Integration of Renewable Energy Sources (RES) with the hydrogen vector

R E S 2 H 2

Objectives

The production of clean hydrogen from renewable energy sources is, without doubt, an important aspect to be taken into account within the real launching of this gas as an "energy vector" of the future, within a society that is ever-increasing its demand for "sustainable development". We must remember that hydrogen is, or is not, a clean energy source, depending on where it comes from. The objective of Project RES2H2 is to prove that clean production of hydrogen is feasible on an industrial level, and that the problem of temporary energy storage that is usually inherent in many renewable energy sources, can likewise be overcome. Therefore, the integration of renewable energy sources with the recently promoted "hydrogen vector" is what is being addressed in this European project.

Challenges

The objective of this Project is the clean production of hydrogen while exploiting a renewable energy source, such as wind power (although solar energy or biomass could also have been considered), to overcome, on the one hand, the problem of storing surplus energy (so frequent with renewable energy sources) and, on the other hand, the production of clean hydrogen that effectively meets the demands of an energy vector that is compatible with sustainable development.

From a storage point of view, in order to ensure increasing penetration of technologies related to renewable energies in isolated networks or in decentralized generation, these technologies must be integrated in hybrid systems that permit storage of the energy. The most efficient possibility, and that which most respects the environment, is the integration of renewable energies with hydrogen technology, which permits the production, storage and (subsequent) use of the same to generate electricity.

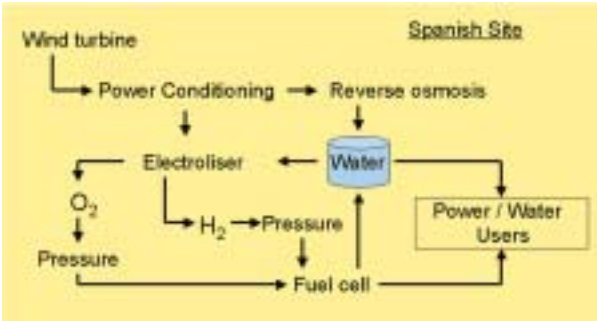
The effort being made is even greater, given that this Project covers four originally independent projects, all at European level, and at two different locations (Greece and Spain). This integrated project joins hydrogen technologies and wind power, with the latter being a renewable energy source with important seasonal variations in power production. Special attention must also be paid to the design of the accompanying water electrolysis unit. Potable water is considered to be another rare commodity, with an increasing energy cost at national and international level. Its co-production will be researched at one of the two locations (Spain).

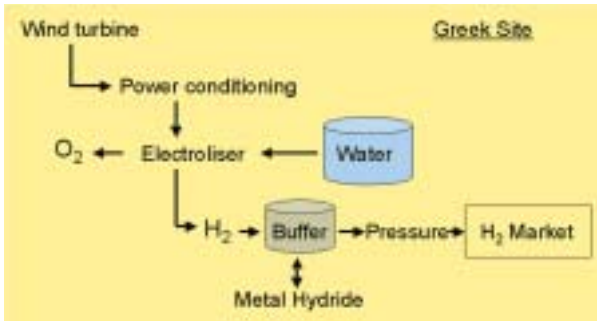
In summary the project will include the design, construction and assessment of two self-sufficient energy systems, in such a way that wind power can be used to generate hydrogen, electricity and water, with the characteristics of hydrogen as an energy vector being used to this end. These types of systems could be implemented in the more or less near future in any region with a high renewable potential (wind power, for example), to produce and commercialize hydrogen and to meet the demand for electricity and water (independent water and renewable energy networks).

Project structure

A total of fourteen partners are participating in the Project, with Inabensa being the coordinator. Inabensa is an Abengoa Group company with vast experience in the execution of Research and Development projects oriented towards renewable energies.

As regards Greece, an eletrolyzer within the 25 to 100 kW range will be connected to a 500 kW wind charger. The hydrogen thus produced





("green" hydrogen) will be stored in a metallic hydride tank (up to 50 Nm^3). It will subsequently be compressed in a series of cylinders in a filling station.

This compressed hydrogen can potentially be put on the traditional hydrogen market, as a first step to familiarising the industrial sector with, and gain confidence in, hydrogen as an energy vector.

As regards Spain, several wind power generating facilities that the ITC has on the islands of Gran Canaria (Pozo Izquierdo) and Fuerteventura (Punta Jandia), were first considered as alternatives. A new possibility has recently been considered – that of using a turbine in Barranco de Tirajana Thermal Power Station.

Hydrogen and water will be produced and stored in Spain, as mentioned above. An electrolyzer and a reverse osmosis seawater desalination plant (production of hydrogen and water, respectively), will be connected directly to a wind farm of up to 450 kW, at an isolated installation.

The produced and stored hydrogen (500 Nm^3, under pressure) will likewise be used to feed a Polymer Electrolyte Membrane (PEM) fuel cell of some 40 kW to produce electricity, when the wind resource is unavailable.

Progress to date

The task concerning the state-of-the-art has already been completed and four documents have been prepared, with each document being related to a different technology. The task related to conceptual design and simulation of the systems is at the point of completion, with the schematics corresponding to the two facilities having being generated and the results of the simulations of the two sites obtained, using the wind potential and its exploitation. There are reports available on the characteristics of the wind chargers to be used, as well as on the simulation of their behaviour (data on output obtained based on the wind data for the site), and a study of the components to be revised/modified in order to integrate them with the electrolyser system. Likewise, a first report on the feasibility of the integration of some of the different components is expected to be available in the near future namely electrolyser engineering, fuel cell and interfaces, and configuration of the reverse osmosis desalination plant.

INFORMATION

References: ENK5-CT-2001-00536

Programme:
FP5 - Energy, Environment and Sustainable Development

Title:
Cluster Pilot Project for the Integration of RES into European Energy Sectors using Hydrogen (RES2H2)

Duration: 60 months

Partners:
- Instalaciones Inabensa (E)
- Instituto Tecnológico de Canarias (E)
- University of las Palmas de Gran Canaria (E)
- Instituto Nacional de Técnica Aeroespacial (E)
- OWK Umwelttechnik und Anlagenbau (D)
- Solantis Energy (P)
- Unión Eléctrica de Canarias (E)
- Compañía Transportista de Gas Canarias (E)
- Integral Drive Systems (CH)
- Centre for Renewable Energy Sources (GR)
- Frederick Institute of Technology (CY)
- Electricity Authority of Cyprus (CY)
- C. Rokas (GR)
- Planungsgruppe Energie und Technik (D)

Contact point:
Africa Castro Rosende
Tel: +34-95-493-7180
Fax: +34-95-493-7008
africa.castro@inabensa.abengoa.com

EC Scientific Officer:
Joaquín Martín Bermejo
Tel: +32-2-2958332
Fax: +32-2-2964288
joaquin.martin-bermejo@cec.eu.int

Status: Ongoing