environmental research. More information is needed, for instance, on the effectiveness of various policy measures and issues related to a fair transition from the users and business perspective.

The approach suggested here **will lead to more efficient and sustainable mobility systems that will enable better services for end-users and innovative business initiatives.** Digitalisation will reduce system management and investment costs and increase energy efficiency. Additionally, a modal shift in both passenger and freight transport is needed. Especially in urban regions, a reduction in private car ownership could result in reduced vehicle-kilometres travelled and in newer and cleaner car fleets, since cars will be used more efficiently and the fleet renewal cycle will become shorter. More information is needed on how these goals can be achieved sustainably, addressing questions such as the use of economic instruments and the promotion of sustainable vehicle production, shipbuilding and infrastructure that supports the uptake of sustainable mobility services.

Service transformation and automation of the transport system will not only ensure better mobility services for people but will also help to reduce greenhouse gases in the transport sector. We should explore opportunities offered by the automation of the transport sector in providing sustainable and energy-efficient mobility services. By combining public transport and a variety of mobility services, we can offer an attractive alternative to private car ownership. Services should support a change in behaviour of users so that they would adopt more sustainable modes of transport, such as public transport, other shared modes, or active modes including cycling and walking. More information is needed on how to create and promote solutions and services that are sustainable. We need to take into account both the individual perspective and the system-level perspective.

Multimodal transport chains are significant components in reaching the ambitious goals of the European Green Deal. R&D&I should allow for and promote inclusion of all modes and different actors in these transport chains, while paying particular attention to the multimodal nodes. At the same time, we should further develop **carbon-neutral fuels and related infrastructure in all transport modes.** In addition to electricity, synthetic fuels, hydrogen and renewable fuels hold major potential to reduce emissions in transport. We should pay special attention to the aviation and maritime sectors where the share of alternative fuels remains minimal.

Mobility services and automated transport call for well-functioning **physical and digital infrastructure along with real-time, accurate road weather information and forecasts**. The energy transition in the transport sector requires improvements also in distribution networks. **Open, shared and high-quality data**, data processing and the ethical use of data are prerequisites for reaching the benefits of multimodality. Additionally, real-time and location-based digital data and reliable data transfer are needed.

Cities play a crucial role in enabling seamless multimodal connections for people and freight. They should be regarded as not only separate urban entities, but also as hubs for long-distance transportation and distribution of clean-energy solutions. In addition, maritime and inland ports act as important nodes in sustainable mobility systems. The digitalisation readiness of ports and their hinterland connections should be improved.

Building blocks for physical and digital infrastructure

✓ Transformation of multimodal hubs to support sustainable mobility services (incl. active modes, e.g. walking and cycling) and distribution of sustainable energy in all transport modes
✓ Distribution of sustainable energy for non-road mobile machinery
✓ Passenger and freight transport systems and fleets, rolling stock and equipment
✓ Data networks, connectivity, fixed and mobile broadband, 4G/5G, data sources (i.e. availability, compatibility, interoperability), cloud services, open data and interfaces, mass data, MyData, data protection, cyber security, analytics, artificial intelligence (AI), machine vision and learning, blockchains and platforms, high-definition 3D maps
✓ Digitalisation of the physical infrastructure and its maintenance and management, intelligent transport infrastructure and traffic management
✓ Information and payment systems

Building blocks for mobility and transport as services

✓ Multimodality: interoperable travel and transport chains, logistic chains and city logistics, mobility as a service (MaaS) operators, shared services, service design, inclusivity, standardisation and development of system interoperability
✓ Financial and commercial framework: insurance, financial and payment services, funding models, public and private investments, instruments for sharing risks
✓ Legislative and administrative framework: identification and deployment of efficient and equitable steering mechanisms to promote sustainable behaviour on the part of users and businesses, data regulation, liability issues, accessibility, passenger rights, automation, vehicle technology, electronic agreements, mobility single market, ethical issues

Contact

Reijo Munther
Delegate, Shadow Programme Committee for Cluster 5
Chief Adviser
Business Finland
+358 50 5577 827
reijo.munther (at) businessfinland.fi

Timo Ritonummi,
Alternate Delegate, Shadow Programme Committee for Cluster 5
Industrial Counsellor
Ministry of Economic Affairs and Employment

Tanja Suni
National Expert, Shadow Programme Committee for Cluster 5
Research Director
Ministry of the Environment

Johanna Särkijärvi
National Expert, Shadow Programme Committee for Cluster 5
Research Director
Ministry of Transport and Communications