Minutes of stakeholder debates (lessons learned) for nine knowledge sharing workshops

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"Support to R&D strategy in the area of SET Plan activities in smart grids and energy storage"

Deliverable D4.1

by

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1 Introduction

1.1 Objectives of knowledge sharing

With the Grid+Storage service contract, knowledge sharing activities are gathered into work package 4 (WP4) "Extracting good practice and support knowledge transfer". The objectives of WP4 are:

- To extract good practices gained in pilots and demonstration activities,
- To support knowledge transfer from these projects to energy network operators, storage players and any other interested stakeholders.

To these objectives, knowledge sharing workshops are organised to emphasise the potential scaling and replication of the experimental or simulation results obtained during the RTD&D projects, and to protect intellectual property rights (IPR) by involving industry in the description of the project results in the existing Knowledge Sharing Platform (KSP) GridInnovation-online[1].

1.2 Organisation of knowledge sharing workshops

1.2.1 Regional approach

The initial approach adopted by Grid+Storage consisted in organising nine physical workshops per area of network operator activities (the "clusters" of the existing EEGI roadmap) with a specific focus on energy storage.

In August 2015, it was decided by the Grid+Storage consortium and approved by DG ENER to change this approach per cluster into a regional approach (workshops organised per group of Member States), with the objective of stimulating the participation from local or national projects rather than focusing on European projects.

The workshops are organised according to the schedule presented in Table 1 below.

Table 1 – Planning for the nine regional first knowledge sharing workshops

Workshop nr.	Member States	Location	Date
1	Belgium, France, Luxemburg, the Netherlands	Lille (France)	25-26 November 2015
2	Estonia, Latvia, Lithuania	Riga (Latvia)	12-13 January 2016
3	Denmark, *Norway*, Sweden, Finland	Helsinki (Finland)	26-27 January 2016
4	Bulgaria, Cyprus, Greece, Romania	Athens (Greece)	8-9 February 2016
5	Portugal, Spain	Madrid (Spain)	15-16 February 2016
6	Austria, Hungary, Slovakia, Czech Republic	Vienna (Austria)	24-25 February 2016
7	Croatia, Italy, Malta, Slovenia, *Switzerland*	Rome (Italy)	29 February – 1 March 2016
8	Germany, Poland	Munich (Germany)	9-10 March 2016
9	Ireland, UK	London (UK)	15 March 2016

[1] See http://www.gridinnovation-on-line.eu/.

The Grid+Storage workshops are organised in cooperation with the ERA-Net Smart Grids Plus initiative[2] in order to stimulate the participation of local stakeholders.

1.2.2 Programme of the knowledge sharing workshops

The nine workshops will be held over between one and two days according to the agenda below (to be adjusted depending on logistical constraints and number of projects presented):

DAY 1

Morning (9-13:00)

- Introduction about the new SET Plan organisation
- Introduction about the future integrated R&I activities on Grid + Storage
- Regional Project # 1
- Regional Project # 2
- First round table about lessons learned by the attendees from the projects

Lunch break (13-14:00)

Afternoon (14-17:00)

- Presentation of the road-mapping process and the Knowledge Sharing Platform (TECHNOFI)
- Preparing the deployment of innovative solutions with ERA-Net Smart Grids Plus
- Regional Project # 3
- Regional Project # 4
- Second round table about lessons learned by the attendees from the projects

Networking dinner

DAY 2

Morning (8:30-11:00)

- Regional Project # 5
- Regional Project # 6
- Third round table about lessons learnt by the attendees from the projects

Wrap up of the workshop (11:30-13:00)

- Final round table animated by TECHNOFI with participation of projects representatives and members of EASE, EDSO for Smart Grids and ENTSO-E
    - Impacts of the new knowledge presented by the six projects onto the Grid and Storage roadmap
    - Recommendations for future R&I activities and regional investments about grid and energy storage solutions
    - Options for the tentative deployment plans of the described solutions and barriers to be overcome according to the ERA-Net Smart Grids Plus approach

Lunch break (13-14:00)

Afternoon

- Potential demo visit if feasible
- Projects prepare their labelling in direct with ERA-Net Smart Grids Plus and TECHNOFI

[2] See http://www.eranet-smartgridsplus.eu/.

