Fuel cells and hydrogen

Joint undertaking

Energy Pillar Topics in 2014 call

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New Energy World JU

fuel cells & hydrogen for sustainability

http://www.fch-ju.eu/

Energy pillar
FCH-02 2014

Topic	Type of Action	Ind. Budget MEURO
2.1: Research in electrolysis for cost effective hydrogen production	Research & Innovation (RIA)	16
2.2: Decentralized H2 production from clean CO2-containing biogas		
2.3: Stationary fuel cell system diagnostics		
2.4: Production of stationary FCs with reduced quality control costs		
2.5: Innovative FC systems at intermediate power range for distributed CHP		
2.6: Development of centrifugal hydrogen compressor technology		
2.7: Stand-alone H2 purification systems for new hydrogen pathways		
2.8: Improvement of electrolyser design for grid integration		
2.9: Significant improvement of installation and service for FC systems by Design-to-Service	Innovation (IA)	25.5
2.10: Large scale electrolysers providing grid services - supply to multiple markets		
2.11: Large scale FC power plant demonstration in industrial/commercial markets		

Energy pillar RIA

Topic 2.1: Research in Electrolysis for cost effective H2 production

Challenge

- Cost of H2 competitive with that of SMR – halve CAPEX, red. e^- by 10%
- Covers Alkaline, PEM, AEM, SOEC

Scope (KPIs of Water Electrolysis study)

- Simplification of system, size reduction, material reduction, scalability
- New components for improved partial load and dynamic behaviour
- Reduced degradation under partial loads

Impact

- Electrolytic H2 competitive with SMR
- Validation of improvements in cost through breakthroughs in materials, components, systems

Indicative Funding; No. of projects

- EU contribution of 2 – 3 Meuro; 1 project; 4 years

Other information

- TRL 3→5, Eligibility criterion: >1 member of IG or RG

Energy pillar RIA

Topic 2.2: Decentralized hydrogen production from clean CO2-containing biogas

Challenge

- Removal of biogas upgrading step (cleaning from sulphur, removal of CO2) to reduce CAPEX and OPEX and increase η of H2 production

Scope

- Proof of concept of optimised system; demo of techno-economic viability
- Develop catalysts and reactors less susceptible to fouling or poisoning
- Build and operate continuously 50-250 kgH2/day reactor with η 72%
- BoP and burner suitable for operation with lower cv streams

Impact

- Demonstration of CO2-containing reforming on-site
- Reduced H2 cost, improved η of 72% reforming landfill/anaerobic gas

Indicative Funding; No. of projects

- EU contribution of 2.5 – 3 Meuro; 1 project; 3 years

Other information

- TRL 3→6

Energy pillar RIA

Topic 2.3: Stationary FC system diagnostics: development of online monitoring and diagnostics systems for reliable and durable FC system operation

Challenge

- Develop low cost and reliable monitoring techs for stationary FC apps that would allow effective detection & prevention before irreversible damage

Scope

- Develop low cost, on-line monitoring & diagnostics system for existing FCs
- Prevent damages by detecting failure modes (contamination, degradation,..)
- Focus on low cost and easy integration to existing systems

Impact

- Demonstration of system in > 2 different stacks, validation of methodology
- > 5 failure modes detectable (air, fuel starvation, cell cracks, leakages,..)
- <3% increase in overall system cost

Indicative Funding; No. of projects

- EU contribution of 1.5 – 2 Meuro; 1 project, 2-3 years

Other information

- TRL 3-4→5, Eligibility criterion: >1 member of IG or RG

Energy pillar RIA

Topic 2.4: Robust manufacturing of stationary FCs with reduced quality control costs

Challenge

- Stabilisation of manufacturing process & automation of quality control even @ pilot scale, specially for stack qualification
- Adopt and implement quality and process control steps and equipment

Scope

- Develop state of the art quality control tools, transferring touch-less, in-line characterisation methods to FC components manufacturing
- Reduce quality control costs to battery manufacturing levels
- Validate in pilot or series manufacturing line, equipment available for sale

Impact

- Manufacturing process yield > 95%, single step > 98%
- Robustness against variations in raw material & processing parameters

Indicative Funding; No. of projects

- EU contribution of 1.5 – 2 Meuro; 1 project; 2-3 years

Other information

- TRL 5→7, Eligibility criterion: >1 member of IG or RG

Energy pillar RIA

Topic 2.5: Innovative fuel cell systems at intermediate power range for distributed CHP generation

Challenge

- Develop & manufacture new generation of FCs with improved competitiveness

Scope

- Build and validate prototypes of new FC products for CHP apps in 10-100kW
- >3,000 h operation of developed FC systems
- Develop value chains and innovative business models
- Co-generation of H2; heat recovery for co- & poly-generation

Impact

- Electrical η ↑ 10% to reach 57%, total η > 82%
- Improve stack lifetime ↑ 50% reaching 30,000 hours, cost ↓ 30%
- Maintenance interval ↑100% to 2 years per planned shut down

Indicative Funding; No. of projects

- EU contribution of 3.5 Meuro; 2 projects; 3 years

Other information

- TRL 4→5, build upon experience of previous projects

Energy pillar RIA

Topic 2.6: Development of centrifugal hydrogen compressor technology

Challenge

- Develop reliable, cost effective, energy eff. centrifugal compression technology for high mass flow rates (>3,000 m^3/hr)

