Elygrid Project

(Grant Agreement nº 278824)

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1. Project achievements: Project & partnership description

- **Elygrid**, Improvements to Integrate High Pressure Alkaline Electrolysers for Electricity/H_2 production from Renewable Energies to Balance the Grid (www.elygrid.com)
- Duration 36 months, from 01/11/2011 to 30/10/2014
- Budget: 3.752.760,80 € / Funding: 2.105.017,00 €
- 10 project partners from 5 countries (D, F, ES, CH, B): 4 large industry partners, 1 SME, 5 Research Centres. 4 members of N.ERGHY.

COORDINATOR:

MOTIVATION:

- Interest in **hydrogen production** by means of renewable energy sources

- New developments are necessary to **match renewable electricity production** with its intermittent nature

- No available technology developed for partial load or intermittent operations within that range of electrolysis power (**3-4 MW**)

- Current technologies must be redesigned to achieve **higher efficiencies** and to be reliable, robust and **competitive** with capacity factors lower than 25%.

1. Project achievements:

ELYGRID project aims at contributing to the **reduction of the total cost** of hydrogen produced via electrolysis coupled to renewable energy sources (mainly wind turbines), and focusing on **mega watt size electrolyzers** (from 0,5 MW and up).

MAIN DRIVERS:

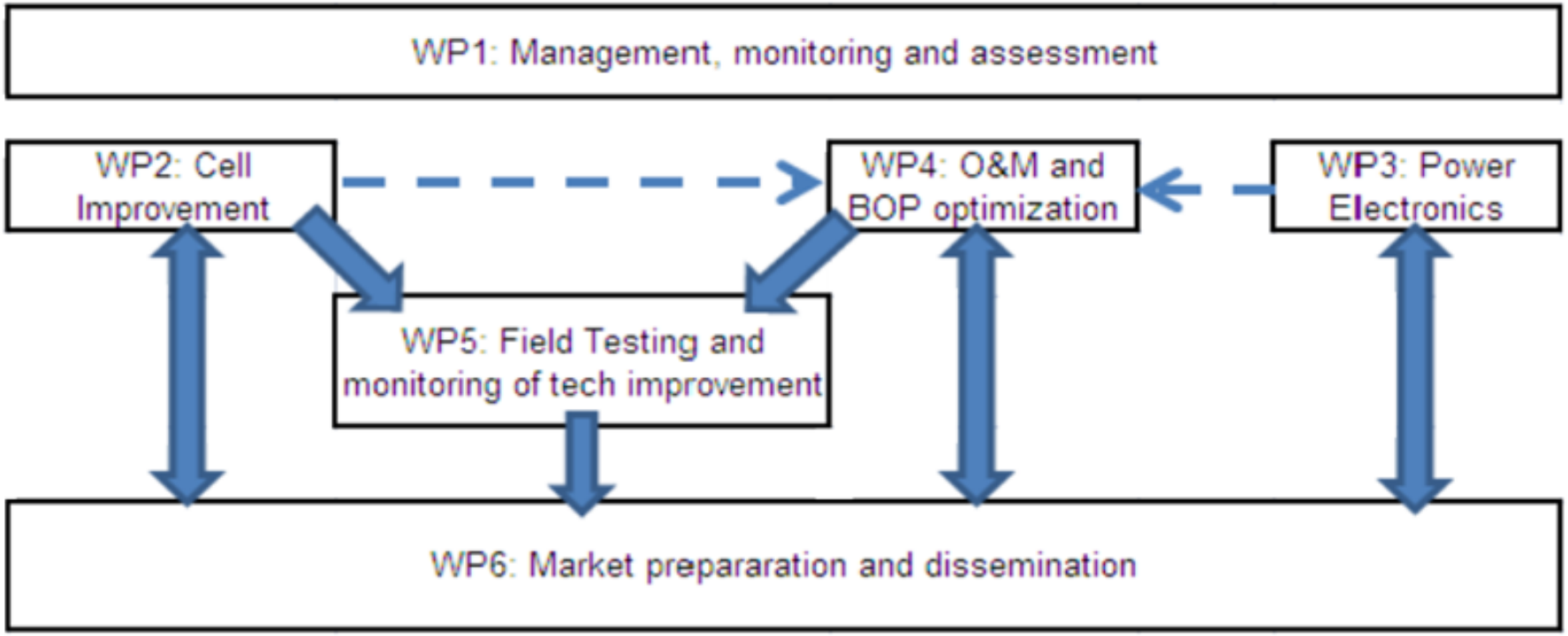
-Big size alkaline electrolyzers

-Leitmotiv: reduction of Total Cost of Ownership (TCO)

-Prototyping and testing with intermittent feeding

-Industrialization and market oriented approach

Work Package Structure



WP 2 - Cell Improvement: Advanced materials development and characterization

Goal: Develop materials for increased KOH temperature and concentration and increase current density (-> decrease cell voltage and increase efficiency). Identification of the critical factors for the membrane efficiency.

Progress:

-Corrosion and electrochemical lab tests on 10 materials: stability, performance and resistance. Different production routes. First down selection on retained materials.

-Improvement of SOA separators (Supported Zirfon©): hydrophilicity, porosity, resistance, stability. Characterization, manufacturability.

Next Steps:

-Further experiments (corrosion and electrochemical at operation temperature and pressure). Dedicated test bench will be available in Q1/2013 -> Second down selection in Q3/2013.

-Development of a set of models as a tool to simulate membrane behavior.