1.3 Structure of this report

For each of the nine knowledge sharing workshops, this report gathers the following information:

- List of projects presented, including the link to the slides displayed at the workshop;
- Participants in the different roundtables;
- List of attendees[3];
- Minutes of the roundtables dedicated to the projects presented, with the main questions raised and topics of discussion;
- Summary of the lessons learned from the workshop (last roundtable).

2 Workshop 1 (Belgium, France, The Netherlands)

The first workshop was held in Lille (France) on the 25th and 26th of November, 2015. The workshop agenda is available on the Grid+Storage website.

2.1 Projects and participants in the workshop

2.1.1 R&I Projects presented

Six R&I projects were presented during the first workshop, as displayed in Table 2 below.

Table 2 – Projects presented at the first knowledge sharing workshop

Project	Country	Purpose	Speaker	Link to presentation
LINEAR	Belgium	Large-scale residential demand response project with 250 families in Flanders. The families have washing machines, dishwashers, tumble dryers, electric boilers, EV's and heat pumps. Dynamic pricing, portfolio balancing, voltage control are tested.	Pieter Vingerhoets, Project coordinator smart grids and ICT applications, KU Leuven / EnergyVille	Link
Pampus Project	the Netherlands	Demonstration on the Pampus Island of second life usage by the DSO of used car batteries at households with solar panels.	Haike van de Vegte, Senior Consultant New Energy Technologies, DNV GL Energy	Link

[3] Only the attendees having agreed to have their names listed in the minutes of the workshops are included.

Smart Substation	France	Innovative solutions bringing new functionalities and complete substation digitizing (electrical, mechanical, environmental data)	Thierry Buhagiar, Project coordinator, RTE	Link
GREDOR	Belgium	Addresses challenges in the management of distribution systems raised by the integration of renewable energy sources and new consumption practices, from investment decisions to real-time control.	Damien Ernst, Professor, Holder of the EDF-Luminus Chair on Smart Grids, Université de Liège	Link
VENTEEA	France	Improve the hosting capacity for renewable energies on the medium voltage network	Didier Colin, VENTEEA Project Manager, ErDF	Link
AES Advancion Energy Storage Array	the Netherlands	Commercial installation of 10 MW Li-ion batteries connected to the transmission network of TenneT NL.	Steve Corwell, AES Europe Vice President, The AES Corporation	Link

2.1.2 Roundtables

Four roundtables were held during the workshop, all facilitated by Serge Galant, Chairman of Grid+Storage Steering Board. The first three were mainly devoted to questions for the representatives of the projects presented. The fourth one, gathering also representatives from EASE, EDSO for Smart Grids and ENTSO-E, aimed at summarizing the debates and extracting the lessons learned from the workshop. Table 3 below shows the participants in each roundtable.

Table 3 – Participants in roundtables at the first knowledge sharing workshop

Roundtable nr.	Participants
1	• Henrik Dam, Policy Officer New energy technologies and clean coal, DG ENER, European Commission • Pieter Vingerhoets, Project coordinator smart grids and ICT applications, KU Leuven • Haike van de Vegte, Senior Consultant New Energy Technologies, DNV GL Energy • Eric Peirano, Grid+Storage Project Manager, TECHNOFI
2	• Thierry Buhagiar, Project coordinator, RTE • Damien Ernst, Professor, Holder of the EDF-Luminus Chair on Smart Grids, Université de Liège • Eric Peirano, Grid+Storage Project Manager, TECHNOFI

3	• Didier Colin, VENTEEA Project Manager, ErDF • Steve Corwell, AES Europe Vice President, The AES Corporation • Eric Peirano, Grid+Storage Project Manager, TECHNOFI
4	• Maria-Laura Trifiletti, EASE • Steve Corwell, The AES Corporation, representing EASE • Victoria Gerus, EDSO for Smart Grids • Norela Constantinescu, ENTSO-E • Iva Gianinoni, RSE, representing also ERA-Net Smart Grids Plus Support Team • Bart Mantels, VITO / EnergyVille

2.1.3 List of attendees

In total the workshop was attended by 36 participants, listed in Table 4 below.[4]

