Joint Programme on Energy Storage (JPES)

EERA Joint Programme on "Energy Storage"

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EERA JPC Meeting

Brussels, 22th October 2012

Vision and general structure of JPES

officially launched at the SET Plan Conference in Warsaw on 28.11.2011

Background

- Stationary Energy Storage supports commercial breakthroughs of renewable energies, helps to stabilize the grid, provides UPS
- Mobile energy storage technologies enable electromobility and transportation as well as automotive starting, lighting, ignition technology
- Thermal energy storage essential for heating/cooling and „green“ industrial processing

Objectives

- Overcome diverse European research activities on Energy Storage by introducing well coordinated strategies
- European industrial leadership in Energy Storage Research and Technologies
- Advanced Energy Storage Technologies are essential for enabling a worldwide transition to Low Carbon Economy by 2050.
- Integrated Energy Storage Simulation (IESS)

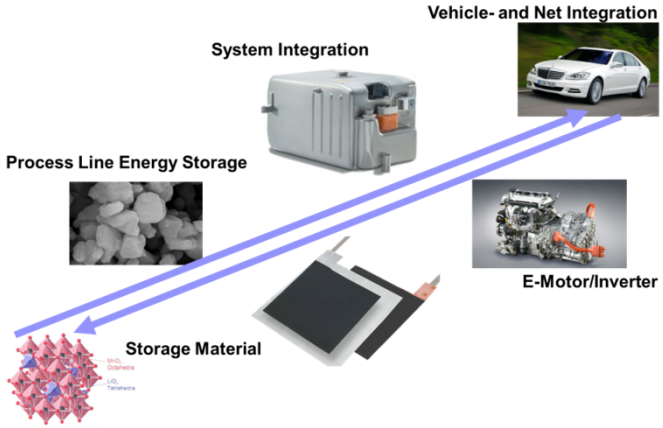
Objectives

Research objectives common to all energy storage technologies:

- Improving **energy density** and **storage efficiency**
- Costs, safety, reliability, availability, cycle life, calendar life, sustainability, standardization and quality issues, social acceptance, economic and environmental impacts

Additionally, large variety of **specific research objectives** for particular storage technologies

- Power density, charge / discharge performances, response time, operating temperature, thermal conductivity, …



All sub-programmes cover the complete value chain

Foreseen activities

- Conducting fundamental and technological research
- Organization of joint workshops and conference symposiums
- Preparation of reports and papers
- Exchange of early stage researchers between partner institutions
- Development of prototypes and test facilities
- Sharing of experimental and test facilities
- Round robin tests
- Accelerating pre-normative research and rapid transfer of research results to industrial technologies and standards
- Collaboration of sub programmes to work on hybrid technologies
- Website and joint database
- Additionally: Integrated Energy Storage Simulation (IESS)

