

Dates and events:

Next:

Bandung (Indonesia), October 5-7, 2015
ICSEEA 2015, the 3rd International Conference on Sustainable Energy Engineering and Application.

Sidney (Australia), October 11-14, 2015
6th World Hydrogen Technologies Convention, devoted to the global hydrogen and fuel cell community.

Past:

Athens (Greece), 8-11 July 2015
The INGRID project has been presented at the 6th International Conference on Experiments/Process/System Modeling/Simulation/Optimization with a paper entitled "Cooperative simulation tool with the energy management system for the storage of electricity surplus through hydrogen".

Rome (Italy), 24-29 May 2015
The INGRID project has been presented at InfoSys IARIA ENERGY 2015 with a full paper entitled "A Matrix Model For An Energy Management System Based On Multi-Carrier Hub Approach".

Gaeta (Italy), 25-29 May 2015
The INGRID project has been presented with the poster "Energy Management in Modern Electrical Power Grids" at the PhD students poster session of 16th Edition of the European PhD School on Power Electronics, Electrical Machines, Energy Control and Power Systems.

Consortium

Engineering Ingegneria Informatica (coordinator)	www.eng.it		Italy
McPhy Energy S.A.	www.mcphy.com		France
Hydrogenics	www.hydrogenics.com		Belgium
Tecnia	www.tecnalia.com		Spain
RSE	www.rse-web.it		Italy
Enel Distribuzione	www.enel.it/it-IT/reti/enel_distribuzione/		Italy
ARTI	www.arti.puglia.it		Italy
Studio Tecnico BFP	www.studiobfp.com		Italy

Imprint

Project Leader Contacts:
Dr. Massimo Bertoncini
Engineering Ingegneria Informatica SpA
massimo.bertoncini@eng.it



Project Web Site: <http://www.ingridproject.eu>



Work partially supported by European Community under the ENERGY programme of the 7th FP for RTD - project INGRID, contract 296012. The Author is solely responsible for the content of this paper. It does not represent the opinion of the European Community, and the European Community is not responsible for any use that might be made of data appearing therein.



Newsletter Ingrid n. 02
September 2015

Newsletter



Editorial by ARTI

Welcome to the second issue of the newsletter of INGRID, the project that is combining the recent advances in Smart Grids and solid state hydrogen-based energy storage to match energy supply and demand and optimize the electricity generated by intermittent Renewable Energy Sources while ensuring security and stability of the power distribution network. This issue will introduce you to the relevant advances and the partnership of the project, a focus on technologies and the recent development in energy storage in Italy.

Enjoy your reading.

RECENT DEVELOPMENTS

ENERGY STORAGE: RECENT DEVELOPMENTS IN ITALY BY RSE

Storage technologies are speeding up the pace for both customer's and network's applications.

"Centralized" application refers to storage devices devoted to network operation, while "distributed" one applies to storage units intended for supporting customer operation (self consumption of local generation, reliability of supply) and only secondarily for providing system services.

Regarding customers' side, the act 574/2014 of the National Regulation Authority (AEEGSI) has provided the rules for installing storage systems in new and already existing plants connected to the public grid. It refers in particular to electrochemical storage systems EESS, alone or in combination with photovoltaic or other distributed generators. Network requirements for these systems were defined to avoid diffusion of a large number of EESS without any basic system services.

Storage technologies can enter in the perspective evolution of the balancing market: now it is restricted to larger units at the transmission level but it will be opened to distributed generators and storage units, with technology-neutral schemes.

On the network side, according to the *unbundling* of the electricity market¹, so far operators are using storages within pilot projects (national or European). TERNA (Italian transmission system operator) was allowed by the Authority to test² 35 MW/232 MWh of NaS battery in six "energy intensive" pilots³, as well as 10 MW Li-Ion and 6 MW of NaNiCl₂ batteries for "power intensive"

applications⁴. Main goal is to increase respectively the transmission grid's capacity and the security of the system in major islands.

At the distribution level, ENEL Distribuzione is testing Li-Ion batteries in national (Isernia 1 MVA/0.5 MWh, Chiaravalle 2 MVA/2 MWh, Campi Salentina 2 MVA/1 MWh, Dirillo 2 MVA/1 MWh) and European (Grid4EU, 1 MW/1 MWh) projects. The goal of these EESS is to regulate the bi-directional flows from renewable resources on LV and MV networks.

