IDROGENO E CELLE A COMBUSTIBILE

Il bando 2014

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IL BANDO

BANDO **HORIZON 2020 - JTI - Fuel Cell and Hydrogen 2 Joint Undertaking – 2014**

Identificativo della call: **H2020-JTI-FCH-2014-1**

Data di pubblicazione: July 9, 2014
Data chiusura della CALL: November 6, 2014

Budget: 93 000 000 euro

Pillar	Action Type	# Topics	Indicative budget (M€)
Transport	5 RIA + 1 IA	6	10
	IA	1	32
Energy	RIA	8	16
	IA	3	25,5
Overarching	IA	1	5
Cross-cutting	2 CSA + 1 RIA	3	4,5
TOTAL		22	93

Informazioni:
http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/calls/h2020-jti-fch-2014-1.html#tab2

AWP2014:
http://ec.europa.eu/research/participants/data/ref/h2020/other/wp/jtis/h2020-wp14-fch_en.pdf

TECHNOLOGY READINESS LEVELS (TRL)

According to MAWP: mainly above TRL=3 (basic research under other EU programmes)

TRL 1 – basic principles observed
TRL 2 – technology concept formulated

TRL 3 – experimental proof of concept
TRL 4 – technology validated in lab
TRL 5 – technology validated in relevant environment *(industrially relevant environment in the case of key enabling technologies)*
TRL 6 – technology demonstrated in relevant environment *(industrially relevant environment in the case of key enabling technologies)*
TRL 7 – system prototype demonstration in operational environment
TRL 8 – system complete and qualified
TRL 9 – actual system proven in operational environment *(competitive manufacturing in the case of key enabling technologies; or in space)*

TRANSPORT PILLAR

1.1	Standardization of components for cost-efficient fuel cell systems for transportation applications	Innovation (IA)	
1.2	Cell and stack components, stack and system manufacturing technologies and quality assurance	Research & Innovation (RIA)	10 M€
1.3	Development of advanced fuel cell systems and system components		
1.4	Hydrogen storage standardisation and components optimization for mass production		
1.5	Development of cost effective and reliable hydrogen refuelling station components and systems for fuel cell vehicles		
1.6	Engineering studies for large scale bus refuelling		
1.7	Large scale demonstration of refuelling infrastructure for road vehicles	Innovation (IA)	32 M€

Transport pillar IA
Topic 1.1: Standardization of components for cost-efficient fuel cell systems for transportation applications

Challenge

• Standardization of interfaces and components to reduce cost to accelerate market introduction of automotive fuel cell technology

Scope

• Identify and select components or subsystems
• Align specifications and interfaces
• Define test protocols
• Transfer to industry codes & standards and regulations

Impact

• Standardization of Balance-of-Plant components will lead to cost reduction and likely, commercialization.

Other information

•*One project maximum. 3-4 years. Indicative budget of 2-3 million €*

Transport pillar RIA
Topic 1.2: Cell and stack components, stack and system manufacturing technologies and quality assurance

Challenge

- Improve manufacturability, production efficiency and production cost of automotive fuel cell stacks

Scope

- Improvements to existing, validated designs for cells
- Improvements in cell and stack manufacturing, assembly and QA methods
- Simplification of design and manufacturing methods of cell components, cells, stacks and/or stack modules
- Testing and validation of critical manufacturing sub-processes

Impact

- Cost reductions of more than 500 €/kW down to 150 €/kW at FC system level
- Manufacturing methods in terms of yield and cost, reducing stack scrap rate
- Decreased materials consumption or/and achieve a higher power density

Other information

- *One project maximum. 3 years. Indicative budget of 4-6 million €*

Transport pillar RIA

Topic 1.3: Development of advanced fuel cell systems and system components

Challenge

• Improvement of functionality, efficiency, manufacturability and cost of automotive application fuel cell technology.

Scope

• Develop low cost fuel cell system components adopting latest system and component level engineering methodologies.

