ENERGYIN PT

COMPETITIVENESS AND TECHNOLOGY CLUSTER FOR ENERGY

The Latest Developments in Portugal

6th meeting of the European National Energy Storage Associations

EASE Offices, Brussels, 10 May 2016

Figure: Porto Santo, Madeira Archipelago

SUSTAINABLE PORTO SANTO

Challenges

- Porto Santo is a small island northeast of Madeira in the North Atlantic Ocean with 42.5 square km, 517 m as highest point and 5,483 inhabitants, from whom 4,640 are electricity consumers.
- Strong seasonality of economic activity, social and cultural activities (usually three months per year).
- Island economy relies almost entirely on imported diesel and fuel oil to supply its energy needs, resulting in significant economic and environmental costs.
- Double insularity taking into account that imported fossil fuels are shipped from Madeira Island.
- 90% of the final consumption is associated with transportation and electricity.

SUSTAINABLE PORTO SANTO

Challenges

- The characteristics and dimensions of the island are particularly suitable for electric mobility.
- The massive shift to electric mobility enables much of the energy consumption to be associated with the Electric System.
- The development path for a Sustainable Porto Santo should be based on a strategy for a Sustainable Electricity System (Fossil Free Island concept)
- How to develop a Sustainable Electricity System in the way to a Fossil Free Island?
    - *Increase the use of renewable resources*
    - *Network support services*
    - ***Energy storage***
    - *Smart power system management*

SUSTAINABLE PORTO SANTO

Strategy to minimize the current constraints

- Installing a new system that allows:
  - *Spinning reserve, all the time, continuously releasing a generation group*
  - *Operating the electrical system with only one unit or even without any group in contingency situations for up to 15 minutes (time required to place a unit on the grid)*
  - *Cooperate with groups to balance strong intermittent renewable production fluctuations*
  - *Improve the integration of renewables*
  - *Improve the efficiency of the electricity system*
  - *Reduce operating costs*
  - *Improve service quality*

SUSTAINABLE PORTO SANTO

Evaluated Solutions

- Common requirement: to provide fast reserve
  - *Flywheel: autonomy less than 1 minute*
  - *Flywheel with additional generator*
    - *Solves the issue of autonomy*
    - *It requires more than one unit to match one of the existing generators*
  - *Batteries: compatible with the desired requirements*

SUSTAINABLE PORTO SANTO

Evaluated Solutions

- Battery Storage with allow:
  - *Operating the system with one thermal group less*
  - *Increase security of supply, through the fast primary reserve of the battery*
  - *"Smoothing" variations of intermittent renewable*
  - *Improve the performance of thermal groups as they can operated with an average power greater and more stable*
  - *Increase the integration of intermittent renewables*

SUSTAINABLE PORTO SANTO

Batteries Solution

- Studies have demonstrated technical and economic viability of the Batteries solution.
  - *Power capacity: 4 MW (equivalent to the power of each thermal unit)*
  - *Storage capacity: to ensure an autonomy of 15 minutes at full load. The study pointed out to a capacity around 3 MWh.*
  - *Technology: given the predictable usage the choice is lithium-ion batteries*
  - *Project status: in preparation of the tender, to be launched in the beginning of the 2nd quarter of 2016.*

ECONOMICAL STUDY FOR COMPRESSED AIR ENERGY STORAGE

Challenges

- In an energy market where one of the strategies is associated with solutions such as the "Smart Grids", it is essential to evaluate the safety and flexibility of the energy network and balance between supply and demand.
- Large-scale energy storage, as provided by the CAES technology, is essential for the integration of renewable energy in a smart grid in Portugal.
- The identification of possible geological reservoirs is crucial to the development of a CAES storage project. In Portugal this mapping is still to make, preventing the assessment of the potential of this technology to support the interconnection of RES in the national electricity system.