Table 4 – Attendees in the first knowledge sharing workshop

Name	Company
Antoine Besson	Bouygues Energies & Services
Christian-Eric Bruzek	Nexans France
Thierry Buhagiar	RTE
Claude Campion	3C Projects
Didier Colin	ErDF
Norela Constantinescu	ENTSO-E
Bertrand Cornélusse	Université de Liège
Steve Corwell	AES EUROPE / EASE
Henrik Dam	European Commission
Bart De Meyer	Eandis
Sophie Dourlens-Quaranta	TECHNOFI
Damien Ernst	Université de Liège
Bruno Francois	Ecole Centrale de Lille - L2EP
Serge Galant	Technofi
Victoria Gerus	EDSO for Smart Grids
Iva Maria Gianinoni	RSE
Victor Gomes	ENERCON GmbH
Cristina Gómez	REE
Vassilis Iliadis	AES Technologies
Bart Mantels	VITO / EnergyVille
Marcel Meeus	Sustesco bvba
Alexandre Parisot	RTE
Eric Peirano	Technofi
Benoit Robyns	Hautes Etudes d'Ingénieur
Janailson Rodrigues	SuperGrid Institute
Johan Steimes	Université Libre de Bruxelles

[4] Only the attendees having agreed to have their names listed in the minutes of the workshops are included.

Marion Steward	EDF
Cédric Thoma	French Ministry of Energy
Gilles Tihon	SPF - Public Service of Wallonia
Maria Laura Trifiletti	EASE
Ruud Van de Meeberg	Enexis BV
Haike Van de Vegte	DNV GL Energy
Gérald Vignal	RTE
Pieter Vingerhoets	ENERGYVILLE - KU Leuven
Conor Wilson	Gaelectric Energy Storage

2.2 Minutes of the debates

2.2.1 Roundtable 1

Questions about the Grid+Storage process to Eric Peirano (TECHNOFI)

- The change in approach between the existing EEGI roadmap and the upcoming Grid+Storage integrated R&I roadmap (RIR) was questioned. It was made clear that the main change is the focus on R&I activities relative to energy storage integration in the power system. An additional change will be the structure of the RIR which should improve readability.
- A question was raised about how to address dissent between stakeholders during the consultations process. The example of micro-grids was taken to illustrate diverging views amongst the smart grids and energy storage community. It is also the role of monitoring and knowledge sharing to provide experience feedback about each type of approaches and technologies. No option shall be discarded for R&I activities except if it has been proven that it is not promising. The project's partners have proposed a dissent management methodology (Deliverable 1.1).
- Clarification was requested since the Grid+Storage contract is supposed not to address batteries. It was made clear that Grid+Storage addresses the integration to the grid of all types of energy storage solutions (including batteries and also power to gas technologies which allow to connect gas and electricity networks); but it does not address R&I activities about battery (or power to gas) technologies such as new materials to improve performances (efficiency, ageing, etc.).
- About the knowledge sharing platform (KSP), it was asked whether data sets could be uploaded to it. It was answered that even though the KSP has not been designed to that purpose, this could be possible. It is currently under discussion in the framework of the eHighway2050 project for a data base relative to transmission technologies (cost and performances).

Questions to Henrik Dam (EC, DG ENER)

- It was asked whether grid operators would be allowed to operate energy storage facilities in the future. Henrik Dam said that the matter is being considered by the European Commission in the context of the energy market design consultation and the proposals for the revision of the Third Energy Package expected by Dec. 2016. In his opinion, the probable scheme would be that grid operators buy services to energy storage operators. For some specific purposes (for instance black-start capabilities), allowing TSOS/DSOs to own the energy storage assets has yet to be decided yet.

- The need for research about regulation to reach the objective of a single energy market covering the 28 Member States (MS) was pointed out. Henrik Dam replied that this is an ongoing process: for instance, MS have to share their development plans; a regional approach to balancing is currently under discussion. In general, R&I projects could challenge existing regulations. For example, in some demonstration projects, DSOs are owning storage assets. The only regulations which cannot be disregarded are the safety regulations.
- Another question was raised about the standards for manufacturers.

Questions to Haike van de Vegte (DNV GL Energy) about the Pampus project

- With the main difference between centralised and decentralised storage being the maintenance costs, it was asked if maintenance costs have been evaluated for the Pampus project; and if these costs are increased because of the second-life use of batteries. More generally, life cycle costs of batteries have to be assessed.
- The status of primary reserve granularity was raised (between 15 and 60 minutes).
- The replicability of the Pampus project was questioned. Is it limited by the supply of second-life batteries? Haike van de Vegte replied that the fleet of electric vehicles (EV) is growing fast. The market for batteries from cars that can be used for second life application shall become serious in 2020 in DNV GL's predictions. In addition, second-life batteries are one of the solutions amongst other storage technologies (including new batteries).
- What about the security aspects of the battery? It is built in containers and a safety protocol developed in the STALLION project[5] is applied.
- The battery management system (BMS) needed to address different types of batteries, with different ages, was discussed.
- How to ensure the capacity of batteries was questioned.
- The issue of the ownership of second-life batteries was raised. In principle the car manufacturer is responsible for recycling the batteries. This legal responsibility can be transferred for a demo project.

Questions to Pieter Vingerhoets (KU Leuven) about the LINEAR project

- Recommendations about regulation were discussed.
- It was asked whether specific R&I activities about demand response (DR) in large industries would be included in the roadmap, complementing residential DR.
- How storage for hot water tanks can be taken into account was discussed. The RealValue project (Ireland) was mentioned.
- The need for automated activation of DR was pointed out, because consumers on the long run cannot realistically be active in a manual manner.
- The motivation of consumers to participate in DR out of a demonstration project was questioned. Pieter Vingerhoets said that 3 main motivations exist: 1) enthusiastic to help; 2) comfort; and 3) money: but for the moment the business case is not here; cost of smart appliances need to decrease.
- The competition between energy efficiency and active consumption was discussed: the more the devices are energy-efficient, the less there is an interest in demand response. More generally, market-based solutions vs. obligations for DR were discussed.
- It was asked whether residential DR could participate in voltage control in Europe. Pieter Vingerhoets answered positively but said that it would not be the main driver.

[5] "Safety Testing Approaches for Large Lithium Ion battery systems".

2.2.2 Roundtable 2

Questions to Thierry Buhagiar (RTE) about the smart substation project and to Damien Ernst (Université de Liège) about the GREDOR project

- A question was raised on the possible roll out of smart substations both at the TSO and DSO levels, and more especially how to use the RTE concept in the GREDOR approach for DSOs? Damien Ernst said that the historical split between TSOs (well monitored and controlled part of the system) and DSOs (part of the system with less monitoring and control capabilities) was not valid anymore, because today we need the DSOs to be equipped with smart substations. Thierry Buhagiar pointed out that many issues needed to be solved before the complete roll out of smart substations in the network: first the level of decentralised control (functions which are completely automated versus functions which remain in the hands of the operators) and the control of the system seen from the TSO (how the different automated systems could interact and generate dynamics that the operators cannot handle). If such issues can be solved, the next challenge would be to share data and have a common model since the TSOs could need to communicate with distributed power generation and large pools of consumers through DSOs: a real-time communication system would need to be created.
- Questions were raised on the profitability of the wide roll out of storage devices in distribution networks. According to Damien Ernst, storage investments would make the distribution system more efficient by avoiding too sophisticated solutions and reinforcement.
- Discussions focussed on the overall profitability of storage in the power system. Many remarks were made arguing that, except for the projects advertised by some companies such as AES, it is still difficult to find profitable applications, except when addressing multiservice applications as recommended by some players. It was pointed out that pumped hydro storage (PHS) in Germany is no longer profitable since the daily market spread has decreased because of PV production. Some attendees pointed out that beyond the perspective offered by integrators such as AES, the domestic battery marketed by Tesla (power wall) should also change the storage market: PV systems with batteries should be competitive shortly. This point opened the debate for the costs that should be charged by network operators in the case of a wide roll out of self-consumption schemes.

2.2.3 Roundtable 3

Questions to Didier Colin (ErDF) about the VENTEEA project and to Steve Corwell (AES Europe) about the AES project

- TSOs and DSOs should seek for the lowest cost for society of storage solutions compared to grid upgrade; it was asked how far we are today (in years or in euros) from this minimal cost. Didier Colin said that such study has been done: there is no advantage for storage except for some cases in substations for multiservice applications (in general for a few hours, and in urban areas). In addition, TSOs/DSOs shall call upon the market to provide services. Steve Corwell (SC) said however, that regulators base their decisions upon cost-benefit analyses (CBA): if storage is cheaper, regulators will allow it.

- Following several questions regarding the profitability of the AES systems, Steve Corwell replied that the company had found at least three business applications: PCR (primary control reserves), replacement reserves (in lieu of power plant derates) and longer duration flexible peaking. SC pointed out that the company is investigating other applications that are now competitive and will become even more so since the cost of batteries should continue to decrease in the coming years due to a significant increase of the manufacturing capacities in the world to meet EV demand. SC explained that AES has developed an integration approach which allows the scaling (up and down) of the systems to accommodate various grid needs and with different batteries and battery providers.
- About the real electrical efficiency of the batteries, Didier Colin said that it was difficult to assess, since it depends on the services provided (ErDF promotes a multiservice business model). Steve Corwell added that there are some issues about the building codes (isolation is mandatory in buildings hosting the batteries while cooling is necessary for the batteries to maintain their performances in time).
- The comparison between batteries and power-to-gas solutions was discussed. It was explained that these two technologies provide different services to the power system at different scales. Power to gas are conversion technologies (from electricity to gas) which allow to store electricity in the form of chemical energy which in turn is easy to store in large quantities (natural gas network). This gas can be used for heating (connection with heating networks), electricity generation in gas turbines, in industry, in the transport sector for instance. Batteries are used for electricity to electricity applications.
- A comment was made regarding the fast penetration of power electronics on the network which could cause stability problems (frequency control for instance) following a discussion on the possible large scale deployment of batteries in the power system.

2.3 Lessons learned from the workshop

These lessons and recommendations have been discussed and agreed upon during the 4th roundtable.

2.3.1 Impacts of the new knowledge presented by the six projects onto the GRID+STORAGE roadmap

The projects presented covered a large range of maturity levels for network operators, from TRL 5 for some applications to TRL 9 for some others.

Storage as a flexibility option will impact the following TSO and DSO clusters in the roadmap:

- Planning,
- Operations,
- Asset management,
- Market design.

2.3.2 Recommendations for future R&I activities and regional investments about grid and energy storage solutions

One first recommendation is that "clean" large scale demonstrations are needed, involving cost-benefit analyses and life cycle assessments. Such demonstrations should involve regulatory bodies and address small scale dispersed storage functionalities.

At DSO level, there is a clear need for support tools for decision making on flexibility management.

2.3.3 Options for the tentative deployment plans of the described solutions and barriers to be overcome

The following topics need to be addressed in the future roadmap:

1. Regulatory harmonisation on storage,
2. Knowledge sharing on demonstrations,
3. Business good practices (from product specification to competitive procurement) to turn energy storage and other demonstration technologies into viable business activities,
4. Valuation of storage as a multi-service solution,
5. Ownership of storage,
6. Standardisation of grid connected energy storage,
7. Clean CBA including LCA approaches,
8. Taxes and fees that puts pressure on the real value of energy storage solutions.

2.4 Projects willing to join the Knowledge Sharing Platform

The following stakeholders have expressed willingness to join the knowledge sharing platform GridInnovation-online.

- CAES (Ireland),
- Université Libre de Bruxelles,
- Université de Liège for the GREDOR project,
- AES energy storage arrays,
- EnergyVille for the LINEAR project (with updated results).

3 Workshop 2 (Estonia, Latvia, Lithuania)

The second workshop was held in Riga (Latvia) on the 12th and 13th of January, 2016. The workshop agenda is available on the Grid+Storage website.

3.1 Projects and participants in the workshop

3.1.1 R&I projects presented

Seven R&I projects were presented during the first workshop, as displayed in Table 5 below.

Table 5 – Projects presented at the first knowledge sharing workshop

Project	Country	Purpose	Speaker	Link to presentation
DSM Platform for Optimal Energy Management Strategies Development	Latvia	Experimental rational use of energy with aim to demonstrate and simulate the potential of smart meters and home area network automation implementation and their interoperability with energy management strategies	Artjoms Obushevs, Researcher, Institute of Physical Energetics	Link

Energy Storage Application in Urban Electric Transport	Latvia	Recuperation of tramway braking energy by equipping substations with reversible rectifiers and installing energy storage devices	Linards Grigans, Researcher, Institute of Physical Energetic	Link
Smart Energy Management System with Energy Storages	Estonia	Overview of two different pilot systems in Tallinn University of Technology: 1. Smart Energy systems - AC/DC Link Based Microgrid System for Research and Study Purposes, and 2. Load Management System – Day-Ahead Electricity Price Based Energy Management System	Argo Rosin, Senior Research Scientist / Vice-Dean for Research, Department of Electrical Engineering / Faculty of Power Engineering, Tallinn University of Technology	Link
Development of a Li-Ion Energy Storage System for Electrical Microgrids	Estonia	Design and construction of a 150 kW Li-Ion energy storage system (ESS) prototype; development of control algorithms and methodology	Tarmo Korõtko, PhD student, Department of Electrical Engineering, Tallinn University of Technology	Link
Smart Electric Thermal Storage (RealValue project)	Latvia	Deployment of Smart Electric Thermal Storage (SETS) at 50 locations in Latvia (homes and commercial buildings); cost-benefit analysis and business plan development	Zane Broka, PhD student, Riga Technical University	Link
Large-Scale Electrical Energy Storage Potential in the Baltic States	Latvia	Analysis of the potential demand for energy storage in the Baltic States; large- and small-scale technologies comparison	Karlis Baltputnis, PhD student, Riga Technical University	Link

Estfeed data sharing platform	Estonia	Software platform capable to integrate many data sources and to provide appropriate services to convert these data into valuable information for energy flexibility management, energy efficiency, audit and benchmarking	Kalle Kukk, Strategy Manager, Elering	Link

3.1.2 Roundtables

Four roundtables were held during the workshop. The first three were mainly devoted to questions for the Speakers and interactions with the audience about the lessons learnt by the projects and the new knowledge needs to better integrate energy storage into the electricity system. The fourth roudtable, gathering also representatives from the ERA-Net Smart Grids Plus support team, EASE and ENTSO-E, aimed at measuring the impacts of the new knowledge presented by the seven projects onto the Grid and Storage roadmap and summarizing the recommendations for future R&I activities and regional investments about grid and energy storage solutions.. Table 6 below shows the participants in each roundtable.

Table 6 – Participants in roundtables at the first knowledge sharing workshop

Roundtable nr.	Participants
1	• Artjoms Obushevs, Institute of Physical Energetics • Linards Grigans, Institute of Physical Energetic • Eric Peirano, TECHNOFI (moderator)
2	• Argo Rosin, Tallinn University of Technology • Tarmo Korõtko, Tallinn University of Technology • Eric Peirano, TECHNOFI (moderator)
3	• Zane Broka, Riga Technical University • Karlis Baltputnis, Riga Technical University • Kalle Kukk, Elering • Eric Peirano, TECHNOFI (moderator)
4	• Zane Broka, Riga Technical University • Karlis Baltputnis, Riga Technical University • Kalle Kukk, Strategy Manager, Elering • Norela Constantinescu, ENTSO-E • Allan Schrøder Pedersen, EASE • Eric Peirano, TECHNOFI (moderator)

3.1.3 List of attendees

In total the workshop was attended by 40 participants, listed in Table 7 below. [6]

Table 7 – Attendees in the second knowledge sharing workshop

Name	Company
Triin Aavik	Eesti Energia As
Ott Antsmaa	Elektrilevi OÜ
Karlis Baltputnis	Riga Technical University
Viesturs Brazis	Riga Technical University
Zane Broka	Riga Technical University
Jānis Černovs	AS "Sadales tīkls"
Vladimir Chuvychin	Riga Technical University
Norela Constantinescu	ENTSO-E
Laimonas Dapsys	Modus Energija
Sophie Dourlens Quaranta	TECHNOFI
Dainis Dravnieks	Ministry of Economics
Juris Flugins	AS "Sadales tīkls"
Helena Geissler	B.A.U.M. Consult
Juris Golunovs	Riga Energy Agency
Larisa Grackova	Institute of Physical Energetics
Ervins Grebesh	Institute of Physical Energetics
Linards Grigans	Institute of Physical Energetics
Ivo Grinbergs	AS "Sadales tīkls"
Polina Ivanova	AS Latvenergo
Leo Jansons	WEC LMC
Tarmo Korõtko	Tallinn University of Technology
Kalle Kukk	Elering AS
Olegs Linkevics	Latvernergo
Bart Mantels	VITO / EnergyVille
Anna Mutule	Institute of Physical Energetics
Artjoms Obusevs	Institute of Physical Energetics
Irina Oleinikova	Institute of Physical Energetics
Eric Peirano	TECHNOFI
Andrejs Roscins	Energokomplecss
Argo Rosin	Tallinn University of Technology
Ivars Rozenštrauhs	AS "Sadales tīkls"
Allan Schroeder Pedersen	Technical University of Denmaark
Antanas Sauhats	Riga Technical University
Gunta Šlihta	IPE
Girt Stana	Riga Technical University

