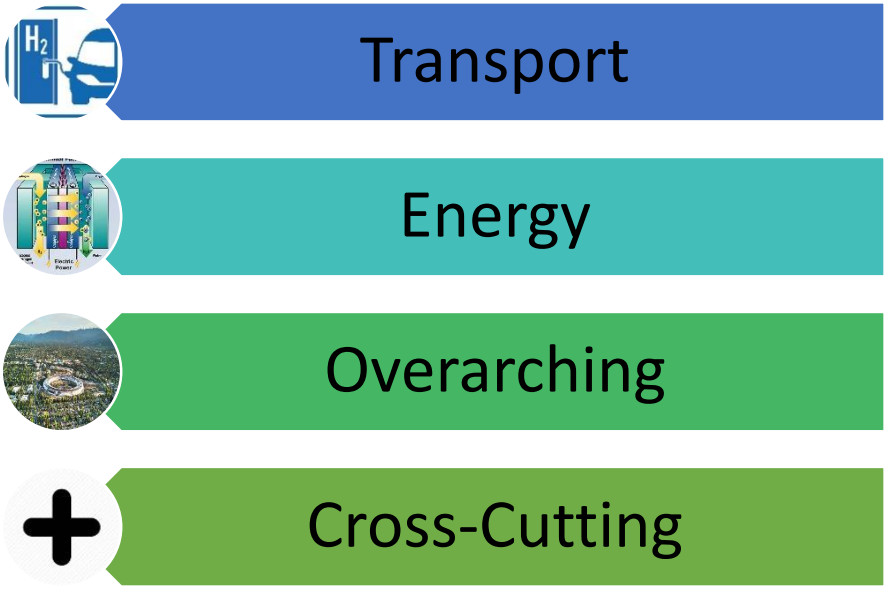
FUEL CELLS and HYDROGEN 2 - JOINT UNDERTAKING

FCH 2 JU is a public-private partnership focusing on the objective of **accelerating the commercialization of fuel cell and hydrogen technologies**. Its aim is to contribute to the Union's wider competitiveness goals, leverage private investment, industry-led implementation structure. The three members of the FCH JU are the European Commission, fuel cell and hydrogen industries represented by Hydrogen Europe and the research community represented by Hydrogen Europe Research.

A call for proposals with an indicative budget of **EUR 80.8 M** has been launched on January 15th 2019, addressing key challenges as identified by the stakeholders in the Joint Undertaking. These challenges encompass different areas of research and innovation: a total of 17 topics will be part of the call for proposals, including 5 for **Transport**, 8 for **Energy**, 1 for **Overarching** and 3 for **Cross-Cutting** issues. They will be grouped into 7 Innovation Actions (IA), 9 Research and Innovation Actions (RIA) and 1 Coordination and Support Action (CSA).

The deadline for applications is April 23rd 2019.



Research and innovation on **Fuel Cells and Hydrogen technologies** is not funded under the Societal Challenge 3, with one exception: topic on Smart Cities and Communities.

Transport

Polymer Electrolyte Membrane (PEM) technology *is the main enabling technology for all transport applications. Specifically, the understanding of the performance limitations for* ***Microelectrode Array (MEA) technology*** *is a challenge that has to be tackled continuously and over several product generations, fostering the EU supply chain. In this call, one topic will address this challenge (as already started in 2017-2018) focusing on the understanding of heat, mass and charge transport limitations in a MEA and proposing* ***breakthroughs in component design, operation strategies and performance prediction evolution of MEA technology****.*

Another key aspect of durability and performance of PEM technology for transport applications is the requirement for high dynamic performance and both production and development cost will influence a fast market penetration significantly. To reach these goals, one topic of this call will look at ***drivetrains optimisation for hybrid system composed of a fuel cell system and a battery****.*

In order to decarbonize industrial and logistic environments, there is a need to consider the big picture of the whole ecosystem: trucks, loaders, vans, and other specialized vehicles yet to be decarbonized. Tackling successfully this challenge presents an enormous opportunity for the technology: once industry customers are convinced of the environmental and economic benefits of a FC based solution, the ecosystem can be easily replicated in production plants worldwide. One topic this year will demonstrate (at least 250 vehicles in 1-2 locations) that ***the environmental and operational benefits do materialize in a real industrial or logistic ecosystem****, thus paving the way to replication.*

Similarly, fuel cell technology using hydrogen or another alternative carbon neutral fuel can enable ***shipping applications to achieve a very large reduction (>90%) in both GHG and pollutant emissions****. There are however several challenges associated with taking larger fuel cells into use in shipping, e.g. fuel cell systems need to be scaled up to the desired MW scale while simultaneously addressing durability, compatibility with maritime conditions and refueling facilities and high-volume fuel bunkering systems are required, particularly for larger vessels. One topic this year will adapt, scale up and demonstrate a 2 MW fuel cell (FC) system for shipping, capable of reducing GHG emissions by at least 70 % and NOX, SOX and particulate matter by at least 80% compared to conventional diesel-based systems for the selected mode(s) of operation.*

Addressing the main barriers to the successful rollout of hydrogen infrastructure in ***urban environments****, one topic will look at improving hydrogen refueling station design, focusing on its largest component, the storage tanks. The development of* ***low-cost, underground storage concepts for compressed gaseous hydrogen*** *will be addressed, in order to enable rollout of a* ***Hydrogen Refueling Station (HRS)*** *network dense enough to meet customer requirements by 2020.*