• Provide advanced analysis and concepts for further system simplification, ease of manufacturing and cost reduction at typical automotive volumes

Impact

• Verification of components on test stations

• Validation of components on the level of a fuel cell system

• Prototyping demonstration in a relevant end-to-end environment

Other information

• *4-5 years. Indicative budget of 3-4 million €*

Transport pillar RIA
Topic 1.4: Hydrogen storage standardisation and components optimization for mass production

Challenge

- **Meet cost and performance targets** of onboard hydrogen storage systems for fuel cell powered vehicles (light and heavy duty).
- **Standardization of systems, processes and components** to accelerate market introduction of automotive hydrogen storage technology.

Scope

- Identify and select onboard storage system components
- Align specifications and interfaces
- Define test procedures
- Transfer to industry standards, codes and regulations

Impact

- Hydrogen storage components for standardization on a world-wide level
- Accepted test procedures for selected components
- cost reduction to 800 €/kg H2 stored

Other information

- *One project maximum. 3-4 years. Indicative budget of 3-5 million €*

Transport pillar RIA
Topic 1.5: Development of cost effective and reliable hydrogen refuelling station components and systems for fuel cell vehicles

Challenge

- Solve the hydrogen refuelling infrastructure currently part-wise **unsatisfactory reliability**
- **Reduce the relatively high CAPEX of HRSs** related to costly components and high HRS complexity.

Scope

- R&D, engineering, prototype manufacturing and/or laboratory testing of key components or complete HRS systems
- R&D and optimization of multiple key components (compression, storage, cooling and refuelling, regulation and control)
- R&D and design of larger scale complete HRS systems

Impact

- Newly developed and laboratory or pilot validated HRS key components and/or complete HRS systems **fulfilling MAWP 2017 targets**.

Other information

- *One project maximum. 3 years. Indicative budget of 4-6 million €*

Transport pillar RIA
Topic 1.6: Engineering studies for large scale bus refuelling

Challenge

- Need of HRS at scale for commercial bus depots (75-300 buses)

Scope

- Detailed engineering design studies for a **minimum of five representative bus depots operating at least 75-150 fuel cell buses**
- Options for supplying hydrogen to bus depots (off-site and on-site production)
- Assess administrative and practical burdens which large fuelling systems
- Implications of local regulations, codes and standards on the designs

Impact

- Identification of the factors which lead to the **lowest costs of hydrogen supply** at a range of specific bus depots
- Provide a mechanism to down-select depots for detailed design work if enough regions are interested
- Indicative layouts for the preferred depot design

Other information

- *One project maximum. 1.5-2 years. Indicative budget of 1-2.5 million €*

Transport pillar IA
Topic 1.7: Large scale demonstration of refuelling infrastructure for road vehicles

Challenge

- Improve FCEV technology.
- Strengthen customer acceptance.
- **Deployment of a refuelling infrastructure for initially limited vehicle fleet**

Scope

- Roll-out of a minimum of **100 FCEVs and 23 HRS**.
- Focus on FCEVs which use a fuel cell system as the main power source and 700 bar hydrogen storage systems but range extenders or other storage possible

Impact

- Develop, deliver and operate hydrogen refuelling infrastructure and a fleet of FCEVs
- Contribute to coordination of “H2Mobility” initiatives at the European scale

Other information

- *One project maximum. 4-6 years. Maximum funding of 32 million €*

ENERGY PILLAR

Research & Innovation (RIA)

2.1	Research in electrolysis for cost effective hydrogen production	Research & Innovation (RIA)	16 M€
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		

Innovation (IA)

2.9	Significant improvement of installation and service for FC systems by Design-to-Service	Innovation (IA)	25 M€
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 (Steam Methane Reforming)** – 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 behavior
- 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 optimized system; demo of techno-economic viability
- Develop catalysts and reactors less susceptible to fouling or poisoning
- Build and operate continuously 50-250 kg_{H2}/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

- **Stabilization 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 characterization 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 M€; 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**; $\eta \uparrow$, cost $\downarrow$
• 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 engineering