[6] Only the attendees having agreed to have their names listed in the minutes of the workshops are included.

Diana Zalostiba	Riga Technical University

3.2 Minutes of the debates

3.2.1 Roundtable 1

Questions about the Grid+Storage process to Eric Peirano (Technofi)

- Following a question raised by an attendee, it was made clear that all types of energy storage technologies are considered in the roadmap (not only electrochemical storage). The focus indeed is on the integration of energy storage to the grid whatever the storage technologies are.
- It was also asked whether power plants capable to adapt their running regime to market conditions could be considered as energy storage. It was made clear that this shall be considered as a flexibility source, but this is not the main focus of the roadmap.

Questions to Artjoms Obushevs (Institute of Physical Energetics) about the DSM Platform

- The relation between DSM profitability and sufficient market price differentials was discussed, as well as automated activation of DSM versus active (manual) participation of consumers.
- Disconnection of load in case of high market prices was considered: it should be done locally and not at substation level.
- The concrete impacts of DSM in Latvia were discussed. For the moment, such impacts are difficult to assess: Latvia's consumption being quite low it is difficult to find a business case for DSM and only consumers with a yearly consumption higher than 2,500 kWh could provide DSM. However, the development of the Internet of Things (IoT) and consequently the decrease in the price of technologies to connect e.g. home appliances should foster the deployment of DSM. In addition, by 2023, 100% of Latvian consumers will be equipped with a smart meter and will have access to real-time consumption data. The participants agreed that DSM for industrial consumers should be addressed first.
- Combination of DSM, storage and auto-consumption was discussed: still, in Latvia, PV is not booming because prices of PV systems remain too high which make it difficult to find a business case for auto-consumption

Questions to Linards Grigans (Institute of Physical Energetic) about Energy Storage Application in Urban Electric Transport

- Benefits of the recuperation of tramway braking energy were highlighted not only for efficient operation purposes but also because it limits the need for building new substations when extending the tramway network.
- The replication value of the proposed solution was discussed and collaboration with other cities was suggested. So far only a tens of cities in Europe are equipped with such solution in urban electric transport, and some projects exist for railway.
- Storing the braking energy in the substation connecting the DSO and the tramway electric network (with a dedicated storage device such as batteries) and injecting it back to the distribution system may be beneficial, for instance for frequency control purposes. However, there would be some issues in terms of permitting (the system operator of the tramway electric network would be considered as a power generator), as well as in terms of power quality (harmonics) and hardware (bidirectional flows in the substation).

- Further research is needed, in particular regarding supercapacitor aging models (supercapacitors and batteries would be a suitable solution for the envisaged system services). The impact of temperature on the performance (life cycle analysis) is also a topic.

3.2.2 Roundtable 2

Questions to Argo Rosin (Tallinn University of Technology) about Smart Energy Management System with Energy Storages

- Profitability of storage systems with regards to price differentials was discussed. In particular, transmission costs avoided thanks to local storage should be taken into account to improve profitability.
- It was highlighted that price differentials are not sufficient to assess profitability: the whole trajectory of the spot price must be taken into account.
- It was mentioned that the increase of stochastic power generation could cause higher and more frequent spot price fluctuations. Increased stochastic power generation will also influence the power quality in the grid, which means higher demand and cost for balancing (or other ancillary) services. This could also increase the feasibility of storage systems.
- Combination of storage systems with load management systems could increase the cyclic lifetime (and feasibility) of storage devices.

