EERA Joint Programmes FCH and Energy Storage
with support from the Horizon 2020 project **BALANCE**

Putting the hydrogen into hybridization: how fuel cells and electrolysers can support energy storage

WHEN: November 5, 2019, 11:00-18:30
WHERE: ENEA Headquarters, Lungotevere Thaon di Revel 76, Rome, Italy

Joint workshop of the EERA JPs FCH and Energy Storage, targeting the higher level of the scientific community and strategy makers for Research & Innovation in Europe. It aims to bring together views on the utilization of hydrogen in hybridization with various technologies as means for energy storage. Technological and infrastructural updates will be merged with debates on sustainability aspects and the pathways for implementation in the coming EU Framework Programme, Horizon Europe, and beyond.

Agenda

Coffee and registration	**11:00**	
Setting the stage		
Welcome, Scope of the workshop and expected outcome	11:20	S. McPhail (JP FCH)
Presentation of JP FCH: research priorities and roadmaps	11:30	JP FCH coord.
Presentation of JP ES: research priorities and roadmaps	11:45	JP ES coord.
Mission Innovation Challenge 8: Upscaling hydrogen	12:00	J. Scholz (MI-IC8)
Mission Innovation Challenge 6: Clean Energy Materials in energy storage	12:15	M. Kozdras (MI-IC6)
Towards an Autonomous Material Development Platform	12:30	H. Ihssen (HHG)
Sustainability implications for different energy storage technologies	12:45	M. Baumann (JP ES)
Demonstrating the flexibility of hydrogen	13:00	M. Testi (FBK)
Lunch	**13:15**	
Hybridization		
Energy storage in the gas grid	14:40	G. Botta (KIWA)
Energy storage and mobility fuels	15:00	A. Goede (JP ES)
Energy storage and geology	15:20	P. Lopion (FZJ, JP FCH)
Energy storage and sector coupling	15:40	L. Wang (BALANCE)
Coffee Break	**16:00**	
Socio-Environmental sustainability		
A Circular Economy approach for battery materials	17:00	P.L. Porta (ENEA)
LCA of FCH: latest developments	16:40	A. Agostini (IEC)
Round-table: how to compare sustainability degrees in energy storage	17:20	All
Financial sustainability		
Prospects for Partnerships in Horizon Europe	17:50	C. Pocaterra (APRE)
Round-table discussion: • Key focus areas for JP FCH and JP ES • Opportunities for next joint actions: HEU, EERA, MI frameworks • Wrap-up and presentation at the JP ES Workshop 7-8 November	18:00	All
Close of Workshop	**18:30**	

Fuel Cells & Hydrogen

EERA European Energy Research Alliance Energy Storage

BALANCE

Attendees

Alessandro	Agostini	Jari	Kiviaho
V.L.	Barrio	Mark	Kozdras
Claudia	Bassano	Peter	Lopion
Manuel	Baumann	Nikolaos	Margaritis
Marcin	Blesznowski	Ivan	Matejak
Domenico	Borello	Stephen	McPhail
Giulia	Botta	Elisabetta	Mecozzi
Marcello	Capra	Carla	Menale
Alessandro	Cavalli	Michele Vincenzo	Migliarese Caputi
Christodoulos	Chatzichristodoulou	Andrea	Monforti Ferrario
Erika	Cherubini	Giulia	Monteleone
Giuseppe	Cherubini	Margherita	Moreno
Daniele	Consoli	Vincenzo	Mulone
Ezilde	Costanzo	Martin	Paidar
Massimiliano	Della Pietra	Claudia	Paoletti
Livia	Della Seta	Gianluca	Pasini
Vincenzo	Delle Site	Stefano	Passerini
Mariasole	Di Carli	Matteo	Pessia
Vito	Di Noto	Giacomo	Petretto
Adel	El Gammal	Raffaele	Pirolli
Jonathan	Fagerström	Chiara	Pocaterra
Marie-Laure	Fontaine	Pier Luigi	Porta
Stefano	Frangini	Paola	Rizzi
Domenico	Gaudioso	Ville	Saarinen
Fabrizio	Giamminuti	Mauro	Scagliotti
Myriam E.	Gil Bardaji	Julius	Scholz
Giovanni	Giordano	Svein	Sunde
Paola	Gislon	Matteo	Testi
Antonella	Glisenti	Mario	Tului
Adelbert	Goede	Daria	Vladikova
Holger	Ihssen		

Key messages

- In the mission to full decarbonization of energy supply, fluctuating renewable energy will become a majour source: electron transport only will not be able to match such supply of energy with demand (in terms of application, time, location and infrastructure), and molecular forms of energy capture and transport will be required**.**
- Power-to-X (through electrolysis and further chemical transformation) provides the possibility to couple grids (gas and power) and sectors (industry, mobility, end use), increasing capacity and flexibility
- The cost-effectiveness of infrastructure required for transportation and distribution of energy through pipelines versus electric cables favour the former over the latter 20-25 times over. Hydrogen admixture to natural gas is widely proven up to 20% and can be pushed to 100% in specific cases where the (distribution) grid is suitable; new composite pipeline materials make this perspective all the more realistic
- Large-scale storage of hydrogen can take place in salt caverns (mainly dislocated in northern Germany), providing many times the required capacity for storage required by the current electric grid (26,000 TWh versus ca. 200 TWh in 2018)
- Aviation fuels in particular are critical in terms of decarbonization/sustainability, as kerosene is still unmatched for this application (hydrogen is too bulky, batteries are too heavy, biofuels would require too much land use)
- High-temperature fuel cell systems are a flexible transition technology, utilising natural gas and other hydrocarbons for multiple generation of products (power, heat, hydrogen)
- Material resources will be crucial for a sustainable and autonomous economy. Critical raw materials must be maintained in the economies where end use takes place (recycling) to minimize new imports from strategically sensitive countries. Steel, concrete, aluminium and copper will not be sufficient by 2035 to fabricate the equipment required for the expected increase in renewable energy exploitation.
- Mission Innovation Challenge 6 establishes a framework for mostly bilateral collaboration on advanced initiatives for new energy materials, such as the design of materials based on a combination of artificial intelligence and robotics for high-throughput characterization, achieving tenfold reduction in costs and timescale of new material discovery. 8 November 2019 a Canada-Germany workshop will be held in Berlin on further deployment of such an Autonomous Material Development Platform.
- Mission Innovation Challenge 8 is focusing on the upscaling of hydrogen production and commercialization, though the showcasing of hydrogen valleys and harmonizing regulations and standards for international trade in particular. A third focus area is hydrogen admixture in the natural gas grid – workshop on this will be held in Chester, UK, 28-29 November 2019.
- In the assessment of the sustainability of a given technology, it is crucial to consider all relevant factors (i.e. not only greenhouse gas emissions, but using the entire planet as the ultimate boundary), paying particular attention to consequential interpretation (where all behavioural consequences of a given displacement of technology or process are taken into account, including rebound effects) as opposed to only attributional modelling (straightforward 1-for-1 substitution effects). Thus, 1 MJ of renewable electricity generated ultimately displaces only 0.1 MJ of fossil electricity. The complexity of this exercise must be understood and mid-point (product/process) assessments should only be treated as such, and not as an indicator of the all-encompassing ”sustainable” epithet.