Partnership and Resources in 2012

Number of full participants: *20*

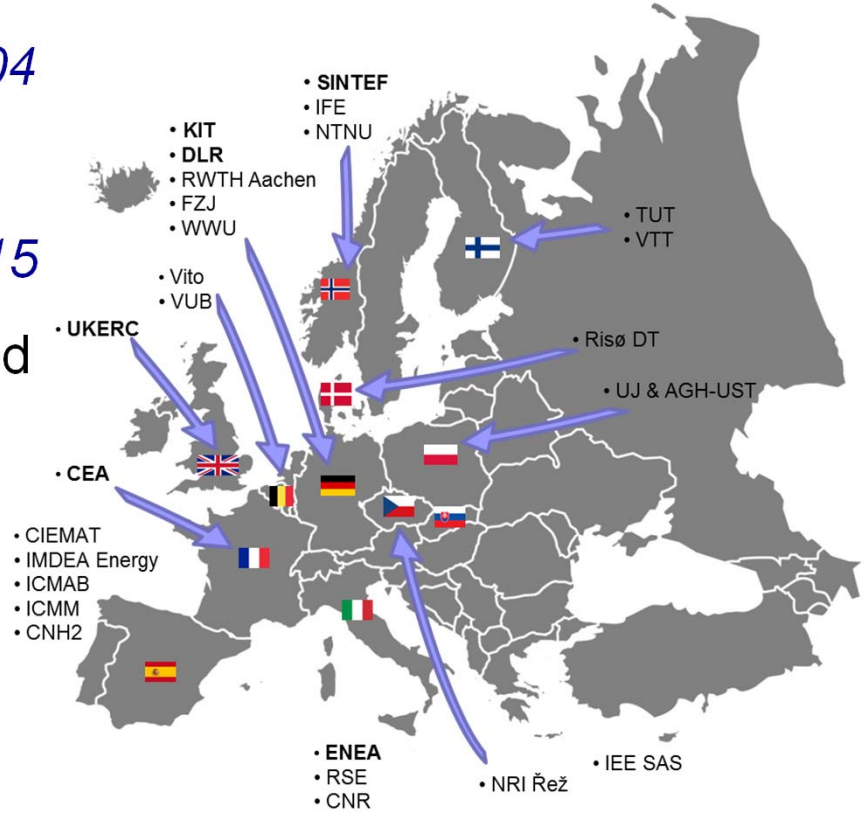
Number of associated participants: *6*

Number of countries involved: *12*

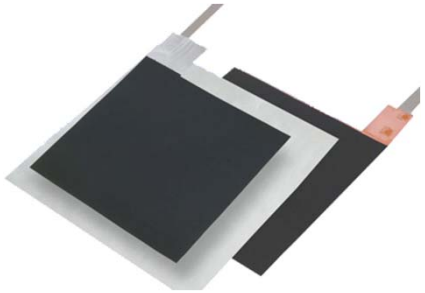
Resources committed – PY/Y: *304*

Potential new participants in 2012: *15*

10 of these will be evaluated and approved during next JPSC Meeting on 25.10.



Main Activities and Outcomes



SP 1 Electrochemical Storage – Mario Conte (ENEA)

Number of participants: *21 (18P / 3A)*

Number of countries involved: *11*

Resources committed – PY/Y: *183*

Potential new participants: *6*

Expected outcomes: State-of-the-art report after 12 months; Completion of first research roadmap; Preparation of joint round robin; Development of pre-normative joint horizontal activities; Preparation of additional research proposals.

Work on: *Lithium Ion Batteries, Super Capacitors, Redox-Flow Batteries, Liquid Metal Batteries, Mg Batteries*

Advanced Power Systems (Hybrids)

SP 1: Most important Achievements 2012

- The partners are preparing a joint proposal in the frame of the FP7-ENERGY-2013-IRP call for the activity ENERGY.2013.10.1.9: Integrated research programme on electrochemical storage
- ISEA, KIT, DLR and FZJ succeeded in getting a grant from the HGF worth of 3.0 Mio € for an energy research alliance on “stationary electro-chemical solid state storages and converters”
- KIT succeeded in getting a grant from the BMWi worth of 7.0 Mio € for a manufacturing line for Li ion pouch cells within the Competence E umbrella project.
- KIT submitted a proposal within the STROM 2 initiative of the BMBF on integrated development of energy-efficient battery systems
- The IMDEA research team has recently started participating in an International Training Network project within FP7-People, which has exchange and training of researchers as one of its main targets.
- KIT was invited by the EC to participate in writing of an assessment report on the demand for energy storage in future for the SET-plan Education and Training action, i.e. the market growth potential and those skills needed in higher education for satisfying this demand.
- Other SP participants have national publicly funded project on electrochemical storage systems (e.g., CNR-ENEA-RSE have programme agreements on the Research for the Electricity Grid funded yearly by the Italian Minister of Economic Development)

Main Activities and Outcomes

SP 2 Chemical Storage – Jean-Philippe Nicolai (CEA)

Number of participants: *12 (10P / 2A)*

Number of countries involved: *8*

Resources committed – PY/Y: *25*

Potential new participants: *3*

Expected outcomes: State-of-the-art report after 12 months; Completion of first research roadmap; Development of integrated multicriteria evaluation; Preparation of additional research proposals.

