Battery-based energy storage roadmap

Stakeholder kick-off report

Subject:	**Stakeholder kick-off report** **BATSTORM Stakeholder kick-off** **March 16, 16:00 to 17:30** **IRES/ESA conference in room 7 B, CCD, Süd**
From:	Ecofys, VITO, Technopolis, Fraunhofer IWES, and Strategen
Project number	POWNL16059

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1 BATSTORM – A European R&D strategy for battery based energy storage

The Batstorm project will support the European Commission and the ETIP team in their progress to identify and support RTD&D needs and market uptake of battery based energy storage as one low-carbon technology of the future energy system. This objective shall be met in line with the aims to increase active consumer participation in the energy system and to improve industrial capacity in Europe. To meet this objective, the knowledge on battery based storages must be fostered and exchanged between stakeholders and research in the field as well as demonstration projects need to be collected and efficiently supported. This includes in particular:

Developing a strategy, including the elaboration of a 10 year roadmap and of a 3 year implementation plan for the organisation of the process for the collection of RTD&D needs: For this purpose, consolidated stakeholder views for the RTD&D needs and market uptake measures for batteries shall be consolidated. RTD&D needs must be prioritised to financially support the development efficiently. The progress on research, demonstration and market uptake must be monitored and compared to targets to identify mismatches and allow timely interventions in the progress.

Knowledge sharing: Knowledge on experiences, best practices and successful pilot and demonstration projects shall be collected and networking activities shall be organised to foster the knowledge sharing process. This includes monitoring and reviewing the projects, programmes and developments in the EU and worldwide.

Support of the policy design progress: The knowledge on batteries is the basis for the policy making process.

Industrial capacity increase and cost reductions of batteries: The progress of increasing industrial capacity and supporting cost reductions shall be supported by developing and implementing appropriate measures. An outline shall be developed and recommendations shall be given regarding measures to stimulate the battery market.

Connect and involve: To stay updated on the project process and to play an active role in our stakeholder engagement please connect online at: http://www.batstorm-project.eu

2 Background and purpose

On Wednesday, March 16, 2016 between 16:00 – 17:30h the first BATSTORM stakeholder workshop took place in Dusseldorf as a site event of the Energy Storage Europe / IRES conference.[1] Together with 20 international experts from all relevant stakeholder groups the BATSTORM consortium kicked-off the stakeholder interaction as an important element of the BATSTORM project. We informed the participants about the general project objectives and the project outline and celebrated the launch of the project website. In an interactive session we discussed the proposed approach and timeline. In three separate break-out sessions for end-user applications, grid system applications and generation & ancillary services the participants gave valuable insights in system needs, market opportunities and financial and legal barriers for key applications of battery storage. The results of the brainstorm sessions will be used as input for an initial implementation plan, a technical analysis and a socio-economic analysis. At the end of the event we invited the participants to further collaboration and interviews of longer duration.

In preparation for the workshop we invited a selected group of battery storage experts. Hereby we tried to involve experts from all relevant stakeholder groups including system operators, the research community, technology developers and other industry, as well as policy makers. Despite the short timeframe and many competing events on the conference we got more than 30 replies which showed the high interest to participate in this stakeholder dialogue. However we aim to grow the number of active participants in the BATSTORM project in order to get a comprehensive picture of research needs and challenges in the broad field of battery storage.

Therefore we motivate all participants to invite further experts to connect to our project website on http://www.batstorm-project.eu/. There you will find regularly updated news items, an extensive survey on battery storage research needs and the possibility to sign up to our newsletter which keeps you informed on project outcomes and further possibilities of stakeholder involvement.

The slides from the general project introduction can be found in annex 3. The results from the discussions in the break-out sessions are consolidated in annex 4. The most important outcome from the fruitful brainstorming on system needs, market opportunities and financial and legal barriers for key applications of battery storage is summarized in the next chapter.

[1] The ESE/IRES conference takes place since 2012. With more than 3000 participants and more than 140 exhibitors it is seen as the largest Energy Storage event in Europe.

Figure 1: Consortium members from VITO present the results of the break-out session brainstorming on system needs, challenges and possible solutions

Figure 2: Invited experts listening to one of the final presentation of break-out session.

3 Main results

In the break-out sessions the participants of the workshop had a fruitful discussion on energy system services that can be provided with battery storage, challenges for scaling-up battery energy storage and possible solutions to overcome/reduce these challenges. Below the results are summarized, please refer to annex 4 for the full input from break-out sessions.

The valuable input given by the participants will be used for the upcoming deliverable of an implementation plan, a technical analysis and a socio-economic analysis. The research needs and the potential measures we will propose in those documents, are based on a gap analysis between the challenges identified by stakeholders and the ongoing research.

In the breakout sessions the experts were split into four groups of expertise:

- End-user applications – residential and commercial
- Generation and ancillary services
- Grid and system applications

In those groups the stakeholders, moderated by consortium members, were able to define **applications and services** which can possibly be provided by battery storage. The drivers for those services were in most cases needs of the changing system ranging from congestion to providing inertia to systems with growing shares of wind and solar. In some cases – especially for end-user applications – the main driver for battery storage applications are revenue streams that can create commercial business cases. A good example is the business case of increasing self-consumption with a battery system connected to a PV cell. The result was a long list of battery applications in the power system for each stakeholder group. The full list can be found in the appendix.

By analysing why those applications have not been scaled up further we identified **challenges and hurdles** for technology and system providers as well as (potential) operators of battery storage. The experts came to the overall result that technical challenges are only minor hurdles for battery storage. On the contrary, the current regulation and possible challenges are seen as greater hurdles for scaling up battery storage. All stakeholder groups agreed that especially the non-transparency and the complexity of markets and regulation as well as insufficient regulatory definition of battery storage hinder exploiting the full potential of battery storage in the power system.

Finally possible **solutions** of how to overcome the discussed challenges were identified. Again all stakeholder groups agreed that the establishment of a simple and harmonized regulatory framework and market rules in Europe will be the most efficient to scale-up battery storage. In their opinion forcing countries to have e.g. balancing markets and rules would help the deployment of battery storage which would again solve electricity system needs. A good way of undertaking this regulatory change the stakeholder groups proposed to learn from "best practice" countries of how to enforce markets/market rules (e.g. Germany).

Below a graphical summary of the brainstorming is shown. In Figure 3 the individual issues raised by stakeholders in the break-out sessions are represented. Each of the issue which was found to be

important by one stakeholder group was later classified into one of sections of challenges. The matrix shows that for some areas of interest (defined by one stakeholder category and by one challenge) no issues where raised while for others there were intense discussions on several issues important to one stakeholder group.

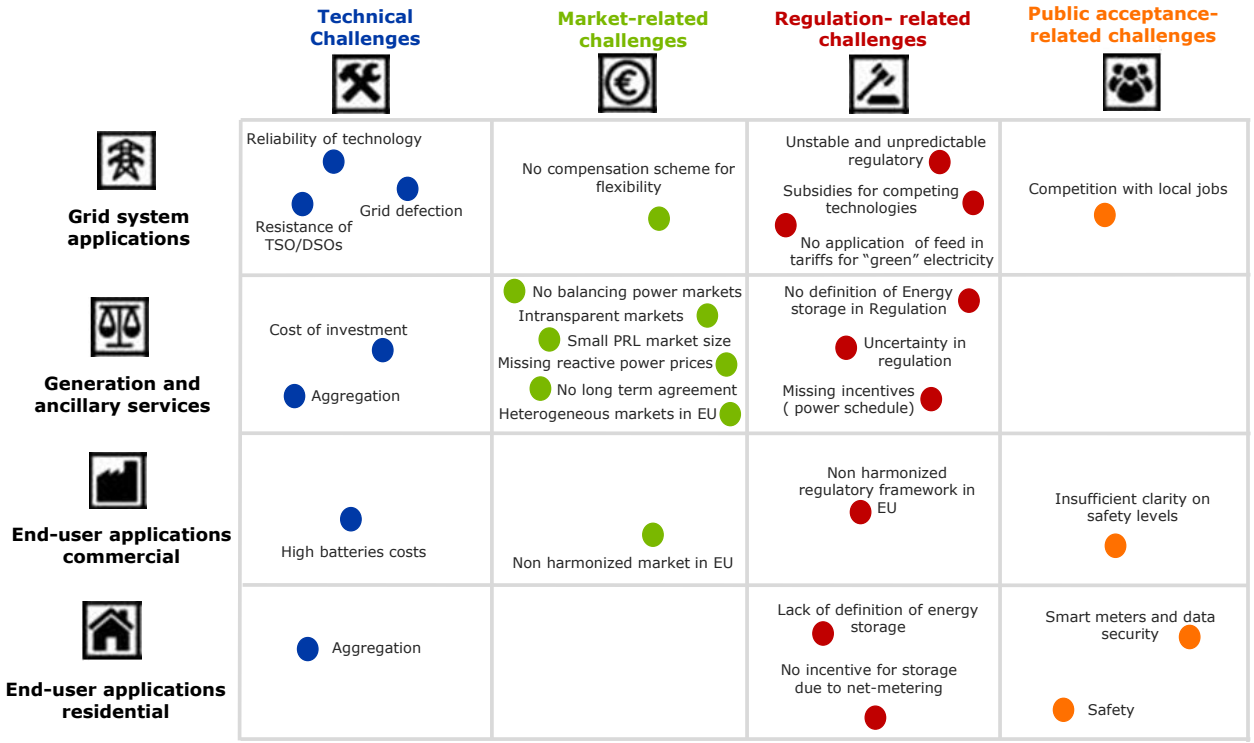

Figure 3: Categorized results from brainstorming with stakeholder groups. Each dot represents an issue raised by the participants.

In a next step the individual results were grouped into 13 clusters. The results can be seen in Figure 4. While some clusters (e.g. data security) are only of concern for one stakeholder group, other (e.g. missing incentives) are touching the business cases of all stakeholder groups.

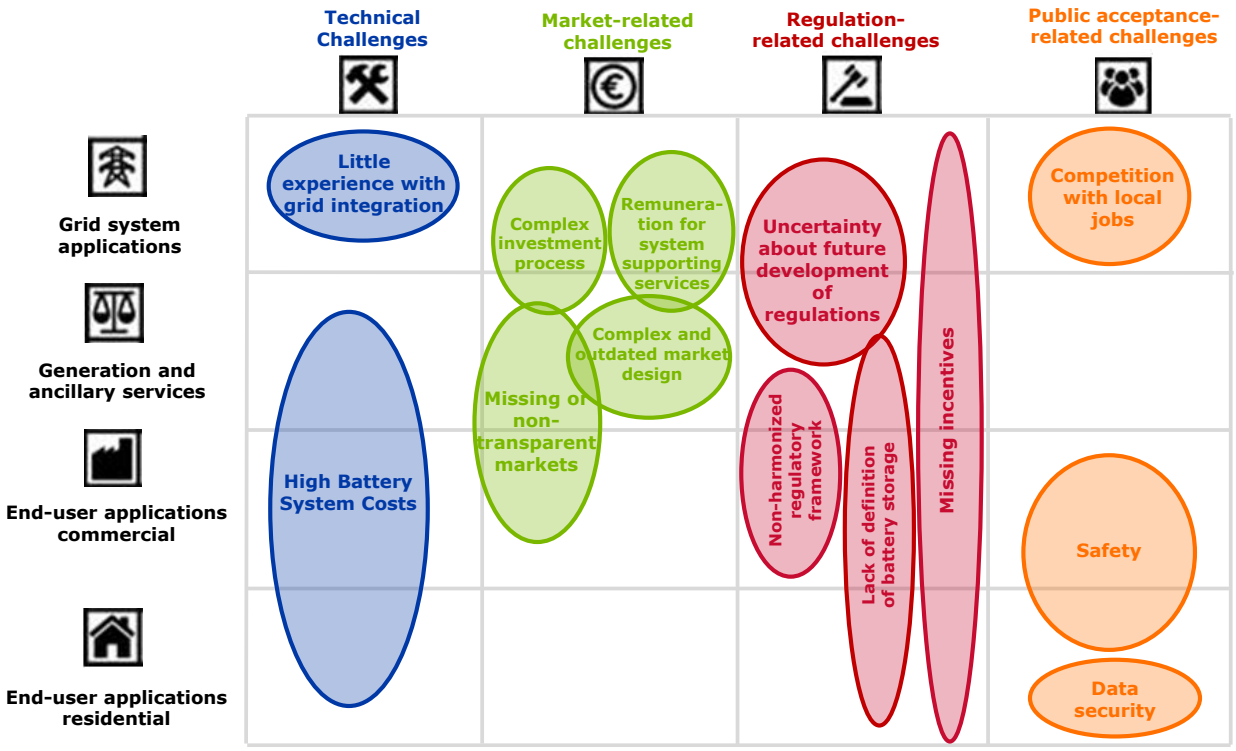

Figure 4: Categorized results from brainstorming with stakeholder groups. The issues raised by participants are grouped into different topics – represented by circles.

Also extracted from the individual input of the brainstorming we weighted the importance of each focus area. If many challenges were identified and grouped into one of the 16 categories, this category appears red or orange. If one of the sections got less attention, this section is coloured with green. Topics where none or only very little challenges could be classified to are marked with blue.

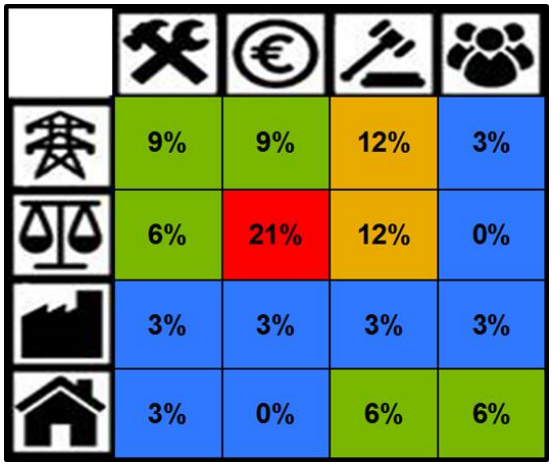

Figure 5: The matrix shows the importance of the different aspects as weighted by stakeholder comments.

Annex 1: Participants list

First name	Last name	Organization	Position
Martin	Baart	Ecoligo	Co-founder
Lars	Holstenkamp	Leuphana University of Lüneburg	Research Fellow
Arsen	Khusnutdinov	European Battery Technologies Oy	Chairman
Jalal	Saidikramov	European Battery Technologies Oy	VP Business Dev
Michael	Child	Lappeenranta University of Technology	Researcher
Raphael	Hollinger	Fraunhofer ISE	Team Leader
Gerold	Neumann	Liacon GmbH	CTO
Janne	Kärki	VTT	Research Team Leader
Franck	Bernard	AES	Director Energy storage EMEA
Jan	Michalski	Ludwig-Bölkow-Systemtechnik GmbH	Project Manager
Geert	Litjens	Utrecht University	PhD student
Karlis	Baltputnis	Riga Technical University	research assistant
Sebastian	Bauer	University Kiel	Professor
Jan	Bozelie	Liandon/Alliander	E-consultant
Stefan	Henninger	University of Erlangen-Nuremberg	research associate
Takefumi	Inoue	GS Yuasa	General manager / Engineering dept. Industrial Li-ion Battery Production Division
Yoshodhan	Gokhale	CES and IESA	
Felix	Holz	Deutsche Bank	Vice President
Michael	Deutmeyer	EAS Germany GmbH	General Manager
Martin	Rothert	SMA Solar Technology AG	Head of Produkt Group Residential and Commercial Storage
Georg	Engel	AEE INTEC	Projectleader
Uwe	Wienand	VDE	Head of Division
Cedric	Christensen	Strategen	Consortium member
Bart	Mantels	VITO	Consortium member
Dominik	Schledde	IWES	Consortium member
Eline	Begemann	Ecofys	Consortium member
Charlotte	Hussy	Ecofys	Consortium member
Frank	Wiersma	Ecofys	Consortium member
Heleen	Groenenberg	Ecofys	Consortium member
Apolline	Terrier	Technopolis	Consortium member
Asel	Doranova	Technopolis	Consortium member

Annex 2: Workshop agenda

16:00-16.20 **Introduction BATSTORM project**

- Project objectives and output
- Approach and time line
- Objectives for today

16:20-16.30 **Questions on project outline**

16:30-17:10 **Stakeholder breakout sessions**

1. Generation & ancillary services
2. Grid & system applications
3. End-user applications – residential
4. End-user applications – industrial

17:10-17:25 **Feedback breakout sessions**

17:25-17:30 **Wrap-up**

Annex 3: Workshop slides

BATSTORM

ECOFYS vito technopolis Fraunhofer IWES WOT STRATEGEN

BATSTORM Project

Towards an R&D strategy for battery based energy storage.

European Commission
Directorate-General for Energy

Stakeholder kick-off

Room 7B, CCD Süd, 16:00 hrs

30/03/2016

Frank Wiersma

Programme

16:00-16.20	**Introduction BATSTORM project** (Frank Wiersma, Ecofys) • Project objectives and output • Approach and time line • Objectives for today
16:20-16.30	**Questions on project outline**
16:30-17:10	**Stakeholder breakout sessions** 1. Generation & ancillary services 2. Grid system applications 3. End-user applications – residential 4. End-user applications - industrial
17:10-17:25	**Feedback breakout sessions**
17:25-17:30	**Wrap-up**

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BATSTORM targets roadmap for battery-based energy storage

Objective

to prepare a roadmap and implementation plan for battery-based energy storage in Europe starting from energy system needs, to inform decision-making on policies and RTD funding.

- Provide consolidated stakeholder views for the R&D needs and market uptake measures.
- Monitor and review projects, programmes and developments in the sector in EU and worldwide.
- Organise workshops to foster knowledge sharing.
- Contribute to the development of an energy system with more active consumer participation.
- Contribute to the improved industrial capacity in Europe.
- Develop an outline and recommend on measures to stimulate the market for batteries.

Main deliverables

(Initial) Implementation Plan 2016-2018	April / June 2016
Research and Innovation Roadmap 2016-2025	January 2017
Implementation Plan 2017-2019	October 2017

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EC SET plan provides framework for BATSTORM project

European Strategic Energy Technology Plan (SET-Plan)

- Aims to accelerate the development and deployment of low-carbon technologies
- Seeks to improve new technologies and bring down costs by coordinating research and helping to finance projects

SET Plan European Electricity Grid Initiative (EEGI)

- Gathers grid stakeholders, technology suppliers and member states in a consensus oriented setting
- Facilitates the development of strategic roadmaps, implementation plans and knowledge sharing arrangements
- GRID+ / GRID+storage projects aim to facilitate this, by consortium formed by TECHNOFI, EASE, EDSO, ENTSO-E, RSE and VITO
- BATSTORM complementary: focused on batteries

BATSTORM initial Implementation Plan 2016 – 2018 will serve as input in defining next steps in SET action plans for battery storage in second half of 2016.

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Main parts of BATSTORM project

Work packages

- Collection of information
- Stakeholder engagement
- Technical analysis
- Development of Roadmap
- Socio-economic analysis
- Define Implementation Plan
- Transfer of knowledge and best practices

Content Outputs

- Technical analysis of ongoing projects
- Costs and benefits for deployment scenarios of battery systems
- Implementation plans 2016-2018 and 2017-2019
- Ten year Research and Innovation Roadmap 2016-2025
- Website for sharing results and best practices

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Outline Roadmap and Implementation Plan

Roadmap: main tracks and milestones (example only)

- Develop technologies
- Improve economics
- Facilitate projects

Implementation Plan: priority actions and action owners (example only)

Theme, Action	Owner	Planning
Theme 1		
Action A		
Action B …		
Theme 2		

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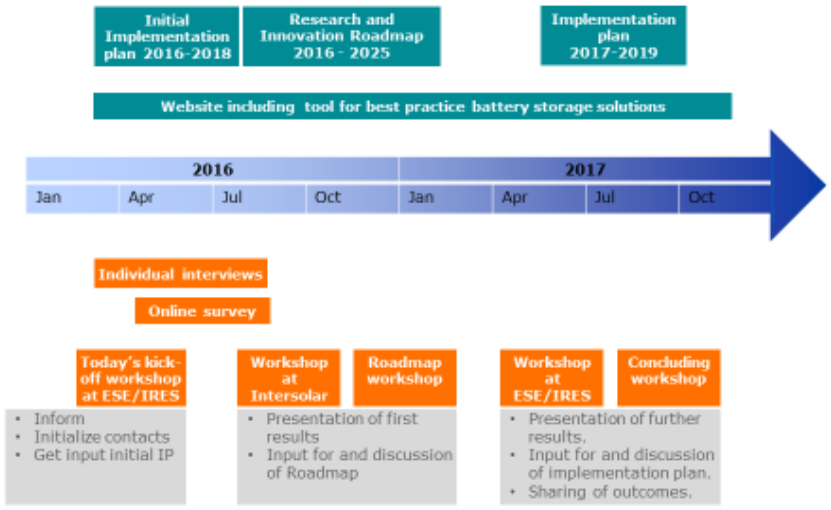
Overall timeline deliverables and stakeholder interaction



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BATSTORM website

Purpose of website

- Keep stakeholder informed and updated about the progress of BATSTORM
- Inform about upcoming opportunities for stakeholder involvement
- Forum for discussions and collecting input

Features of website

- Best practices database
- Interactive map
- Online survey
- Knowledge sharing of user groups
- Newsletter

batstorm-project.eu

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Questions on the BATSTORM project

Break-out sessions to discuss battery storage for different applications (16:30 – 17:10)

Four break-out groups

1. Generation & ancillary services
2. Grid system applications
3. End-user applications - residential
4. End-user applications - industrial

Focus for each break-out session

1. **Identify energy system services that can be provided with battery storage**
2. **Identify challenges for scaling-up battery energy storage.**
   - Technology research
   - Development and production
   - Regulation
   - Market entry
   - Public acceptance
3. **Identify possible solutions to overcome/reduce these challenges.**
   - Economic instruments
   - Changes in regulation
   - Information and networking
   - Research support

After the break-out sessions, each group will have the opportunity to briefly summarise key results

Feedback breakout sessions

Four break-out groups

1. Generation & ancillary services
2. Grid system applications
3. End-user applications - residential
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Feedback breakout sessions

Four break-out groups

1. Generation & ancillary services
2. Grid system applications
3. End-user applications - residential
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Annex 4: Break-out session results

End-user applications – residential

Needs

- Self-consumption of PV
- Lower energy cost / tariff difference between purchase price and feed-in tariff
- Backup
- Feeling of self-sufficiency
- Enthusiasm for technology
- Grid services

Challenges

- Technical
  - Safety: Currently this is not perceived as a hurdle since there are few systems installed and hence almost no incidents. This may change in the future.
- Regulation
  - Unfair taxes (e.g. storage at district level)
  - Definition of energy storage in the grid and the respective rules. Currently energy storage is viewed both as a consumer and as a generator and e.g. pays taxes twice.
- Market
  - Net metering
- Public acceptance
  - Consumers are wary about smart meters and data security

Solutions

- Not covered

Risks

The fact that less power is consumed from the grid can be an issue for the financing of the grid, e.g. if this financing is relative to the power consumed.

End-user applications – commercial

Needs

- Lower energy bill. To achieve this, these systems have to deliver multiple services.
- Backup (UPS)

Challenges

- Technical
  - insufficient clarity about the required safety levels. Manufacturers may be able to achieve this safety levels but then they have to understand the needs.
  - The cost of batteries is currently too high for economic viability
- Regulation
  - There is no harmonized regulatory framework in the EU
- Market
  - The market is not harmonized in Europe so there is no generally viable business model

Solutions

- Support the production of EVs and batteries in Europe to decrease their cost.
- Establish simple and harmonized regulatory framework and market rules in Europe.

Generation and ancillary services

Functions/needs

- PCR: Primary control reserve
- SCR: Secondary control reserve
- TCR: Tertiary control reserve
- Inertia
- Black start
- Arbitrage
- Stick to power schedule
- Voltage control
- Reactive power
- Harmonic compensation
- Phase balancing (ABC)
- (aggregation of small units in order to provide services)

Challenges

- Market
    - Cost of investment
    - Missing prices for reactive power
    - Missing markets for balancing power
    - Price risks because of small market size (→ PCR)
    - Lack of transparency/non-transparent markets (for some markets in all countries for others for some countries only)
    - Transaction costs (→ aggregation)
    - No long term agreement possible
- Regulation
    - No definition of Energy storage in Regulation
    - Missing incentives (→ power schedule)
    - Instability/uncertainty in regulation
- General
    - complexity

Solutions

- Force countries to have balancing markets and rules
- Learn from "best practice" countries of how to enforce markets/market rules (e.g. Germany)
- Standardization on PPA, black start, inertia
- Implement power based instead of energy based feed-in tariffs (to stimulate sticking to power schedule)

Grid system applications

Functions/needs

- Ensure grid balancing
- Congestion management in the grid
- Provide power reserve capacity

Challenges

- Technological/Technical
  - Reliability of technology; e.g. in case battery is used in not professional manner, it can fail. This creates poor image for battery technologies
- Regulatory
  - Unstable and unpredictable regulatory landscape prevents investments in battery projects/infrastructure
  - No feed-in tariffs can be applied if you store your "green" electricity in batteries and add it to a grid later
  - No compensation scheme for providing flexibility in energy grids by batteries, which otherwise would make technology economically attractive
  - Subsidies for competing technologies
  - Uncertainty about metering (e.g. in NL)
- Market
  - Grid defection
  - Resistance by the traditional technologies
- Public acceptance
  - Narrow vision and poor understanding of battery technologies for grids by general public, which is based on their experience with batteries used in computers, phones, etc.
  - Resistance and old-fashion thinking of TSO/DSOs make them do not dare to rely on batteries and decentralised power supply systems; older generation prefer relying on traditional cable technologies/large centralised power systems and not considering alternatives (knowledge gap)
  - In specific places (e.g. small islands) batteries are seen as technology that can kill local jobs related to traditional energy supply technologies, such as diesel suppliers, etc.
  - Occasional technical problems with batteries create negative image to a whole family of projects/technologies that otherwise function well

Solutions

- In regards to compensation for flexibility: there is an interesting experience in Younicos project (US)
- To combat the old fashion reliance of TSO/DSOs on traditional power systems, the educational programmes about alternative systems are needed. New generation of engineers already has wider thinking in these subject, thus it is also good to involve them more in transformation processes.
- Develop subsidy schemes for battery technologies. Linking them with green energy technologies might help
- Promote and demonstrate best practice examples of battery technologies in order to improve the public acceptance