Questions to Tarmo Korõtko (Tallinn University of Technology) about the Development of a Li-Ion Energy Storage System for Electrical Microgrids

- It appears that a "universal use case" (applicable to households, factories, etc.) is infeasible within today's market conditions.
- The multiservice business model of batteries was discussed: they could be used for stabilizing power coming from RES generators but also for frequency control, fast reserve, etc. A multiservice business model (as discussed during the first workshop in Lille) would help to find a competitive business case for electrochemical storage. According to Elering, this type of storage clearly has a role to play for TSOs (new products, mFRR, etc.) and should be operated by other stakeholders.
- The use of second life batteries was identified as a promising solution to keep costs down.
- The impact on network tariffs of storage and auto-consumption deployment has been discussed, in particular for distribution network operators. New remuneration schemes for DSOs (based on capacity rather than on energy) may have to be found.

3.2.3 Roundtable 3

Questions to Zane Broka (Riga Technical University) about Smart Electric Thermal Storage (SETS)

- Profitability of sophisticated solutions like SETS and aggregation was questioned mainly by DSOs, compared to simple day/night signals sent to usual water boilers. It was highlighted that today, SETS are more profitable than other storage technologies. Automated activation is an important feature to guarantee the profitability.
- The role of the aggregator, and the possible impact of aggregated storage devices on congestion management were discussed (both in terms of volume and spatial distribution).
- Upscaling potential was questioned: simulation of SETS deployment with different energy scenarios is to be done both for planning and operation purposes, as well as behavioural studies.

Questions to Karlis Baltputnis (Riga Technical University) about Storage Potential in the Baltic States

- Modelling of weather correlation between Nordic and Baltic regions was identified as a key issue for smooth market integration.
- Suitable market incentives to develop storage were discussed. They could be similar to Feed-in-Tariffs for RES to ensure enough revenues for storage owners. Not only investment costs should be considered but also operation costs (for example efficiency of PHS is 70%: it is profitable only if price differentials are greater than 30%). To increase revenues of storage owners, price arbitrage must be complemented by provision of reserves.
- The question of central vs. decentralised accumulation was discussed: actually both would be useful and complementary.

Questions to Kalle Kukke (Elering) about the Estfeed platform

- Realistic deployment of DSM for households was questioned, since their consumption is considered as quite inelastic. Dynamic pricing would be a prerequisite.
- Legal issues may be raised for aggregators accessing the platform: they need to be authorized by the consumers. An important feature for the platform is to be operated by a neutral player (the TSO).

3.3 Lessons learned from the workshop

These lessons and recommendations have been discussed and agreed upon during the 4th roundtable.

3.3.1 Impacts of the new knowledge presented by the six projects onto the GRID+STORAGE roadmap

The projects presented cover a large range of maturity levels for network operators, from TRL 4-5 for some applications to TRL 9 for some others

Storage as a flexibility option will impact the following TSO and DSO clusters in the roadmap:

- Operations,
- Asset management,
- Market design.

3.3.2 Recommendations for future R&I activities and regional investments about grid and energy storage solutions

The following R&I activities must be considered in the roadmap:

- Business model for storage with multiple services;
- Second-hand automotive battery for stationary applications;
- Storage in transport electricity network located in substations to provide system services to DSOs;
- Home area network monitoring and control as a mean to promote DSM (price of automation and control expected to strongly decrease);
- Use of automated local thermal energy storage devices (consumer level) by aggregators so as to provide system services for network operators;
- Design market incentives together with taxes and fees for the integration of medium to large-scale storage (price signals);
- Dynamic price signals as a mean to stimulate demand response;
- Network reinforcement (interconnections) as a way to ease market integration

3.3.3 Options for the tentative deployment plans of the described solutions and barriers to be overcome

The following topics need to be addressed in the future roadmap:

- Open source software and open hardware;
- Interdependence of gas and electricity networks, i.e. for heating (not only heat networks but also decentralised Power-to-Heat devices);
- Services provided by DSM and storage to not only to DSOs but also TSOs;
- Data sharing and availability, use of ICT tools

3.4 Projects willing to join the Knowledge Sharing Platform

The following stakeholders have expressed willingness to join the knowledge sharing platform GridInnovation-online.

- Estfeed project (Estonia).