Work on: *Hydrogen*
Other chemicals (ammonia, methane, methanol, …)

SP 2: Most important Achievements 2012

- Kick-Off meeting on 02.27.12. in KIT with 6 participants: the objective was to agree on the DoW on chemical storage (tasks and participants).
- Phone meetings with individual participants for further WP refinement on chemical energy storage and tasks on the state of the art review have been allocated. Slight change on the DoW have been accepted.
- The partners are preparing the state of the art review on chemical storage and a dedicated workshop before the end of 2012
- Partners are preparing joint proposal s in the framework of the JU-FCH calls for 2013
- CEA have presented the EERA JP energy storage and the chemical storage sub-group to potential French partners

Main Activities and Outcomes

SP 3 Thermal Storage – Doerte Laing (DLR)

Number of participants: *7 (7P / 0A)*

Number of countries involved: *6*

Resources committed – PY/Y: *25*

Potential new participants: *3*

Expected outcomes: State-of-the-art report after 12 months; Completion of first research roadmap; Development of integrated multicriteria evaluation; Preparation of additional research proposals.

Work on:
- *New salt systems*
- *Phase change materials (PCM)*
- *New fluids and composites*
- *Design and internal heat transfer concepts*
- *Storage integration*

SP 3: Most important Achievements 2012

- First workshop on Thermal Energy Storage was conducted in May. Workpackages for Task 1 to 3 have been discussed in detail and responsibilities have been distributed among partners.
- The first reports will be prepared until December 2012 according to the work programme.
- AIT has expressed interest in joining the meeting and has attended the meeting as a guest.
- Milestone 3.1 Workshop on Materials and design concepts has been scheduled for January 2013.
- Milestone 3.8 Report on Review of currently used small scale TES systems is scheduled for January 2013.

Main Activities and Outcomes

SP 4 Mechanical Storage – Atle Harby (SINTEF)

Number of participants: *6 (5P / 1A)*

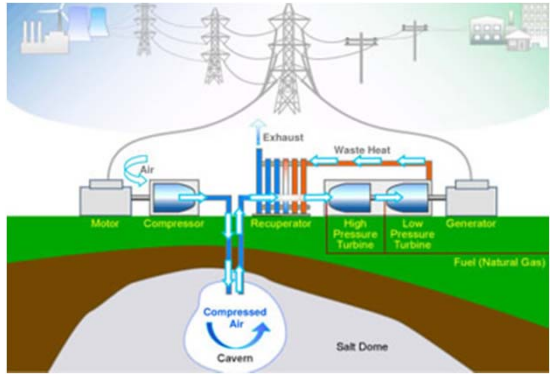
Number of countries involved: *5*

Resources committed – PY/Y: *14*

Potential new participants: *3*

Expected outcomes: State-of-the-art report after 12 months (with emphasis on simulation); Completion of first research roadmap; Overview on grid connections (Europe); Future scenarios; Environmental impacts , Governance and social acceptance

Work on: *(Pumped) Hydro*
Fly Wheels
Compressed Air (CAES)



SP 4: Most important Achievements 2012

- Contact with hydropower industry (manufactoring: Andritz, Rainpower; hydropower companies: Statkraft, EnBW, E.ON., RWE, EdF, Endesa) – with information of JP Energy Storage
- The SPC applied for additional funding from the Research Council of Norway (RCN) to organize meetings. RCN has also provided additional funding for research on energy storage by hydropower and environmental impacts from hydropeaking in China. This may serve as an important contribution for the world-wide overview and state-of-the-art about mechanical energy storage as China is an important energy country.
- Scientific progress: Several studies and analysis are summarized in reports and conference papers on large-scale storage and balancing from hydropower. These are available at www.cedren.no.
- CEDREN and Statkraft organized an international seminar in Sand, Norway in September on the topic "large scale balancing from Norwegian hydropower" focusing on hydro storage. Scientists and energy companies from Norway, Germany, Spain, France and the UK participated in the seminar. http://www.cedren.no/Events/Event/tabid/3645/ArticleId/1900/International-seminar-on-large-scale-balancing-from-Norwegian-hydropower.aspx
- Planning for a Sub-group meeting to be organized in Trondheim in December 2012 or January 2013 has started.

