INTERNATIONAL PARTNERSHIP FOR
HYDROGEN AND FUEL CELLS IN THE ECONOMY

IPHE Country Update May 2017: Italy

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1. New Policy Initiatives on Hydrogen and Fuel Cell

Report on the introduction of new policy initiatives on FCHs:

a) Decree from Italian Government (DLGS December 16, 2017 n. 257concerning the acceptance of the EU decree 2014/94/UE issued October 22, 2014 on the "Deployment of Alternative fuel infrastructure".

b) The decree contains four Strategic frameworks for sustainable mobility:
   1) Electric mobility
   2) Compressed Gas for autotraction / LPG
   3) LNG for cars and marine applications
   4) Hydrogen

   Regarding hydrogen, main points of this national plan are:
   - Captive fleets approach:
     - Balanced design of vehicle fleets/end users and required infrastructures (hydrogen refuelling stations).
     - Sustainable grade of utilization of refuelling infrastructure.
   - Stage approach:
     - 2020-2022: small fleets (up to 109 cars and 11 buses) with small size hydrogen refuelling stations
     - 2023-2025: big fleets (up to 229 cars and 29 buses) with higher size hydrogen refuelling stations
   - TEN-T Corridors have been considered in designing the possible network of hydrogen refuelling stations

c) Approval with the above mentioned decree of the National Plan for the development of H2 infrastructures for FCEV.

d) Acceptance with the same decree of European standards, which means the acceptance of 350 bar and 700 bar HRS. The standard about distances and other characteristic of HRS are in discussion.

e) A Report on the long-term strategy (2030) for sustainable transport and a vision up to 2050 will be tabled May 30, 2017. This report is based on the work of a national working group driven by the government of Italy. H2 and FCEV are officially part of this strategy and vision.

f) In May 2017, the Italian association of all Italian municipalities (more than 8,000) named ANCI launched a working group to establish the guide lines that should help the Italian municipalities put into practice the activities for sustainable transport.

2. Hydrogen and Fuel Cell R&D Update

There has been significant progress in numerous research and demonstration projects. The FCH JU funded most of these projects with some funded by Structural Funds (PON). Below are a few examples.

In particular, in the framework of the FCH JU:

- Electrohypem project on PEM electrolyser development achieved significant progress in efficiency targets i.e. energy consumption < 3.6 kWh/Nm^3 H_2 at a current density of 1 A cm^{-2} (~77% vs. LHV), performance of 3.2 A cm^{-2} at 1.8 V.
- Duramet project achieved a power density of ~200 mW cm^{-2} for direct methanol fuel cells used in auxiliary power units.
- CoMETHy project on Solar Steam Methane Reforming (SMR) achieved a reduction of CO_2 emissions by 38-53% with respect to the traditional route.
- SOFCOM and DEMOSOFC projects demonstrated a 53% conversion of the primary fuel in high value electric power and 46% of the primary fuel converted in low-grade heat flow in CHP systems based on SOFCs. These were fed by different typologies of biogenous primary fuels (biogas and bio-syngas, locally produced) integrated by a process for the CO_2 separation from the exhaust gases.
- HEALTH-CODE project developed advanced monitoring and diagnostic tools for μ-CHP and backup PEM fuel cell systems to support stack failures detection and to infer the residual useful lifetime.
- NELLHI project dealing with stack design for mass production demonstrated low degradation for high temperature stacks (<1%/1000h).
- BioROBUR project developed cost-effective advanced fuel processors delivering 99.9% hydrogen from different biogas types (landfill gas, anaerobic digestion of organic wastes, and anaerobic digestion of wastewater-treatment sludges).

These are just a few examples of the recent R&D achievements in this field in projects coordinated by Italian organisations. Demonstration and deployment activities are reported separately in the following section.