Action	Topic
IA	Demonstrating the blueprint for a zero-emission logistics ecosystem
IA	Scaling up and demonstration of a multi-MW Fuel Cell system for shipping
RIA	Cyber-physical platform for hybrid Fuel Cell systems
RIA	Towards a better understanding of charge, mass and heat transports in new generation PEMFC MEA for automotive applications
IA	Underground storage HRS

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RIA: Research and Innovation Action
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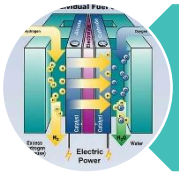

Energy

Electrolysis as the key enabling technology for increased renewables sources in the EU energy system while decarbonizing the gas sector remains in the focus of the FCH 2 JU during 2019. It is continued the activity started in 2018 on steam electrolysers increased scale; the related topic will aim to demonstrate at multimegawatt scale how ***high-temperature electrolyser (HTE) technology is well suited for Energy intensive industries (EII)*** *and how the* ***availability of low-grade heat sources helps to improve the process efficiency*** *and hence the production costs.*

In addition, a separate research topic will look to ***new material breakthroughs and design concepts for Anion exchange membrane (AEM) electrolysis****, to potentially combine the beneficial features of the PEM and alkaline electrolyser technologies. A similar research topic will look at next generation of cells and stacks for the various SOC related applications, including* ***new materials, architectures and associated manufacturing processes****. It would consider several operating modes, SOE and rSOC modes being mandatory.*

The programme will concentrate some of its activities on the ability to ***inject hydrogen into the European gas infrastructure via the power-to-gas approach****. One topic will demonstrate how to overcome the issue of low HRS utilisation (when coupled with an electrolyser) through the selling of surplus hydrogen as green gas to natural gas distribution networks. A complementary topic will explore how to enable injection of hydrogen into the high-pressure gas transmission network safely at industrial scale, addressing both the issue of scalability (ability to decarbonize the gas usages in all their aspects), and marketability/bankability of projects. A third topic (as cross-cutting activity and effect into standardisation) will ask for prenormative research to identify and verify the impacts of continuous and time-varying supplies of hydrogen-natural gas mixtures (H2NG) blends on the combustion characteristics (flame speed and shape, temperature, emissivity, emissions) of appliances together with the potential impacts on appliance safety, efficiency, lifetime and environmental performance (e.g. NOx emissions).*

As regards the stationary fuel cells (for CHP solutions), the ***exploitation of the strengths of solid oxide cells will be demonstrated in a polygeneration system to prove the ability to provide hydrogen from electricity in the electrolysis (SOE) mode or from methane when no electricity is available (SOFC mode)****. In addition, a research topic will further explore the integration of available monitoring and diagnostic techniques along with the development of both prognostic algorithms and advanced control techniques for enhancement of durability and reliability of stationary PEM and SOFC systems. Finally, continuing the effort to address HTPEMFC technology for mini-CHP devices in the range of 5-10 kWe as a promising technology to satisfy local demands for heat and electricity, and their permanent availability, but also as an addition to intermittent RES power production, one topic is in particular looking at improving the electrical efficiency and performance on the stack level.*

Action	Topic
IA	Combined electrolyser-HRS and Power-to-Gas system
IA	Multi megawatt high-temperature electrolyser for valorisation as energy vector in energy intensive industry
IA	Continuous supply of green or low carbon H2 and CHP via Solid Oxide Cell based Polygeneration
RIA	New Anion Exchange Membrane Electrolysers
RIA	Systematic validation of the ability to inject hydrogen at various admixture level into high-pressure gas networks in operational conditions
RIA	New materials, architectures and manufacturing processes for Solid Oxide Cells
RIA	Development of highly efficient and flexible mini CHP fuel cell system based on HTPEMFCs
RIA	Enhancement of durability and reliability of stationary PEM and SOFC systems by implementation and integration of advanced diagnostic and control tools

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Overarching

Building on the Regions Initiative (signature of the MoU by a total 92 regional and local authorities representing 22 countries in Europe), a topic was introduced as the next logical step towards market introduction of FCH technologies at regional scale. The topic will target building up of ***local/regional H2 value chains and integrated use of FCH technologies across different sectors and applications,*** *and therefore aiming to establish a '****Hydrogen Valley****'.*

Action	Topic
IA	H2 Valley

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Cross-Cutting

These activities are included in order to both support and enable activities undertaken within the Energy and Transport Pillars, and also to facilitate the transition to market for fuel cell and hydrogen technologies. These activities will be implemented through three separate topics.

Pre-normative research *is more and more necessary to establish standardised fuelling protocols for any medium or heavy-duty vehicle to enable the short-term uptake of these hydrogen vehicles based on modelling, experimental validation and field tests. Similarly, it is considered strategic to start looking at the* ***hydrogen admixture in the natural gas grid and the impact during Europe energy transition*** *(see above under Energy activities).*

Public awareness and acceptance regarding fuel cells and hydrogen technologies *have essential impacts on the market implementation and stabilization of FCH applications, especially regarding safety aspects****. Professional knowledge and skills are needed by first and second responders to tackle situations involving hydrogen systems and infrastructure****. One topic will therefore explore the 'train the trainer' approach and establishment of pan-European integrated training resources.*

Action	Topic
CSA	Training of Responders
RIA	Refueling Protocols for Medium and Heavy-Duty Vehicles
RIA	Hydrogen admixtures in natural gas domestic and commercial end uses

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