ECONOMICAL STUDY FOR COMPRESSED AIR ENERGY STORAGE

Objectives

- The main objective of proposed study is to determine the potential use of CAES technology and its economic viability in the Portuguese context.
- The specific objectives to achieve are:

1. Mapping of geological reservoirs suitable for application of CAES technology in Portugal and spatial relationship with renewable energy production sites;
2. Economic evaluation of the application of CAES technology, the storage components (underground and surface in mainland Portugal, and especially surface in the autonomous regions) and surface facilities;
3. Feasibility and impact CAES under the European regulations and the Portuguese energy market, including the integration of RES in Portugal

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ECONOMICAL STUDY FOR COMPRESSED AIR ENERGY STORAGE

Methodology

- Benchmarking of CAES systems - seeking out a review of existing literature on CAES systems and technology development in countries with high penetration of RES.
- Geological Storage Potential characterization in Portugal - with the objective of defining the areas and geological formations with storage potential and quantify the storage capacity in Portugal and its integration with renewable.
- CAES Economic Analysis for Portugal - to study the economic and financial viability of CAES technology in the Portuguese national energy context.
- Framework of CAES technology in the Portuguese electric system - in order to assess the challenges of regulation and discuss possible business models.
- Coordination and dissemination of results

ECONOMICAL STUDY FOR COMPRESSED AIR ENERGY STORAGE

Methodology

WP_1 – 3 months

Benchmarking of CAES systems

I. Review of the literature (State-of-the-Art) and existing CAES projects in the world;

II. Characterization of CAES technologies.

WP_2 – 12 months

CAES Geological Storage Potential characterization in Portugal

I. Definition of criteria for selection of geological;

II. Analysis of geological information;

III. GIS Spatialization of reservoirs and areas with RES potential ;

IV. CAES potential mapping in Portugal.

WP_3 – 12 months

CAES Economic Analysis for the National territory

I. Methodology to assess the costs and the financial return of CAES projects;

II. Costs of the underground component of CAES systems;

III. Costs of the surface component of CAES;

IV. Economic analysis for the Portuguese case: a) large and small-scale CAES (Portugal Continental); b) CAES small scale (Archipelagos).

WP_4 – 6 months

Framework of CAES technology in the National electricity system

I. National and European regulation;

II. Evaluation of possible business models.

ECONOMICAL STUDY FOR COMPRESSED AIR ENERGY STORAGE

Partners

DGEG – Direcção Geral de Energia e Geologia

Institute of Earth Sciences (Évora University, Porto University, Minho University) and the Energy for Sustainability Initiative from Coimbra University

EnergyIN – Competitiveness and Technology Cluster for Energy

REN – Redes Energéticas Nacionais

EDA – Empresa de Electricidade dos Açores (invited)

EEM – Empresa de Electricidade da Madeira (invited)

PROJECT SENSIBLE

The project SENSIBLE addresses the call LCE-08-2014 by integrating electro-chemical, electro-mechanical and thermal storage technologies as well micro-generation (CHP, heat pumps) and renewable energy sources (PV) into power and energy networks as well as homes and buildings.

The benefits of storage integration will be demonstrated with three demonstrators in Portugal, UK and Germany.

Évora (Portugal) will demonstrate storage enabled power flow, power quality control and grid resilience/robustness in (predominantly low-voltage) power distribution networks – under the assumption that these networks are „weak“ and potentially unreliable.

Nottingham (UK) will focus on storage-enabled energy management and energy market participation of buildings (homes) and communities – under the assumption that the grid is „strong“ (so, with no or little restrictions from the grid).

Nuremberg (Germany) will focus on multi-modal energy storage in larger buildings, considering thermal storage, CHP, and different energy vectors (electricity, gas).

PROJECT SENSIBLE

An important aspect of the project is about how to connect the local storage capacity with the energy markets in a way that results in sustainable business models for small scale storage deployment, especially in buildings and communities.

SENSIBLE will also conduct life cycle analyses and assess the socio-economic impact of small-scale storage integrated in buildings distribution networks.