Main Activities and Outcomes

SP 5 Superconducting Magnetic Energy Storage – Mathias Noe (KIT)

Number of participants: *8 (7P / 1A)*

Number of countries involved: *6*

Resources committed – PY/Y: *35*

Potential new participants: *1*

Expected outcomes: State-of-the-art report after 12 months; Completion of first research roadmap; Development of superconductors with higher operating temperatures; New concepts for up-scaling of HTS magnet design; Hybrid energy storage using liquefied hydrogen and SMES; Round robin tests.

Work on: Superconductors with high operating temperatures and low AC losses
System technologies including cryogenic infrastructures

SP 5: Most important Achievements 2012

- Kick-Off meeting on 07.10. in Portland with 9 partners with the objective to discuss new concepts in superconducting magnet design and fabrication based on superconductors with higher operating temperatures (“HTS”). The presentations showed a strong complementarity of expertise and equipment gained mostly in former SMES projects or in somewhat related HTS projects. It was agreed on the following objectives:
  - Establish a joint European characterization and demonstration platform for SMES related superconducting materials with higher operating temperatures
  - Implement higher temperature superconductors in modular SMES approaches
  - Increase volumetric energy and power density
  - Decrease system cost for becoming fully cost-competitive with alternative short term energy storage
- Milestone 5.3 Progress Report on “Higher in-field current densities” and on “Low AC loss conductors” has been scheduled for January 2013.
- Milestone 5.4 Progress Report on “Hybrid Energy Storage using liquefied Hydrogen and SMES” has been scheduled for March 2013.

Main Activities and Outcomes

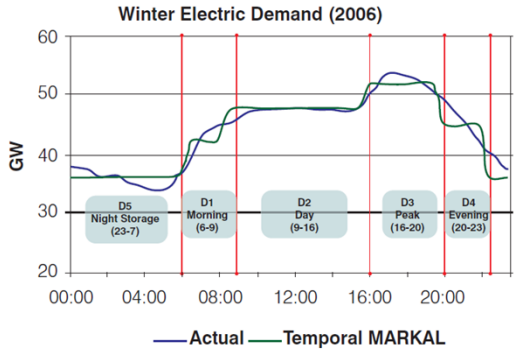
SP 6 Techno Economics – Peter Hall (Univ. of Sheffield)

Number of participants: *9 (9P / 0A)*

Number of countries involved: *7*

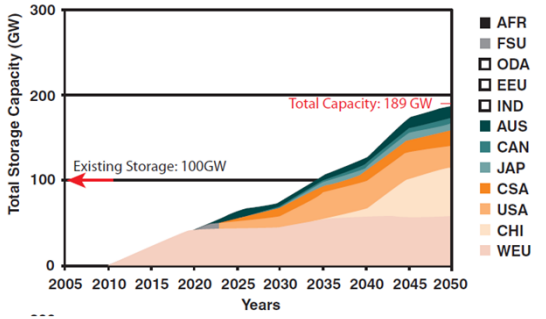
Resources committed – PY/Y: *19*

Potential new participants: *./.*



Expected outcomes: State-of-the-art report after 12 months; Completion of first research roadmap; Development of MARKAL model to include energy storage; Establish of future energy storage revenue streams in different planning scenarios. Assessment of externalities of energy storage.

Work on: *MARKAL model*
Storage time-shifting models



SP 6: Most important Achievements 2012

- Kick-Off meeting on 08.-09.11. in Sheffield with the objective to compare the status of energy storage in different EU member countries and to compare and contrast different economic modelling approaches.
- 2 meetings of SP Management Committee for further WP refinement, because the status of energy storage and identifying potential markets is a subject that is rapidly changing. However, the overall objective is unchanged: To incorporate energy storage into energy planning models, especially TIMES and MARKAL. The initial conclusions from the Management committee meetings are:
  - Although there is competition from technologies such as large-scale interconnection and demand side management, large-scale energy storage will be necessary to balance future electrical grids and smart grids
  - Arbitrage market possibilities exist in all EU markets studied to date
  - Recent reports have suggested that there are definite markets for investment deferment both at the transmission and distribution scale
- The Engineering and Physical Science Research Council (UK) has recently funded a £5M programme on grid connected energy storage. As part of this package funding was explicitly made for an experienced researcher at 0.2 py/y specifically to interface with JPES