Scope

- Identification & assessment of specs for providing grid services
- System & component optimization 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 M€; 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 M€, 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 realization of large demos for confidence building & ↓ TCO (total cost of ownership)

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

OVERARCHING PROJECTS

3.1	Hydrogen territories	Innovation (IA)	5 M€

Overarching projects IA
Topic 3.1: Hydrogen territories

Challenge

- **Demonstrate pioneer hydrogen economy models at territories levels where there is a strong political commitment**
- **Prove the viability and feasibility of hydrogen economy concept in off-grid areas (isolated territories).**

Scope

- Develop and deploy replicable, balanced and integrated fuel cell and hydrogen solutions in both energy and transport fields
- Near/fully autonomous hydrogen buildings/quarters/districts
- Integration of hydrogen refuelling infrastructures and provision of vehicle fleets powered by hydrogen

Impact

- Increase the energy efficiency of isolated territories and the mobility efficiency with lower emissions of pollutants and CO2.

Other information

- *One project maximum. 5 years. Maximum funding of 5 million €*

CROSS CUTTING ISSUES

4.1	Educational initiatives	Coordination and Support Action (CSA)	4,5 M€
4.2	Develop strategies to raise public awareness of fuel cell and hydrogen technologies		
4.3	Pre-normative research on vented deflagrations in containers and enclosures for hydrogen energy applications	Research and Innovation (RIA)	

Challenge

• Establish a **network of academic, and other relevant institutions** for education and training in fuel cell and hydrogen.

• Develop and make available **high-quality** and **harmonized** teaching and experimental **materials**.

Scope

• **Graduate and post-graduate** teaching and the equivalent level of vocational training - **continuous professional development**.

• Building on **previous and on-going projects**: TrainHy, HyProfessionals, HyFacts, HyResponse, KnowHy, and others (e.g. US DoE).

• Access to **research and industrial infrastructures** in order to allow practical training in real environments.

Cross-Cutting CSA
Topic 4.1: Educational initiatives

Impact

• **Network of universities** and other relevant organizations, and development of **joint degree programmes** (when of interest).

• **Training materials** with focus on learning outcomes for students and trainers, by **developing further existing materials** (previous and on-going projects).

• Coverage of a **reasonable number of EU languages.**

• **Mutual recognition** using **European Credit Transfer System** (ECTS).

• **Web-site** and **e-learning platform** for hosting teaching materials.

• Delivery of **pilot courses during the project duration** (e.g. in existing curricula, new courses, summer schools, etc.).

Other information

• Indicative budget: **EUR 1 to 1.5 million** *(Nonetheless, this does not preclude submission and selection of proposals requesting other amounts).*

• **1 one project;** duration: maximum of **4 years**.

Cross-Cutting CSA
Topic 4.2: Develop strategies to raise public awareness of fuel cell and hydrogen technologies

Challenge

• **Make the public (and other stakeholders) aware** of the potential of Fuel Cell and Hydrogen technologies in order to prepare a **commercial market entry**.

Scope

• Increase **public awareness** of fuel cell and hydrogen technologies (in particular to future potential clients).
• Consortium to include **energy transition**, **marketing** and **communication** experts, and **web communication agency**.
• Develop and use of an **internet platform**, **innovative communication tools** and the **social media** to communicate fuel cell and hydrogen technology to targeted audiences.

Impact

• **Overview study** on potential long-term macro benefits in terms of innovation, job creation, energy security and balance, and health in the EU.
• Dissemination of the results of the study through a well-defined **media strategy** reaching out to **policy makers at European and national levels**.
• Supply a **one-stop-shop for information** on hydrogen and fuel cells via **internet** and **specialized web portal**.
• Improved public information by supply of **technical content suitable for the general public** to platforms such as Wikipedia
• Supply of **demonstrational items** (other than vehicles) for exhibitions, fairs and other events.
• Organization of **public debates** in different Member States.

