



Hydrogen - A Competitive Energy Storage Medium To Enable the Large Scale Integration of Renewable Energies

Seville, 15-16 November 2012

INGRID - High-capacity hydrogen-based green-energy storage solutions for grid balancing

Overall Objectives and Budget

INGRID main objective is to demonstrate the effectiveness of originally combining safe, high-density, solid-state hydrogen storage systems with ICT-based active network control technologies for balancing highly variable power supply and demand in a scenario of high penetration of distributed renewable energy.

The core innovation brought forward by the INGRID project will consist of the Green Energy System, which includes:

- **A Water Electrolyzer (WE)** sub-unit provided by Hydrogenics partner, powered instantaneously by the electricity generated by the Renewable Energy Source used it to split the inlet water into pure O_2 and H_2 gases
- **Hydrogen Solid Storage (HSS)** with a maximum storage capacity of 1.10 GWh that accepts all the pure hydrogen flowing out from WE with no intermediated H_2 compression stage;
- **Fuel Cell (FC)**, provided by Hydrogenics partner, which, on-demand, de-absorb H_2 gas from the HSS in order to process and recombine it into air and heat producing electricity.

INGRID will prepare the ground for a win-win business model among hydrogen and electricity value chains

Budget: **Total Costs:** 23.986.585,00 €
EU Financial Contribution: 13.789.563,00 €

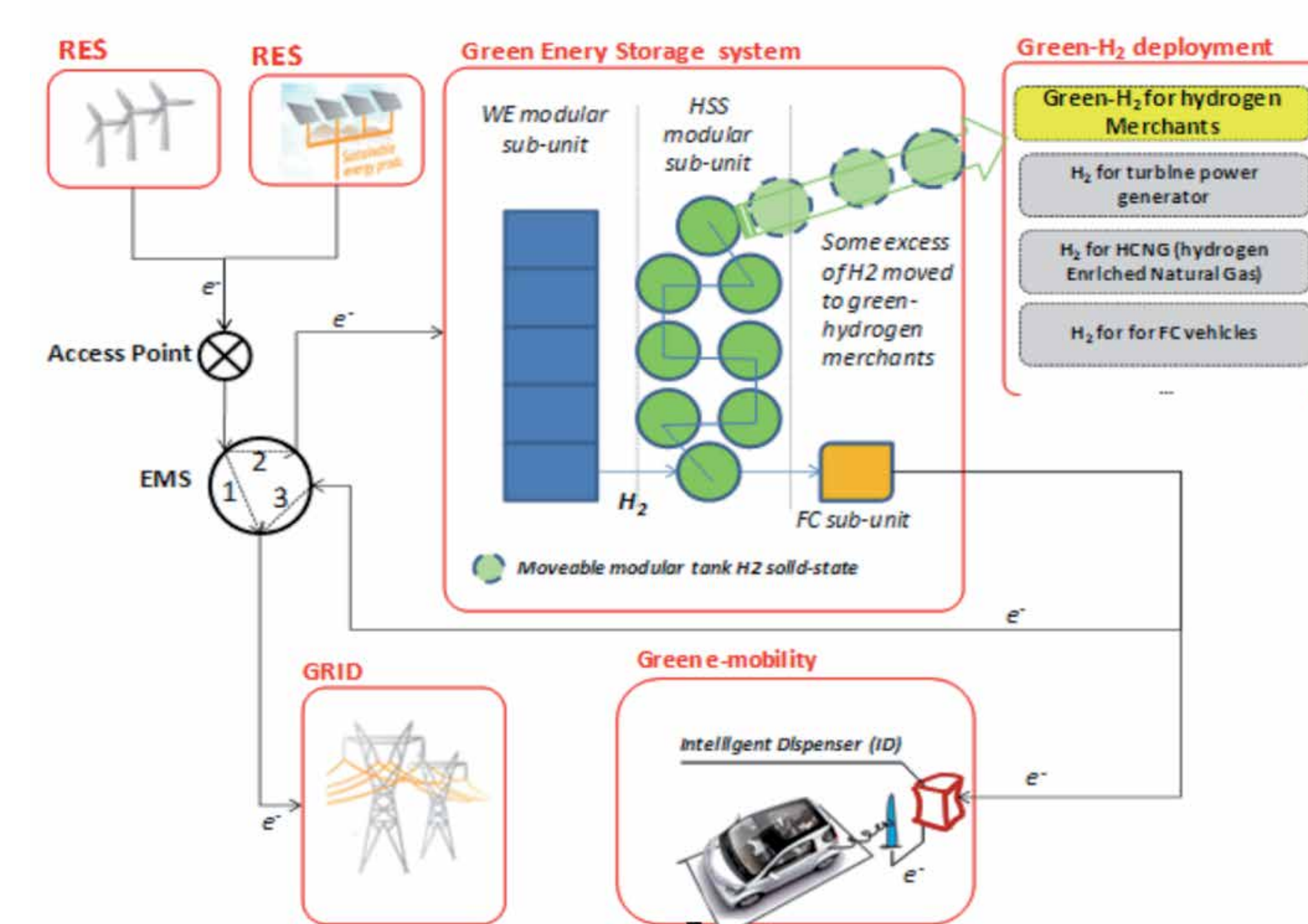
Technical Barriers and Targets

Hydrogen is undoubtedly a high-promising storage technology due to its high energy density and high reversibility, but it currently faces security and cost problems preventing it to be largely exploited into the energy storage market. Metal hydrides provide a much higher volume density than compressed or liquid gas. In particular magnesium hydrides (MgH_2) have been selected for mass storage with clear advantages in terms of safety, stability, modularity, high density, high dynamic and reversibility. INGRID project aims at achieving the following targets: Round-trip Efficiency (up to 50-60%), Energy Density up to 600 kWh/m^3