By integrating different storage technologies into local energy grids as well as homes and buildings, and by connecting these storage facilities to the energy markets, the project SENSIBLE will have a significant impact on local energy flows in energy grids as well as on the energy utilization in buildings and communities. The impacts range from increased self-sufficiency, power quality and network stability all the way to sustainable business models for local energy generation and storage.

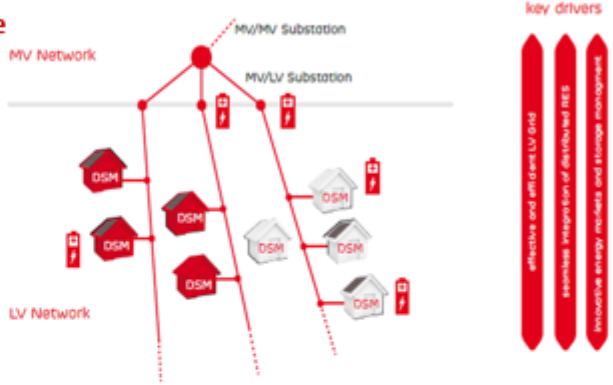
PROJECT SENSIBLE

SENSIBLE – Overview

Storage-Enabled Sustainable Energy for Buldings and Communities – H2020-LCE08-14

Sensible Scope - Demonstration of distributed energy storage and energy management

- Demonstrate distributed energy storage (thermal, electro-chemical and electro-mechanical) and energy management in grids, communities and buildings



Highlights

- Led by Siemens Corporate Technology A.G.
- Overall budget of 15,4 M€ (EDP secured 2,2 M€ of a total of 11,8M€)
- EDP Labelec / N.E.W. R&D leads demonstration WP
- EDP's works involves 7 FTEs (Labelec/NEW – 5; EDPD – 2)
- 42 months duration

Three Demonstrators

- Évora (focus on rural / semi-urban grids-DSO)
- Nottingham (focus on community energy management)
- Nuremberg (focus on building energy management)

Partners

- Siemens AG
- EDP Labelec/EDPD
- INESC TEC
- Siemens SA
- INDRA
- GP TECh
- U. Sevilla
- Advice
- Armines
- Th Nuremberg
- K&S
- U. Nottingham
- Mozes
- Empower

EDP Objectives

- **Demonstrate concrete applications of distributed energy storage and energy management** in the distribution grid creating value for the **DSO** and **enabling innovative business models** and competitiveness / efficiency on the retail side
- Understand **how EDP's Smart Grid concept should evolve** in order to facilitate referred applications
- Develop business cases of the different distributed energy management and energy storage applications in order **to determine the optimal mix of applications in different scenarios** (different grid contexts, penetration of distributed generation, etc.)
- Understand **what regulatory framework and policy developments** should be promoted

EXPOENERGEA CONFERENCE 2015

EXPO energea

ExpoEnergea: Sé Renovable, Sé Independiente
20-22 October, Mérida, Spain

Objectives

- Strengthen the development of renewable energy and related activities in Extremadura, helping its position as a strategic sector for the future of the region.
- Provide a specific professional meeting place for companies, professionals and institutions participating sectors, consolidating it as an annual event of reference both regional and national, international and cross-border.
- Promote knowledge, innovation and active cooperation between event participants and visitors of it.
- Raise awareness among society both Extremadura and the other regions and countries renewable energy, the benefits we bring and the importance of our industry to achieve true sustainable development on the planet.

GRID + STORAGE

Objectives

- Complementing the activities performed so far by the European Electricity Grid Initiative (EEGI) and the Grid+ project, a consortium formed by TECHNOFI, EASE, EDSO, ENTSO-E, RSE and VITO has been selected by the European Commission to support DG Energy and the Member States in defining a European R&D roadmap integrating energy storage into grid research and innovation activities, both at electricity transmission and distribution levels.