Cross-Cutting CSA
Topic 4.2: Develop strategies to raise public awareness of fuel cell and hydrogen technologies

Other information

- The project is expected to be active in a **minimum of ten Member States**, with preferably different languages.
- Indicative EU funding: **EUR 2 million** *(Nonetheless, this does not preclude submission and selection of proposals requesting other amounts).*
- Number of projects: a maximum of **1 project** may be funded under this topic.
- Expected duration: **3 years**

Cross-Cutting RIA
Topic 4.3: PNR on vented deflagrations in containers and enclosures for hydrogen energy applications

Challenge

• **Hydrogen-energy systems and applications** are commonly designed and integrated into **containers and/or small enclosures**.

• Specific attention where best to apply safety barriers in order to **ensure the highest level of safety for hydrogen energy applications**.

Scope

• Conduct **pre-normative research** on hydrogen-air vented deflagrations in real-scale containers to prepare an **International Standard on "hydrogen explosion venting mitigation systems".**

• Performing **experiments in real-life industrial enclosures** and further develop **analytic and CFD modelling tools**.

• Improve the understanding of the **structural response of containers** exposed to a vented explosion.

Cross-Cutting RIA
Topic 4.3: PNR on vented deflagrations in containers and enclosures for hydrogen energy applications

Impact

- **Input to an International Standard** on “hydrogen explosion venting mitigation systems”.
- Safe and successful introduction of hydrogen-energy systems into the market by definition of **harmonized and standardized hydrogen vent sizing requirements** for installations in enclosures.
- Prediction of **hydrogen explosion effects** for certification and planning purposes by developing, verifying and validating analytical and CFD predictive models.
- **Verification of models by performance of real-life hydrogen-air vented deflagrations** in industry-representative hydrogen-energy enclosures and containers.

Other information

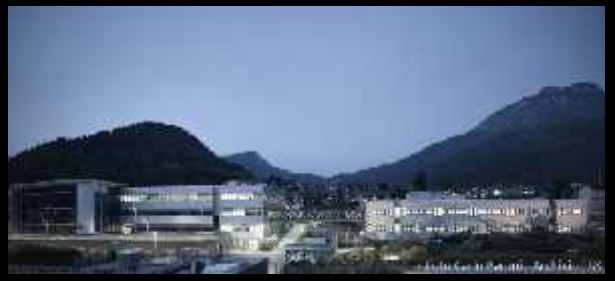
- Indicative funding: **EUR 1.5 million** *(Nonetheless, this does not preclude submission and selection of proposals requesting other amounts).*
- Number of projects: a maximum of **1 project** may be funded under this topic.
- Expected duration: **3 years**

Materiale per il Bando: 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



Grazie per l’attenzione!!!

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Transport pillar

Technologies for Transportation Systems

– Road Vehicles
  - Car & Bus demonstration projects
  - Improvement of fuel cell
  - APUs for trucks or recreational vehicles
  - Two wheelers under discussion

– Non-road mobile vehicles and machinery
  - Deployment of Forklifts and material handling vehicles

– Refuelling infrastructure

– Maritime, rail and aviation application
  - APUs for different applications and propulsion for boats

Energy pillar

- Technologies for Energy Systems

  – Hydrogen production from renewable electricity
    - Large green hydrogen production systems compatible for (smart) grid integration
    - Large scale hydrogen storage and injection of hydrogen in the natural gas grid
    - Re-electrification
  – Hydrogen production with low carbon footprint from other resources and waste hydrogen recovery
  – Fuel cell systems for combined heat and/or power on industrial, local, domestic scales and small applications
  – Hydrogen storage, handling and distribution

Others

- Overarching Projects

- Cross-cutting research activities
  - Social acceptance and public awareness
  - Education and training
  - Safety
  - Pre-Normative Research
  - Building databases for environmental, economical, socio-economic subjects
  - Identification and development of financial mechanisms to support market introduction
  - Support portable applications & other niche market fuel cell solutions
  - socio-economic research to determine environmental and societal impact
  - Recycling of FCH technologies
  - Other supporting activities