3. Demonstration and Deployments Update

a) Case study–Bolzano –Hydrogen Centre and Refuelling Station:

- On Site Hydrogen Production from renewable energy
- Hydrogen Production Capacity: 400 kg/day
- More than 1,000,000 km achieved by H2 buses and H2 cars as of 1st of March 2017
- Reduction of air pollution:
  - ✓ 877.000 kg CO2
  - ✓ 7.734 kg NOX
  - ✓ 13,27 kg PM10
  - ✓ Number of H2 Refuellings:
    - Public transport buses: 2,857 (53,902 kg H_2)
    - Private cars: 1,481 (4,085 kg H_2)
  - ✓ Availability of H2 Refuelling Station: >99%
  - ✓ Availability of H2 buses: >96-98% since 3 years

b) Riviera project: within the structure of the EU funded project named “High V.LO-City”, Liguria Region has bought 3 H2 buses (originally planned for 5) with the HRS under construction.
c) Lazio region, 3Emotion EU funded Project: ATAC, the public transport company of Rome has issued a call for tender for 5 H2 FC buses. An HRS is already existing but needs to be repowered in order to be able to deliver at least 150 kg H2 per day
d) HPIC (Hydrogen Electric Passenger VeniCe boat): funded by Veneto region and Environment Ministry. Pilot hybrid (i.e., batteries and FC) ship owned by AliLaguna Company to transfer passengers from Venice Airport to Piazza San Marco. The boat (40 passengers) was launched at the end of 2016.
e) I-NEXT Project (PON Structural Funds): Demonstration of Fuel Cell Hybrid Electric Minibus Capo D’Orlando (Sicily) with seating capacity of 17, using a fuel cell as a range extender. This minibus is providing specific public transport service in the Nebrodi area.
f) SHIP PROJECTS: “GREENSHIP” and “TESEO” (PON Structural funds): these projects assessed fuel cells and auxiliaries systems for marine applications. The Green-ship project simulated marine critical conditions in a “Dry Corrosion Test Cabinet” and implemented different acceleration tests. TESEO carried out field tests.
g) “BHYKE” project: dealing with 250W fuel cell bicycle using a hydrogen solid-state storage cylinder of 900 Sl at 12 bar and covering a range of 130-150 km.
h) H-BUS project (Law 297 MIUR FAR funds): compared two different levels of powertrain hybridization (batteries and fuel cells) in a fuel cell minibus. Field tests were carried out in Messina at the CNR-ITAE.

At the present, there are at least five sites for HRS in Bolzano, Milano, Mantova, Liguria and Sicily. There are plans to demonstrate additional hydrogen buses (>15) based on recently approved demonstration projects.

Some key near-term strategies planned by the stakeholders include:

- Marketing of the fuel cell-based vehicles starting from mini-buses;
- Powertrain composed by integrated technologies (electric motor, batteries, fuel cells, supercaps, etc.);
- Fuel cells used as “range extenders”: increase the range of traditional electric vehicles (in terms of km or hours);
- Lowering fuel cell power by a reduction of the stack size with a lower cost for the hydrogen storage on-board; and,
- Lowering costs for fleet investment and management.

4. Events and Solicitations

Specific hydrogen and fuel cell conferences:

- ✓ EFC2017 Piero Lunghi Conference & Exibition, Naples December 12-15, 2017. Toyota and Hyundai cars will be present and available for the public to drive. Organizers are working on having other H2&FC vehicles available such as city cars, bicycles, and motorcycles.
- ✓ HYPOTHESIS XII HYdrogen POwer THeoretical and Engineering Solutions International Symposium. Syracuse, Sicily June 28-30, 2017 Conference

5. Investments: Government and Collaborative Hydrogen and Fuel Cell Funding

Government funding for activities directly related to FCH have essentially focused on the Structural funds-supported projects as mentioned above. FCH JU provided significant support for a variety of projects, as referenced above.

Government measures planned in the coming years to achieve the targets reported in the National Hydrogen Implementation Plan (DAFI) fall into five categories:

1. Legal measures and administrative regulations to support the implementation of the infrastructure for alternative fuels;
2. Strategic measures: Incentives for the purchase of vehicles powered by alternative fuels and for building infrastructure including technical and administrative procedures and legislation regarding the authorization processes;
3. Research and development programs;
4. Policy measures: Hydrogen as an alternative fuel should be taken into account in drawing up the strategic plans prepared by all the regional and the local authorities; and,
5. Communication measures: Promoting the awareness of the technical and safety features of alternative fuels.