¹Directive 2003/55/EC concerning common rules for the internal market in electricity and natural gas

²http://www.terna.it/default/home_en/the_company/about_terna/Terna_Storage_en.aspx

³Act 66/2013/E/eel

⁴Act 43/2013/R/eel



A FOCUS ON TECHNOLOGIES

GRID SCALE WATER ELECTROLYSIS: ENHANCING THE PENETRATION OF RENEWABLE ENERGIES BY CONVERTING EXCESS ENERGIES BY HYDROGENICS

INGRID project aims to exploit on a large industrial real scale a solid state hydrogen-based energy storage technology, storing electricity in the form of hydrogen: this element is a high density energy carrier, produced by no-emission water electrolysis process powered by excess of electricity.

This is done by decomposing water pure molecules (H₂O) into oxygen (O₂) and hydrogen (H₂) gases by applying a direct current (DC) through electrodes immersed in the water.

Roughly 39 kWh of electricity and 9 liters of water are required to produce 1 kg of hydrogen. The figure below shows a typical unit with a total power of 300 kW with all its utility systems. The over-all efficiency of the electricity-to-hydrogen conversion ranges from 60 to 80% for this type of units.

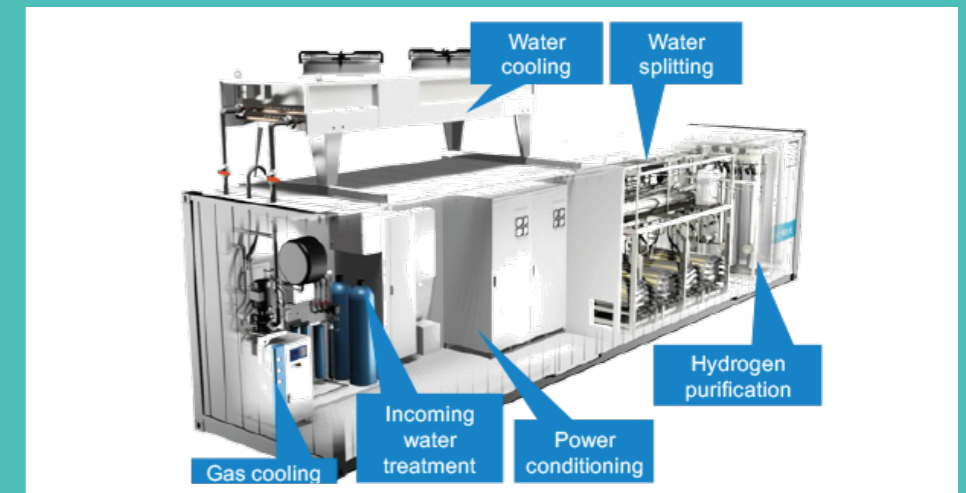
Water electrolysis systems are modular, thus they can be easily grouped to produce hydrogen and store energy over wide scales, ranging from few kilowatts to hundreds of megawatts. In the INGRID project, Hydrogenics is building a unit that is 1 MW modular building block, consisting of about 400 electrolysis cells that work together. This type of units can be grouped together and connected to the grid at different locations and thus make up a nearly unlimited power capacity, provided that there is demand or adequate storage for the produced hydrogen.

Once hydrogen is stored, it can be released and used "on-demand" by various (also combined) user systems:

- an advanced modified turbine for power generation, advanced hydrogen fuelled turbines for power generation;
- a fuel cell stack to produce directly green-electricity, that functions in a "reverse mode" of the water electrolyzer, thus recombining hydrogen with oxygen to produce electricity and

waste heat and pure water;

- as a green-fuel for either Fuel Cell vehicles or modified internal combustion engine vehicles;
- introducing this green-hydrogen by hydrogen merchants, thus providing an alternative to conventional hydrogen, normally produced by Steam Methane Reforming, SMR, at high carbon footprint;
- mixing hydrogen in the natural gas grid, providing unlimited storage capacity, as demonstrated in Falkenhagen by Hydrogenics and E.ON



INGRID PARTNERSHIP: AN INTRODUCTION TO ENGINEERING

Engineering Group is the Italian largest systems integration group and a leader in the provision of complete IT services and consultancy. Engineering Group has about 7400 employees and over 40 branch offices, throughout Italy, Belgium, Norway and Serbia, and (outside the EU) in USA, Brazil and Argentina. It has a global production capacity in 30 different countries. Since 1987, current and past research initiatives have been carried out at European level, by participating to hundreds of EU R&D projects from the EU FP4 onward to the FP5, FP6, FP7 and H2020 Programmes. The R&D Unit is distributed across 6 different locations, in Italy and Europe, with around 250 researchers currently involved in co-funded national and international initiatives.