WP 3 – Power Electronics

Goal: Study the effect of the electric power supply topology on the electrolyzer efficiency at full and partial loads. Analysis of different topologies of power supplies. Technical requirements to build an electrolyzer power supply emulator/prototype able to match renewable energy electricity

Progress:

-Definition, analysis and simulation of eight different power electronic configurations and theoretical comparison of efficiency.

Next Steps:

-Further design of two configurations either for base load (industrial use) or intermittent use (connected to renewable generation grid), taking into account potential field tests within the project and commercialization (compliance with existing RCS) .

WP 4 – O&M and BOP optimization

Goal: Identify technical improvements related to Balance of Plant (BOP). Improvements on regular O&M actions. Re-design BOP with the objective to reduce the total cost with better functionality.

Progress:

-Data retrieval from existing facility in different operating conditions. Compilation of the base line (engineering toolkit). Qualitative Risk Analysis.

-Scope for simulation and definition of individual models.

Next Steps:

-Further operation to gain more experience (partial loads, fail safe). Improvements on field instrumentation.

-Development of a dynamic modular model for a complete system (validated against the existing facility).

-Redesign and optimization of individual components, and specifications of a new concept electrolyser.

WP 6 – Market preparation and dissemination

Goal

- Development of business cases
- Identification of potential uses and specifications
- Standardization and identification of barriers to commercialization
- LCA, RCS and homologation
- General dissemination and conveying the marketing message to the potential users.

Progress:

- Definition of scope of work and base lines, coordination and work share, information retrieval and exchange.
- Communication plan and toolkit (web site, press release, corporate image, flyers).

Next Steps:

- Compilation of preliminary results of the various tasks in a single report (“living document”).

2. Alignment to MAIP/AIP

- **Correlation to MAIP (AA2):**
  - ***Quantitative targets in MAIP***
    - *Baseline 2010: 1.5 t/d cap., 65% eff., 3.1 M€/(t/d)*
    - ***Mid term 2015: 1.5 t/d cap., 68% eff., 2.8 M€/(t/d)***
    - *Elygrid project tries to realize even more challenging improvements. TBC…*
  - ***Priorities of the MAIP application areas – Hydrogen Production & Distribution***
    - *"Main emphasis […] on research and development of mature production and storage technologies and on breakthrough orientated research of longer term. The mature production technologies include […] cost-efficient low-temperature electrolysers adapted for the large-scale use of carbon free electricity"*
  - ***Long term vision***
    - *"In the 2050 vision, […] hydrogen will be used as an "energy buffer" to balance the production and demand cycles of intermittent power sources integrating large volumes of renewable energy in the energy system."*
  - ***One of the priority topics for the FCH JU:*** *namely H01*

- **Correlation to AIP 2010 (AA2):**
  - ***Programme Overview – Hydrogen Production and Distribution***
    - *"By helping renewable hydrogen production to become **cost competitive**, the actions will prepare the ground for future large investments".*
  - ***Topic SP1-JTI-FCH.2010.2.1, Rationale***
    - *"further **improvement of performance** and **reduction** of both capital and operating **costs**".*
    - *"make the technology fit for **integration with renewable** energy generators"*

- **Correlation to AIP 2010 (AA2):**
  - ***Topic SP1-JTI-FCH.2010.2.1, Scope of Work***
    - Advanced power electronics and controls (addressed!)
    - Increasing operation temperature and electrolyte concentration (addressed!).
    - Improve durability and reliability optimizing production processes through design optimization (addressed!).
    - Development of low cost (low capex), highly efficient (low opex) electrolyser system operating at high pressure (15MPa = 150 bar with internal compression or 3MPa = 30 bar without additional compressing means). (addressed!)
    - Field trial(s) with RES @>25kW capacity. Improvements in modelling and design tools and in optimization of BoP components and control methodologies (addressed!).
    - RCS and Comparative Life Cycle (addressed!).

2. Alignment to MAIP/AIP

- **Identify and comment on gaps/bottlenecks in RTD&D proposed by MAIP/AIP documents**
  - *N/A*
- **Priorities and topics possibly under/over-estimated in the AIPs in terms of technical challenge:**
  - *N/A*

- **Contribution to Cross-cutting issues**

  - ***Work Package 6 considers many items typical for Cross-cutting, as market analyses, RCS, or communication and outreach.***

  - ***Information on publications:***
    - Initial Press Release to the media. Broad outreach even in international specialized media (Fuel Cell Today, EHA newsletter).
    - Poster presentations:
      - IPHE Workshop “Hydrogen – A competitive Energy Storage Medium to enable the large scale integration of renewable energies”, Seville, Spain, 15-16 November 2012.

- **Technology Transfer / Collaborations**
  - Collaborations will be sought during the last part of the project, once results and IPR has been generated. Two workshops or equivalent actions will be done to address the potential stakeholders (technologists, investors, energy companies)
  - International cooperation was foreseen at the beginning of the project with a Japanese R&D center, but had to be cancelled due to funding shortage at their side.

- **Project Future Perspectives**
  - Opportunities for increasing cooperation and for building alliances: the project is conceived as a value-added chain of suppliers and customers, with materials specialists, components, system integrators and even users of end-product on board. A good technical performance can lead to very fruitful collaboration after the project.
  - Opportunities for international collaboration: the goal of the project targets a (mostly) European product for a global market.
  - Possible contribution to the future FCH JU Programme: the project could have a continuation in a full-size proof-of-concept and further development steps.

To know more…

ELYGRID

http://www.elygrid.com/

http://www.hidrogenoaragon.org

COORDINATOR: