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Smart Grid initiatives, challenges and opportunities

Outcomes from the 1st Smart Grid International Forum



On the 30th of November and 1st of December 2010, WEC Italy (Italian National Committee of the World

Energy Council), ANIE (the Federation of electro-technical and electronic companies operating in Italy) and Gruppo Italia Energia (a specialised Editor on energy issues) organised the 1st Smart Grid International Forum, in Rome. Almost 100 national and international companies and 300 participants attended the Forum. Among the Institutions, the Ministry of Economic Development of Italy, the European Commission, the US Department of Energy, the UN Economic Commission for Latin America, the Council of European Energy Regulators, the Italian AEEG (Regulatory Authority for Electricity and Gas), RSE (Research into Energy System) and GSE (Energy Services Manager) were present.

The opening remarks by the Minister of Economic Development of Italy, Hon. Paolo Romani, opened the Forum followed by many political and industrial presentations with both national and international perspectives.

The Forum's debates gave an accurate picture of state-of-the-art "smart grids". A timely analysis of the main political and normative initiatives as well as industrial ones in Europe, United States, Latin America and Asia, points out the need to realise pilot projects as a prerequisite to the successful development and dissemination of smart grids.

The debates also revealed very important

outcomes that have been achieved in Italy in the field of smart grids and the challenges ahead.

THE INTERNATIONAL LANDSCAPE

Smart grid issues and the adoption of even more intelligent and efficient networks which assure a broad availability of energy and a reduction of the environmental impact are a topic of great interest both to industrialised as well as developing countries.

In the framework of the Major Economies Forum (MEF) with the institution of the "Global Partnership for low-emission and clean technologies", smart grids were recognized as one of the ten technological areas of priority on which all Member States must cooperate in order for a transition towards *clean technologies*.

Moreover, many initiatives concerning the development and deployment of smart grid technologies have been adopted around the world over the past few years.

Among the most important, the Republic of Korea and China set up institutional working groups committed to produce detailed road-maps and accelerate a transition of their electrical networks based on smart grid concepts.

On the other side of the Pacific Ocean, the United States of America allocated \$4.5 billion for the modernisation of their electrical networks in the framework of the American Recovery and Reinvestment Act in 2009, while the United Nations Economic Commission

for Latin America (CEPAL) started a collaboration with the Italian Ministry of Economic Development named “Smart Grid in Latin America” which aims to improve efficiency and “intelligence” of the grids within South and Central America.

THE NEED FOR SMART GRID TECHNOLOGIES

The development of smart grid technologies is considered key for the efficient improvement of energy systems and their move towards “the renewable energy era”. This slow-shift, which started at the beginning of the century, is progressively changing power networks from a “load following” model with large-size centralised plants to a distributed power generation model where there will be an increasing role of low-size plants fuelled by intermittent and non-programmable renewable energies.

Thus, future power systems will have to be designed to produce, store, transmit and distribute electricity in an even more efficient and flexible way, and network infrastructures will have to allow bi-directional flows of energy as well as information between producers and consumers: e.g. data about classification and consumption costs or real-time information, like weather conditions, that are able to improve power line performances.

In this fields, the joint application of transmission and distribution equipment developed by the electro-technical and electronic industry, together with data management and transmission software developed by companies operating in the segment of information and communication technology (ICT), will be key to the growth and deployment of high efficiency grids that are also more in line with CO₂ emission reduction goals.

It is worth remembering that there is no single smart grid model that fits all regional or local contexts. Technologies and actions needed to make a grid “intelligent” are heterogeneous and they depend on the framework in which a company acts. There is only one basic distinction always applicable to all circumstances and it refers to actions and measures needed for transmission networks and those necessary for distribution networks.

As for transmission systems, efficiency

improvements and interconnection enhancements are key actions to be implemented through the deployment of technologies already developed by electro-technical, electronic and ICT industries. For example, national system interconnections will be strategic in order to enable the integration of significant energy productions expected from renewables within Europe. From windy Northern Europe to sunny Northern Africa and the large-hydro Central-East Europe, energy system interconnections will be key to enable continuous flows of renewable electricity across a pan-European grid.

