Stakeholders Consultation: SET Plan Key Action 8 - Bioenergy and Renewable Fuels – Position EMIRI

1. Introduction EMIRI-EMIRIT

- EMERIT (Energy Materials for Europe – Research and Industry innovating Together) is the Industry-Driven Initiative (IDI) on Advanced Materials for low carbon energy technologies put together by the EMIRI association.
- Based on reinforced public-private interactions, EMERIT is fully aligned with the SET Plan Integrated Roadmap and the Integrated SET Plan Communication aiming at accelerating the transformation of the European Energy System through various key actions including more efficient and effective research & innovation across Europe.
- The EMERIT Industry-Driven Initiative will 1) Identify clear priorities for industrial growth & jobs in EU-based sector of Advanced Materials for low carbon energy technologies ,2) Develop a strong presence in Europe of innovation ecosystems and manufacturing value chains,3) By innovating with Advanced Materials fit to serve the demanding & growing market of low carbon energy technologies .

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2. Agreement with the targets and ambition of the Issues Paper

- EMIRI has no specific advanced materials program on" Bioenergy for Power Generation or for Heating and Cooling" and as such not able to comment on these corresponding Issues Paper's targets.

- For **Renewable fuels for transport** we have the following comments/recommendations: Dedicated action is indeed needed to facilitate and bring to scale production of renewable hydrogen for the transport sector, the roll-out of which is expected to accelerate post-2020 in the European markets. Production of hydrogen by electrolysis based on excess renewable energy in combination with carbon capture initiatives can also lead to the production of methanol ,one of the advanced renewable fuels for transport.
- Such combination of excess renewable energy/hydrogen production by electrolysis/eventually with methanol production, is described in EMIRIT's work program Key Component 3 – Advanced Materials to enable energy system integration, and more specifically as K3-I3 –see description in slides 3/4- and corresponding EMIRI KPI's in slide 5.

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- K3-I3 – Advanced Materials for lower cost storage of energy in the form of hydrogen or other chemicals (power to gas, power to liquid technologies) (Research & Innovation Actions)
- Innovation here in field of power to gas / power to fuels & chemicals relates to technically improved, innovative and affordable electrolysers, to develop ways to use the gas produced and to use renewable electricity for synthesis of different molecules (such as in combination with CO2). Advanced Materials innovation will focus on high capacity durable proton-exchange membranes (PEM) and solid oxide electrolysis cell (SOEC) electrolysers for hydrogen production. Other topics that can also be included are the development of cost efficient tank materials for high-pressure storage of hydrogen, the development of Advanced Materials to support catalysts in presenting longer lifetime and improved efficiency.

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Key Component 3 - Advanced Materials to enable energy system integration	
K3-I3	**Advanced Materials for lower cost storage of energy in the form of hydrogen or other chemicals (power to gas, power to liquid technologies) (Research & Innovation Actions)**
Innovation Challenges	The innovation of Power to Gas/Power to Fuels and Chemicals relates to technically improve electrolysers (especially innovative and affordable electrolysers are needed to pave the road for any kind of long term storage), to develop ways to efficiently use the gas produced (injection in the natural gas network, mobility, etc.), and to use renewable electricity for electrochemical synthesis of valuable chemical feedstock such as ammonia, methanol, ethanol and formic acid. Cost-optimized Advanced Materials innovation focuses on high capacity durable PEM and SOEC (Solid Oxide Electrolysis Cell) electrolysers for the production of pressurized hydrogen.
Activities	Major key points are the reduction of catalysts loading of the electrodes (for PEM water electrolysis), improved Ni-based hydrogen electrodes (for SOEC), improved electrolytes in terms of ionic conductivity, low cost cell frames, durable interconnect coatings and industrialized automated manufacturing (for both technologies) .The identification of new low cost Advanced Materials for solid state storage of hydrogen at low pressure is envisaged, those materials targeting at the same time improved storage density and cycling durability. To fulfill this trade off, new chemistries and/or associated synthesis or manufacturing processes have to be investigated. Other research items are the development of cost efficient tank materials for high-pressure storage of hydrogen, the development of new synthesis or manufacturing processes, the development of optimized flow and low cost reactors, as well as new catalysts presenting longer lifetimes based on Advanced Materials and chemistries.
Expected Outputs	A series of novel Advanced Materials for electrolysers and hydrogen storage enabling to achieve a total hydrogen cost, including energy, investment and operating cost, significantly below 5€/kg . Various valorization channels are to be explored with a specific view on Advanced Materials to enable profitable business cases.

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Advanced Materials to enable energy system integration		KPI	2020	2025	Beyond
K3-I3	Advanced Materials for lower cost storage of energy in the form of hydrogen or other chemicals (power to gas, power to liquid technologies)	PEM electrolyser cost	1000 euro/kW	500 euro/kW	<300 euro/kW
		Precious metal loading	1 mg/cm2	0.5 mg/cm2	<0.5 mg/cm2
		Lifetime	40.000 hrs	60.000 hrs	>60.000 hrs
		H2 storage materials	6 wt% H2 (2 kWh/kg)	8 wt% H2 (2.5 kWh/kg)	10 % H2 (3 kWh/kg)
		Hydrogen cost	4 euro/kg	<4 euro/kg	<3 euro/kg
		At electricity price	30 euro/MWh	20 euro/MWh	0-20 euro/MWh
		Efficiency	70%	75%	80%

Conclusion

- Comparison with Issues Paper targets:
  - In line with efficiency targets for electrolysis
  - in line with required hydrogen cost ,EMIRI even more ambitious for the longer term depending on electricity cost (representing +/- 70% of the H2 electrolysis cost)
  - additional performance targets for electrolysers added in K3-I3.