Technical accomplishments / progress / results

- Technological, safety, security, legal, lay-out requirements gathering for the hydrogen-based demonstrator deployment

- Demonstration site identification, within Puglia Southern Italy region, where there is a huge availability of intermittent Renewable Energy Source



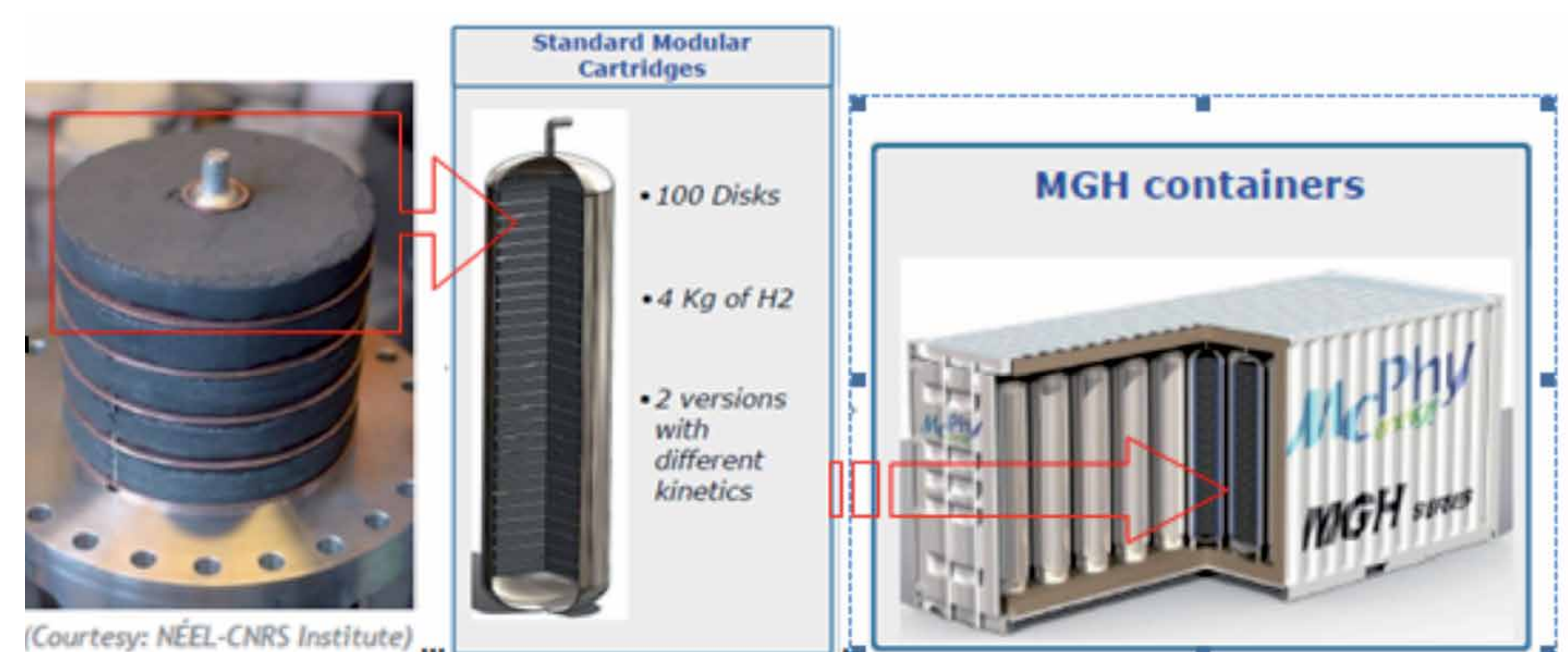
The INGRID Green Energy Storage Concept

Future Work

Design of the hydrogen storage system and of the real time ICT Monitoring and Control System. aimed at facilitating the power supply and demand balancing

Conclusions and major findings

N/A



The Modular Hydrogen Energy Storage (provided by McPhy partner)

Project Overview

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- Engineering Ingegneria Informatica (Italy) - McPhy (France) - Hydrogenics (Belgium) - Tecnalia (Spain) - Ricerca sul Sistema Energetico RSE (Italy) - ENEL Distribuzione (Italy) - ARTI Puglia (Italy)
- From 07/12 to 06/16
- http://www.ingrid_fp7euproject.com