In the field of distribution network, strong changes are required in comparison with the traditional paradigm. Distribution networks, founded with the exclusive role to widely supply costumers with electricity, has to revolutionise its functioning because of the growth of distributed generation and renewable energies within low-medium voltage grids and the entrance of *prosumers* on the “stage”. In particular, the future distribution networks will have to be able to manage two-way energy and data flows between low-medium voltage grids and medium-high voltage ones. In this segment as well, proper technologies are already available and new solutions are being implemented by ITC industry in order to improve the optimisation of grid performances.

In the future, such a development of electricity networks would pave the way for new energy models within cities too, where the bulk of energy consumption is being focused due to the growth of urbanisation around the world. In urban areas, in fact, smart grid implementation could allow for the deployment of electric cars and “smart buildings”, as well as the optimisation of distributed generation integration into the grids, transforming today’s cities into “smart cities” of the future.

EUROPEAN AND ITALIAN INITIATIVES IN THE FIELD OF SMART GRIDS

At a European level, the associations of European Transmission System Operators (ENTSO-e) and Distribution System Operators for Smart Grids (EDSO4SG) are jointly committed to develop and deploy energy networks of tomorrow

through the *European Electricity Grid Initiative* (EEGI). The EEGI is a European RD&D program (2010-2018) that allocates €2 billion in private/public funding. The goal of the program is to back 12 pilot projects aimed at demonstrating good quality, efficiency, advantages and benefits of smart grids.

Among European countries, Italy is considered the main smart grid laboratory around the world. The *Telegestore* program carried out by the biggest Italian utility, Enel, installing more than 32 million smart meters and 100,000 automated sub-stations within the country, is considered the pre-eminent experience to date. This program has enabled Italy to develop “intelligent” distribution network pilot projects within its territory: cities as well as rural areas and islands. Starting from this important national experience, the Italian Ministry of Economic Development (MSE) is involved in and committed to smart grid issues at an international as well as a national level. In 2009, Italy and the Republic of Korea were appointed by the Major Economies Forum to carry out the “Technology Action Plan: Smart Grids”.

Moreover, Italy joined the Republic of Korea and the United States of America in July 2010 as a co-founder of the International Smart Grid Action Network (ISGAN), which aims to promote smart grid development at an international level, sharing know-how and best practices within all the Clean Energy Ministerial Member States.

At an Italian level, in the framework of national energy strategy, the Ministry of Economic Development is working out the second Energy Efficiency Action Plan - to be presented to the European Commission within June 2011 - in which, among other measures, the backing of distribution network improvements in line with smart grid concepts is organically counted. At the same time, the development of the electricity networks has also gained great attention during the past few years in the area of technology innovation backing. In fact, the Ministry of Economic Development allocated €27 million for projects aimed at improving and optimising distribution networks through the *Industria 2015* program.

Moreover, the funds for research into electrical systems allocated €210 million to Program Agreements between ENEA (Italian National Agency for new Technologies, Energy and Sustainable Economic Development), CNR (National Research Council) and RSE (Research into Electrical System) for the 2009-2011 period. The priority area of the Program Agreements' projects is the grid development.

In addition, in the framework of the "Interregional Operative Program - renewables and energy savings", €77 million was allocated through an agreement between the Ministry of Economic Development and Enel Distribuzione for distribution network optimisation which aims to enable a wide diffusion of low-size photovoltaic power plants into the southern Italian grids.

In the field of energy regulation, the Italian Regulatory Authority for Electricity and Gas (AEEG) introduced a tariff system based on time slots: more expensive tariffs during the daily peak hour-slot and cheaper ones during the rest of the day. This system, incentivising the shift of customer consumptions towards non-peak hours while, at the same time, allowing money-saving on electricity bills, is considered a virtuous example of "intelligent pricing".