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Summary Country Update May 2017: Italy

Transportation	Target Number	Current Status	Partnerships, Strategic Approach	Policy Support
Fuel Cell Vehicles[1]	about 1000 by 2020	10 [2017]	Captive fleets approach: • Balanced design of vehicle fleets/end users and required infrastructures (hydrogen refuelling stations). • Sustainable grade of utilization of refuelling infrastructure.	• Subsidy for purchase (national government initiative, *EU funded projects*)
FC Bus	Between 50 and 100 by 2020	13 [2017]	Fleets for big urban areas (Milan, Rome, Naples, Turin, Florence, Genoa, Bari, Palermo, Bologna)	• Subsidy for purchase (state government transit initiative, *EU funded projects*)
Fuel Cell Trucks[2]	n.a.	n.a.	n.a.	n.a.
Forklifts	No target, but development in progress	n.a	n.a.	• No support policy yet
H_2 Refueling Stations	**Target Number**	**Current Status**	**Partnerships, Strategic Approach**	**Policy Support**
70 MPa On-Site Production	5 by 2020	1 [2017] WW	Stations to be Built, Owned and Operated for 5yrs by the Public Private Partnership	• Subsidy only for the realization not for operation

[1] Includes Fuel Cell Electric Vehicles with Range Extenders
[2] As above

70 MPa Delivered	5 by 2020	0 [2017]	Stations to be Built, Owned and Operated for 5yrs by the Public Private Partnership	• Subsidy only for the realization not for operation
35 MPa On-Site Production	5 by 2020	2 [2017]	PPP	Subsidy for installation
35 MPa Delivered	5 by 2020	1 [2017]	PPP	Subsidy for installation
Stationary	**Target Number[3]**	**Current Status**	**Partnerships, Strategic Approach**	**Policy Support**
Small[4]	Around 10.000 units by 2020	About 200 units installed	National/European public subsidy	• Revision of standards and regulations
Medium[5]	500 units by 2020 - 2022	n.a.		
Large[6]	No target	n.a.		
District Grid[7]	No target	n.a.		
Regional Grid[8]	No target	n.a.		
Telecom backup	No target	About 300		

[3] Targets can be units installed and/or total installed capacity in the size range indicated
[4] <5 kW (e.g., Residential Use)
[5] 5kW – 400 kW (e.g., Distributed Residential Use)
[6] 0.3MW – 10 MW (e.g., Industrial Use)
[7] 1MW – 30 MW (e.g., Grid Stability, Ancillary Services)
[8] 30MW plus (e.g., Grid Storage and Systems Management)

H_2 Production	Target[9]	Current Status	Partnerships, Strategic Approach	Policy Support
Fossil Fuels[10]	Reduce as much as possible the use of fossil fuels to produce H2 (less than 50%) by 2020	Italy produces between 500 – 600 kt H2 per year most of them by Steam Methane Reforming. Most H2 for transport applications is produced on site by electrolysis (PV)	• To be defined and agreed. Most probably will be PPP	In still in discussion in the present days
Water Electrolysis[11] (PEM, Alkaline, SOEC)	Promote the water electrolysis and other renewable chains to produce carbon free H2 (more than 50%) by 2020	A few alkaline water electrolysis stations are installed to refill FC buses with capacity in the range 50-100 kW (20-40 kg H_2/day)	• To be defined and agreed. Most probably will be PPP	In still in discussion in the present days

[9] Target can be by quantity (Nm^3, kg, t) and by percentage of total production; also, reference to efficiency capabilities can be a target
[10] Hydrogen produced by reforming processes
[11] Please indicate if targets relate to a specific technology (PEM, Alkiline, SOEC)

By-product H_2				
Energy Storage from Renewables	**Target[12]**	**Current Status**	**Partnership, Strategic Approach**	**Policy Support**
Power to Power[13] Capacity	-	INGRID project 38 MWh of electricity storage from wind R&D project at lab. Level	-	-
Power to Gas[14] Capacity	-	INGRID project 38 MWh of electricity storage from wind R&D project at lab. Level	-	-

[12] Can be expressed in MW of Installed Capacity to use the electricity from renewable energy generation, and Annual MWh of stored energy capacity
[13] Operator has an obligation to return the electricity stored through the use of hydrogen back to electricity
[14] Operator has the opportunity to provide the stored energy in the form of hydrogen back to the energy system through multiple channels (e.g., merchant product, enriched natural gas, synthetic methane for transportation, heating, electricity)