Science & Technology

FORESIGHT

from society to research

Background Document

"Next Generation Energy Storage Technologies: Challenges and Opportunities"

2-3 December, 2015 - Taormina

WG ENERGY

National Research Council of Italy

BACKGROUND DOCUMENT

"Next Generation Energy Storage Technologies: Challenges and Opportunities".

Taormina (Italy), 2nd-3rd December 2015

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CNR INTERDEPARTMENTAL PROJECT

« SCIENCE AND TECHNOLOGY FORESIGHT »

Mission

The Science and Technological Foresight Project seeks to define a medium to long-term vision – 5 to 30 years – in order to elaborate coherent research strategies and to address serious socially relevant problems related to environment, health, food, energy, security and transportation.

The holistic approach followed in analysing the topics and the active participation of internationally acknowledged scientists and experts from academia, government and the private sector in the foresight activities and in particular in a series of explorative and "Face to Face" (F2F) workshops, each of them focused on specific correlated, sub-topics are two of the key characteristics of the project.

The explorative and F2F workshops are *invitation only events*, organized in such a way as to guarantee to participants from a range of backgrounds and positions the conditions necessary for a free and open debate. This approach is designed to facilitate convergence towards common positions related to research priorities, knowledge gaps and funding needs and to address the social acceptability of future products and services and resultant market potential.

Working Method

The organization of the F2F workshops has four operational phases: the definition of the program of workshops, the preparation of preliminary documents, the selection of experts – interested in confronting problems in all their complexity, and the preparation of the reports following each workshop. The identification of the participants, crucial to the success of the F2F workshops requires time, credibility and a wide network of contacts. This interactive and reciprocal exchange leads to the consolidation of a collective intelligence which goes beyond the linear view of cause and effect towards the development of a systemic, collective and integrated vision.

Using the dedicated web platform (www.foresight.cnr.it), those who wish to can join the Foresight Network and contribute to the project with concepts, ideas, questions and observations.

Workshop on

"Next Generation Energy Storage Technologies: Challenges and Opportunities".

Organised in the framework of the Science and Technology Foresight Project (STFP)
(http://www.foresight.cnr.it)

Hotel Villa Diodoro, Taormina, Italy 2-3 December 2015

National Research Council of Italy (CNR) and Trieste AREA Science Park

Organisers: - E. Andreta, G. Einaudi, A.S. Aricò (CNR); S. Taylor (AREA Science Park).

Mission

Climate change with the consequent need for reducing atmospheric CO_2 concentration has prompted a move toward the use of the carbon friendly renewable energies (RE) such as solar and wind to power the electrical grid and towards green transport solutions. On the other end, increasing energy demand requires to secure the surplus of RE generated in low consumption periods for a delayed use, using economical and safe storage solutions.

As a consequence, renewable energy technology has been disruptive in the way that has dramatically changed the status quo of the electrical grid management at different grid space scale and time horizons endangering grid stability and safe and secure energy supply.

Before the "coming to age" of power generation from RE, the end-user demand for power was matched by balancing outputs from schedulable generating plants, usually hydroelectric, nuclear and fossil fuel. This landscape has been changing rapidly over the past decade as RE is increasingly penetrating the electricity market and contributing to the total power supply.

Because of the intermittent nature of renewable power generation, storage technology represent the solution for utility-scale solar and wind farm installations and can be symbolized as the "missing link" between the variable RE power production and the grid demand at different time horizons and grid scales.

Energy storage is one of the three pillars of the energy infrastructure system acting in mediating between variable sources and variable loads supplying energy to the grid during high demand periods and to absorb excess electricity from generators during low demand periods for rescheduled sale during high demand or during high electricity price.

For these reasons one of the four S&T topics on which the Science and Technology Foresight Group is concentrating its efforts is "Energy Storage". We adopt a long-term view and address the issue of energy storage in its broadest sense, from electrochemical energy storage to hydrogen and fuel cells, to thermal energy storage, power to gas, CO_2 recycling, the direct coupling of storage systems with renewable power sources and the distributed energy generation.

The topic of future energy storage technologies is central to ongoing discussions at all policy and science levels, as well as to many European and international research, technology and management projects.

It is clear that there are many issues at stake which are all linked to each other. If we keep focusing on one single aspect, the solution to one problem may result in the aggravation of another while we should learn to consider them as a set of interlinked and mutually reinforcing set of challenges. In order to enable knowledge, assessment and identification of potential applications and socio-economic impacts and to point out obstacles, gaps in knowledge, education, funding needs, market potential and social acceptability, explorative and "Face to Face" (F2F) workshops will be organized, which will have a focus on different, but correlated sub-topics.

It is of primary importance to select the specific topics having the highest priority and contact relevant experts. Even the choice of the topic requires the input of experts and this is why we are organizing an exploratory workshop on the theme of Next Generation Energy Storage Technologies: Challenges and Opportunities, on December 2 and 3 in Taormina, Italy.

The aim of the exploratory workshop is to identify such topics as foresight priorities to propose a road map for the following F2F workshops. This requires the participants to separate the long term objectives from the intermediate steps and milestones along the way. In order to do that, we have invited experts representing different sectors, asking them to introduce, in a ten minutes contribution, their point of view regarding future challenges. Ample time will be given to discussion so as to address all important subjects, prioritize them and discover the interactions between them.

The results of the workshop will be summarized in a *Report* on energy storage, that will be prepared after the workshop and agreed with workshop participants. This will contain a roadmap of the following F2F workshops, which appeals to researchers, policy makers, industry and consumers and encourages the cooperation in the assessment of risks and benefits. This explorative workshop will be followed in 2016 by the first F2F workshop, discussing the most relevant energy storage questions, as defined by the roadmap, and a *Report* containing the main results will be prepared.

Recommendations for Speakers:

Invited speaker are requested to send a short Abstract (free format) of their presentation to the organisers at least a week before the event. This will be circulated among the participants to prepare the audience with respect to the specific arguments that will be discussed during the meeting.

Invited speakers should limit to two slides the description of the state-of-the art in the specific field and the presentation of consolidated results while most of the presentation should focus on the new research directions.
Since the aim of this explorative workshop is to promote a debate among all speakers, we recommend the invited speakers to limit their presentation to 10 min to allow for an extensive joint discussion both after a set of presentations dealing with similar topics and especially on the second day that is dedicated to brainstorming activities.

We expect the invited speakers including scientists, policy makers and industry representatives

- to present new research pathways in the field, propose radically new approaches, actively discuss the ideas proposed by their colleagues.
- comment on the socio-economic impacts of the proposed approaches, indicate possible funding mechanisms and individuate eventual obstacles.
- indicate the market needs, risk assessment, public acceptability, the novel solutions which are requested in the field, which are the main obstacles that should be overcome in the energy storage field.

The *Report* as final result of this workshop will be agreed with all speakers.

Acknowledgements

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