Moreover, the AEEG worked out an incentivising scheme for "active-grid" projects with the resolution ARG/elt 39/2010. This resolution establishes the procedures defining the technical requirements that pilot projects relating to medium voltage grids must take in order to be included for the purposes of satisfying the requisites for the promotion of smart grids and for finance through electricity tariffs. In particular, projects admissible for incentives are those aimed at changing a traditional medium voltage (MT) grid, or a section of it, into a grid with control, balancing and metering systems where a transit of electricity is recorded from the MT-grid to the high voltage grid, or to the main MT-grid, for at least 1% of the yearly operating hours. To date, eight Italian utilities have submitted projects to receive the "incentivising treatment" and the first pilot projects will be implemented during 2011.

The National Transmission System Oper-

ator (TSO), Terna, has already entered into the "smart grid era" as it has had to dispatch electricity within the national network in the presence of increasing renewable energy productions that are intermittent and non-programmable. In fact, during the past few years, Terna has committed to developing the national transmission network in order to allow connections of renewable-fuelled power plants. Moreover, Terna has improved the interconnections between the peninsula and the main islands (Sicily and Sardinia), as well as between Italy and foreign states, including North African and Balkan countries.

Recently, Terna realised the 1,000 MW interconnection line Sardinia-Italy that also allows the optimisation of the wind generation existing in the island. Moreover, the completion of the 2,000 MW interconnection line Sicily-Italy is foreseen by 2013-2014.

At present, the priority actions and measures that are being developed by Terna concern: increasing control automation in order to assure economy and traceability; implementing the transmission network in order to assure renewable dissemination, cost reductions and interconnections; minimising forced blackout while integrating intermittent generation into the grid; optimising load management; participating in RD&D programmes and initiatives at the national and international level.

Looking forward, Italy could take advantage of its position in the middle of the Mediterranean sea. The interconnections between the country and the Balkan or North Africa states, in fact, could make Italy the European hub for electricity.

PRIORITY MEASURES AND OPPORTUNITIES RELATED TO SMART GRID DEVELOPMENT AND DEPLOYMENT IN ITALY

Over the past few years, Italian transmission and distribution companies, research institutes and universities have all achieved important results in the field of smart grids. However, there are still challenges to be addressed in order to change the national grid into an even more efficient network.

At present, the priorities refer to:

- coordination of all existing competences regarding smart grid issues at an institutional level through the formalisation of a permanent working group - as done in the US, China and the Republic of Korea - with the aim to elaborate on a national strategy or action plan identifying priority needs and paths to follow in order to pave the way for the transition of the Italian electrical system towards the "smart grid era";
- assuring the stability of the political-normative framework in order to allow for investment decision planning by industry over a mid-long term period;
- finding new resources in addition to Italian and European financial backing through innovative project financing schemes, e.g. public-private partnerships;
- building-up of pilot projects: in this regard, cities and islands represent the optimal habitat for "intelligent grid" projects. In particular, the natural islands' microcosm could allow companies to test new technologies and business models, and could create low-risk opportunities for industries and universities.

These are some of the main priorities for building-up an ideal system in which electricity will friendly, widely and economically flow where and when it is needed.

It is worth remembering that addressing these challenges and enabling the progress of the national grid -the main artery of the national economy- into an "intelligent grid" will also result in increased job creation and improve the competitiveness of the country as a whole. ■

NOTE

1. The Clean Energy Ministerial is a high-level global forum to promote policies and programs that advance clean energy technology, to share lessons learned and best practices, and to encourage the transition to a global clean energy economy. Initiatives are based on areas of common interest among participating governments and other stakeholders. Governments participating in Clean Energy Ministerial initiatives include: Australia, Brazil, Canada, China, Denmark, the European Commission, Finland, France, Germany, India, Indonesia, Italy, Japan, Korea, Mexico, Norway, Russia, South Africa, Spain, Sweden, the United Arab Emirates, the United Kingdom, and the United States (www.cleanenergyministerial.org).