- Across two years (January 2015 - December 2016), the following activities will be implemented by the six partners within the Grid+Storage project:
  - Public consultation
  - Project monitoring
  - Regional Knowledge Sharing Workshops
  - Knowledge Sharing Platform

GRID + STORAGE

GRID+ STORAGE

Activities

Public consultation

Relevant stakeholders of the electricity value chain and of other energy networks are targeted at EU level

Project monitoring

Ongoing and planned smart grid and energy storage projects at national, regional, EU and international levels are analysed

Regional Knowledge Sharing Workshops

Interactions with state-of-the-art projects and the Member States are carried out to identify research needs

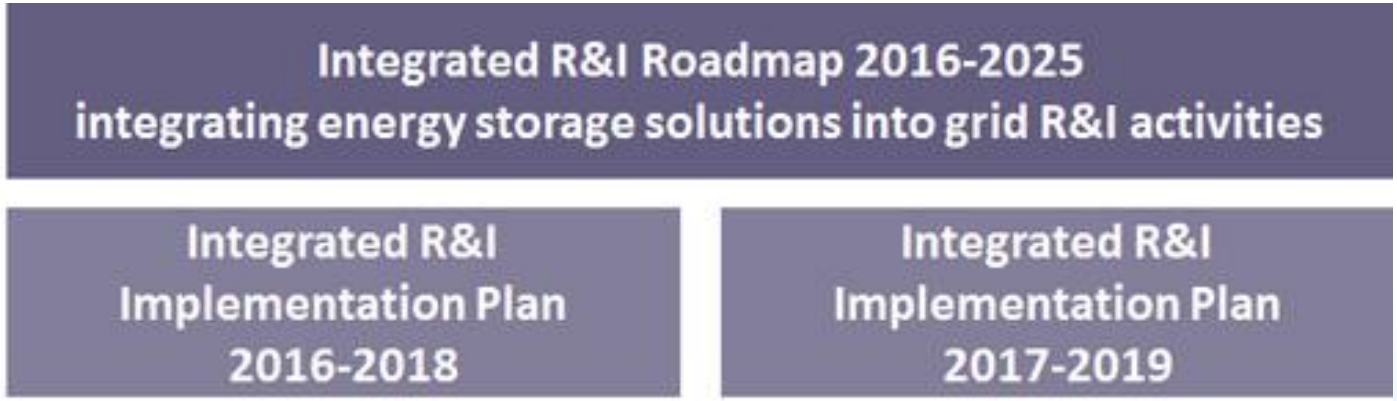
Knowledge Sharing Platform

Knowledge obtained from ongoing or completed projects is gathered and disseminated

GRID + STORAGE

Activities

- These activities will allow the six partners to deliver a ten-year integrated Research and Innovation Roadmap (RIR) towards a more secure single European electricity market will be delivered at the end of 2016 and related **short-term Implementation Plans** (2016-2018 and 2017-2019).



GRID + STORAGE

5th Grid+Storage Regional Knowledge Sharing Workshop (Portugal and Spain)
15-16 February 2016, Madrid, Spain

Speakers

José Oliveira Paulo	EnergyIN	National Storage Projects in Portugal
Ricardo Santos	EDP Distribution	Storage Projects EDP in Portugal
		InovGrid Project
Miguel Moreira da Silva	REN	Multi Attribute Energy Storage Planning

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2nd ENERGYLIVE CONFERENCE

EnergyLiveExpo

Energy and Societal Challenges
Panel III – Energy Storage
3 March 2016, Lisbon, Portugal

Speakers

Chairman

Miguel Moreira da Silva	REN

Speakers

Ricardo Santos	EDP Distribution	SIESTORAGE
	EEM	Sustainable Porto Santo
Ricardo André	New Energy World	SENSIBLE
Paulo Partidário	DGEG	Energy storage challenges in buildings

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Thank You!

Figure: Windmills, Porto Santo, Madeira Archipelago

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