Interfaces with other European Initiatives

- European Industrial Initiatives (EII)
- Fuel Cell and Hydrogen Joint Technology
- Electricity Grids
- Smart Cities
- Wind and Solar Energies

- European Energy Technology Platforms (ETP)
- Smart Grids
- Wind
- Photovoltaics

- European Association for Storage Of Energy (EASE)

- Energy Materials Industrial Research Initiative (EMIRI)

- Public Private Partnerships (PPP´s)

- FP 7 – 15 large or medium scale projects

- KIC InnoEnergy – European Institute of Innovation and Technology

... and overseas
- **Electricity Storage Association (ESA), USA**
- **Energy Storage Association of China**
- **Energy Supply Association of Australia**
- **NEDO (Japan)**

Aim at optimum coordination of R&D efforts between industry and public research organizations

International Cooperation

- *South Korea:* *- Organization of KIT-KIST workshop on electrochemical energy storage (15.-19.10., Seoul, South Korea)*
  - Young researcher exchange KIT-KIST
- *Japan:* *- Participation at the CONCERT-Japan Conference and Partnering Event (27.-28.09., Milano, Italy)*
  - Meeting with NEDO researchers
- *USA:* *- Meeting with DOE researchers in Los Angeles (1-6 May) and Stuttgart (14-17 September)*
- *IEA* *- Existing collaboration with the International Energy Agency Implementing Agreement on HEV with focus on storage systems (Mario Conte – Deputy Chairman)*

Interfaces with other Joint Programmes

Interface with JP on…	Interface description	Interface Management
Advanced Materials and Processes for Energy (AMPEA, H. Bercegol)	Materials research	JP AMPEA is focused on fundamental materials research for electrochemical energy and hydrogen storage, while the JP ES mainly covers more applied materials research on component, system, hybridisation and integration level for all kinds of energy storage
Fuel Cells and Hydrogen (FCH, A. Moreno)	Chemical storage technologies	In the JP on FC&H the focus is set on fuel cells, water electrolysers and non-electrochemical hydrogen production, while the JPES is focused on the development of new storage systems for hydrogen
Smart Grids (L. Martini)	Electrical storage technologies	The JP on Smart Grids highlights impact of integrating energy storage systems in the grid, while the JPES covers the storage technologies themselves and the requirements they have to fulfil for integration.
Smart Cities (B. Bach, R. Schütz,)	Decentralized energy storage, thermal storage technologies	The JP on Smart Cities highlights the impact of integrating energy storage systems in buildings and cities, while the JPES covers the storage technologies themselves and the requirements they have to fulfil for integration.
Concentrating Solar Power (CSP, D. Martínez-Plaza)	TES materials and design concepts for solar trough and tower technologies covering temperature range from 300-1000 °C	Both JPs have their own SP on TES. The JP on CSP is focused on TES coupled with solar power plants, while JPES is open to any heat source or heat drain where TES is of interest. Molten salt technology – materials and design concepts – is part of the JP on CSP and will not be treated in JPES
Photovoltaic Solar Energy (PV, P. Wyers)	Electrical storage technologies	Because in the JPPV only the energy generation aspects are treated, the JPES covers the storage technologies and the requirements they have to fulfil for PV integration.
Wind Energy (P. Madsen)	Electrical storage technologies	In the grid integration SP of the JP on Wind Energy tools are developed that support the interaction of wind power with energy storage, while the JPES covers the storage technologies themselves and the requirements they have to fulfil.

JP Management and Outlook

Management and dissemination activities

- *1 JPMB and 1 JPSC meeting (next meetings both on 25.10. at KIT)*
- *Set up and discussion of governance rules to be approved by the JPSC during the next meeting including criteria for membership in the JPES, voting rules and purpose, tasks and responsibilities of the JPMB, JPSC, JPC and SPCs.*
- *Creation of Role of assistant in charge of fostering interfaces and managing and of JP manager*
- *Set up of Share Point for exchange of information between partners*

Outlook

The potential increase by 10 partners committing additional 107.1 PY/Y shows that energy storage is really a “hot” topic that enables a lot of other technologies to be successfully applied on the way to a sustainable energy system with a low carbon generation

→ **The JPES is on a good way to be established as one of the most important European research networks on energy storage.**