Scope

- Design and test a centrifugal compressor from 20 to 500 bar; η ↑, cost ↓
- Material should take into account H2 properties
- Validate concept on-site, including η and cost, at least at single stage level

Impact

- Enable manufacturing of large H2 compression systems
- Energy consumption < 4kWh/kg H2 for 20-500 bar compression

Indicative Funding; No. of projects

- EU contribution of 3 Meuro; 1 project; 3 years

Other information

- TRL 3→5

Energy pillar RIA

Topic 2.7: Stand-alone H2 purification systems for new H2 pathways

Challenge

- Develop efficient and low cost stand-alone systems for the purification of H2 coming from industrial H2 pipelines and undergrounds storage caverns

Scope

- Develop and optimise proof-of-concept of H2 purification techs – PEM FC purity levels
- Large scale; stand-alone; close to zero waste
- Low energy consumption, low CAPEX, OPEX (cost of purification 0.15 Euro/kg)

Impact

- H2 losses < 10%
- CAPEX down to 350 Euro/(ton H2/day)

Indicative Funding; No. of projects

- EU contribution of 2 – 3 Meuro; 1 project; 2-3 years

Other information

- TRL 3-4→5-6

Energy pillar RIA

Topic 2.8: Improvement of electrolyser design for grid integration

Challenge

- Provide grid services: start-stop & dynamic operation, high η across load curve
- Reduce CAPEX to 30% by 2020; improvements in stack design, BoP, system eng.

Scope

- Identification & assessment of specs for providing grid services
- System & component optimisation for dynamic operation; understanding of degradation under dynamic operation
- Control system for interaction with grid and RES
- Identification of optimal economics depending on local tariffs and regulations

Impact (2020 KPIs)

- 52 kWh/kg H2 for alkaline, CAPEX 630 Euro/kW; 48kWh/kg H2 for PEM, CAPEX 1,000 Euro/kW; fully grid integrated operation; testing at full scale

Indicative Funding; No. of projects

- EU contribution of 2 – 3 Meuro; 3 years

Other information

- TRL 6+ → 7+, Eligibility criterion: >1 member of IG or RG

Energy pillar IA

Topic 2.9: Significant improvement of installation and service for fuel cell systems by Design-to-Service

Challenge

- Obtain simple to maintain, regulations compliant FC systems
- Elaborate lean after-sales structures that integrate lessons from field demos

Scope

- Reduce service cost including cost of spare parts
- Simplify services to be accomplished by normally trained installers with standard tools
- Reduce down time and on-site technical intervention time

Impact

- µ-CHP: service cost <600Euro/kW/yr, < 4h service time, interval >1 yr
- Mid-CHP: service cost <550/kW/yr, < 8h service time, interval >1-2 yr
- Large CHP: service cost <290Euro/kW/yr, < 300h service time, interval >2yr

Indicative Funding; No. of projects

- EU contribution of 1.5 Meuro, max. 3 projects (1 per FC technology); 3 years

Other information

- TRL 6 → 7

Energy pillar IA

Topic 2.10: Demonstrating the feasibility of central large scale electrolysers in providing grid services and hydrogen distribution and supply to multiple high value markets

Challenge

- Grid balancing services through operation at times of excess or lack of RES e^-
- Large scale demo at sites offering multiple value markets

Scope

- Deploy >1 MW (justified) electrolyser and supporting H2 distribution systems
- 55-60 kWh/kg H2; CAPEX 930 for alkaline and 1,570 for PEM (Euro/kW)
- Commercial contracts to demonstrate benefits from various benefit streams
- Operation > 2 years; tech neutral approach; consortia covering complete chain

Impact

- Confirm capturing of revenue from grid balancing services and supply to various markets; tecno-economic analysis
- Assessment of legislative and RCS implications; recommendations on policy

Indicative Funding; No. of projects

- EU contribution of 14 (1 project) to 16 (2 projects) MEURO; 4 years

Other information

- TRL 5 → 7, Eligibility criterion: >1 member of IG or RG

Energy pillar IA

Topic 2.11: Large scale FC power plant demonstration in industrial/commercial market segments

Challenge

- Achieve market entry of FCs in commercial/industrial segments (50kW-10MW) through realisation of large demos for confidence building & ↓ TCO

Scope

- 50kW-several MW in CHP using biogas, NG or H2; create partnerships
- Validate units in commercial apps; end-users gaining experience
- Develop business plans and service strategies
- Clearly spelled roles for all involved entities

Impact

- Reduce CAPEX <7,000 Euro/kW (<1MW) to < 4,000 Euro/kW (>1MW)
- Reduce use of primary fuel by electrical η > 45%, total η > 70%
- Build trust among stakeholders, participation of consumers, create jobs

Indicative Funding; No. of projects

- EU contribution of 2.5 (<1 MW, 2 projects) to 9 (>1MW, 1 project) MEURO

Other information

- TRL > 7, Eligibility criterion: >1 member of IG or RG; 5 years

More information

Call Material http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/calls/h2020-jti-fch-2014-1.html

FCH JU official website:
http://www.fch-ju.eu/

European Industry Grouping for a FCH-JTI (NEW-IG):
http://www.fchindustry-jti.eu

New European Research Grouping on FCH (N.ERGHY):
http://www.nerghy.eu