Engineering is a very active player in the ICT for Energy Efficiency domain. In particular the Utilities Business Unit is the strategic technology provider for the largest energy distribution companies in Italy (ENEL, HERA, IREN).

In the last seven years, Engineering R&D has played a key role in the ICT for Energy and Smart Grids technologies, in particular through the involvement in several national and international projects addressing the matter of ICT for Energy Consumption Awareness (BeAware, ENERGETIC), Green Data Centres (coordinating GAMES and GEYSER projects) and Smart Grids (FINSY, INERTIA, FINESCE, Nobel Grid, MG InnoC, ELSA). The team involved in these activities has built-up a comprehensive know-how and produces different

assets, related to Energy Efficiency, Energy Management Systems, Energy Consumption Awareness, Energy and Ancillary Services Marketplace, Demand Response management, HMI, SCADA and interaction protocols, in widespread industrial applications.

Role in the project. Engineering has been leading the Project Management and the ICT-based Energy Management System design and development, while significantly contributing to the rest of the Project, from the definition of the INGRID plant site and equipment, to their integration and deployment, to the dissemination and exploitation of the Project outcomes.

INGRID PARTNERSHIP: AN INTRODUCTION TO TECNALIA RESEARCH & INNOVATION

TECNALIA Research & Innovation is the first privately funded Applied Research Centre in Spain and one of the leading such centres in Europe. With a workforce of more than 1,400 highly-qualified people, a 110 million Euros turnover and a portfolio with over 4,000 clients, TECNALIA is determined to change its way of working with companies to promote the transformation of knowledge into wealth.

Inspiring business

Our "Inspiring Business" slogan means knowing how to imagine. A synthesis of two concepts that go hand in hand: imagining and making it come true. For TECNALIA, "imagining" means having ideas that help our clients and society have a better future. Ideas that create value. "Making it come true" is providing imaginative, technological, creative solutions. Solutions that bring real results. Creating ideas that are transformed into value and competitive business opportunities for their clients.

How it is organised

One of TECNALIA's differentiating characteristics is its innovative operation model based on 7 sectorial Business Divisions. Sustainable Construction, Energy and Environment, Industry and Transport, ICT-European Software Institute, Health, Innovation Strategies and Technological Services, which allow TECNALIA to provide personalised and multi-disciplinary attention for our clients. Thus, TECNALIA covers a broad range of sectors and is present in all the relevant areas of society. Offering its clients comprehensive solutions, making the most of the technological and marketing capacities of its Business Divisions, which are clearly client-focused.

People without borders

TECNALIA's best asset is our team, made up of more than 1,400 experts who work to transform knowledge into GDP in order to improve People's quality of life by generating business opportunities for Companies. Experts from 30 different countries are divided into 21 headquarters; they are responsible for visualising, identifying and developing comprehensive technological solutions with creativity and imagination for over 4,000 clients and offering comprehensive solutions paying personalised and multi-disciplinary attention to each one of them.

TECNALIA has four branches abroad: Mexico, France, Italy and Serbia; four associated innovation centres in Bulgaria, Colombia, Egypt and France; as well as an extensive network of partners worldwide. TECNALIA also works with partners on projects in many countries around the world, such as Australia, Bolivia, Chile, China, Ecuador, Peru, United Kingdom, United States, etc.

A European benchmark

According to the European Research Ranking, TECNALIA holds position 20 among the thousands of European Research Bodies (both private and public) taking part in the EU 7th Framework Programme, being the first private entity in Spain; TECNALIA has been involved in 377 projects, leading 81 of them, thus responding to the trust of companies and other leading research organisations in their relevant sectors.

It also secured funding of 131 million Euros and, more importantly, it facilitated the participation of more than 320 Spanish companies, mainly SMEs, in European R&D&I benchmark consortia.



NEWS

Interview with Adamo Scenci (McPhy) - Board Member, VP Sales & Projects
CEO McPhy Energy Italy - "The INGRID project and the electrolysis potentialities" on the e7 magazine (Quotidiano Energia)

