Cooperation between Horizon 2020 Projects in the field of Smart Grids and Energy Storage

Main findings and recommendations

Business Models Working Group

July 2019

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Disclaimer: *While aiming to consider the new provisions stemming from the Clean Energy Package (CEP), the report may not entirely reflect the new rules. Proposals for follow-up are without prejudice to main short-term priorities decided during the General Assembly of BRIDGE held in March 2019.*

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Introduction to the BRIDGE initiative

Purpose of the initiative

BRIDGE is a cooperation group involving Low Carbon Energy (LCE) Smart-Grid and Energy Storage projects funded under the Horizon 2020 program over the last five years (2014-2018). It aims to foster the exchange of information, experience, knowledge and best practices among its members.

BRIDGE wants to provide field experience, feedback and lessons learned from the participating projects to help overcome the barriers to effective innovation. It aims to gather coordinated, balanced and coherent recommendations to strengthen the messages and maximize their impacts towards policy makers in view of removing barriers to innovation deployment.

BRIDGE Working Groups

This cooperation group involves four different types of activities (Working Groups) addressing cross-cutting issues enlisted as follows:

Data Management

- **Communication Infrastructure**, embracing the technical and non-technical aspects of the communication infrastructure needed to exchange data and the related requirements
- **Cybersecurity and Data Privacy**, entailing data integrity, customer privacy and protection
- **Data Handling**, including the framework for data exchange and related roles and responsibilities, together with the technical issues supporting the exchange of data in a secure and interoperable manner, and the data analytics techniques for data processing

Regulations

- As regards to **energy storage**, the regulatory framework needs to provide clear rules and responsibilities concerning ownership, competition, technical modalities and financial conditions, for island and mainland cases
- In terms of **smart grids**, regulatory challenges arise regarding the incentives for demand-side response, commercial arrangements, smart meter data, etc.

Customer Engagement

- Customer Segmentation, analysis of **cultural**, **geographical** and **social** dimensions,
- **Value** systems - Understanding Customers
- **Drivers** for Customer **Engagement**
- Effectiveness of Engagement Activities
- Identification of what triggers **behavioral changes** (e.g. via incentives)
- The **Regulatory** Innovation to Empower Consumers

Business Models

- Defining common language and frameworks around **business model description and valuation**
- Identifying and evaluating **existing and new or innovative business models** from the project demonstrations or use cases
- The development of a **simulation tool** allowing for the comparison of the **profitability of different business models** applicable to smart grids and energy storage solutions is being developed and tested by the Working Group members

Projects involved in the Business Models Working Group

Presentation of the report

This report gathers the issues identified by the members of the BM WG related to the use cases they are dealing with in their different projects. These issues and main findings are detailed in the next parts of the present document. To better structure the content and recommendations to be provided by the WG, it has been decided to structure the BM WG in four Sub Working Groups (SWGs) as follows:

- Business Models aspects in Regulated Activities;
- Business Models for Local Energy Management;
- Business Models for Energy Storage;
- Business Models for Demand Response.

Main Findings and recommendations

Business Model aspects in Regulated Activities

The objective of the SWG related to “Business Models aspect in regulated activities” is to assess business model conditions related to regulated grid activities and including: new grid devices and the involvement of flexibilities for grid planning, operation and control. Within the SWG, 5 main issues have been determined, each of them raising a specific challenge.

The first issue deals with the **incentives provided to operators and market players in order to facilitate the development of a positive business case for smart equipment**. The main recommendations defined are based on the work achieved within the UPGRID project which addresses risks with investment and operation in/of smart technologies. The UPGRID project has finished during 2018, however, a publication describing the numerical methodologies that were used to quantify the benefits output is being prepared by partners of the UPGRID consortium. For instance, a recommendation towards the investment in smart technologies is the adoption of a stochastic distribution network planning approach in order to account for uncertainties on future demand / distributed generation (DG). Moreover, a recommendation to tackle the risk related to operation of smart technologies is the reduction of operational uncertainty of smart technologies through enhanced testing and trials to minimize uncertainties. A Cost Benefit Analysis has been conducted by UPGRID related to the deployment of smart equipment across the DSO network in each country participating in the project. The four pilots of the project showed positive business cases, however results are country specific due to the different network characteristics and regulatory frameworks of each country.

Furthermore, the Regulated Activities SWG focuses on **market design to meet efficiency and scalable demands**. The inteGRIDy project is working to define a methodology and a business model tool to foster the internationalization of energy organizations and enable them to adapt their business models in an easier manner. During 2018, a methodology has been elaborated to analyse and develop patterns for the energy industry and an educational module for practitioners. Also, a Market Design canvas has been developed by the project to this purpose.

The next challenge addressed by this SWG is linked **to data and financial flow-organization for the different players,** specifically about data enabling business models (excluding issues related to transitive energy management and data management dealt in other BRIDGE groups) as at this stage there is no framework for data exchange between the different players at the local level. For this issue, a questionnaire has been shared with some BRIDGE projects (GOFLEX, STORY, FLEXITRANSTORE, FUTUREFLOW and INTERFLEX). For instance, it has been found that for local flexibility markets technical, economic and market data are necessary to develop viable business cases. With this data, the actors would be able to estimate grid constraints, the value of using flexibility and ensure a healthy competition among the stakeholders involved. It is to highlight that this type of data would need to be accessible by all the market players and anonymised for security reasons.

Then, the SWG targets **market design** issues **for the use of flexibility by the Distribution System Operator (DSO)** for planning and/or operation purposes. By raising market design questions to different kind of European DSOs, the SWG will try to understand how they deal with flexibility in their contexts. A questionnaire has been elaborated to this purpose and is to be launched targeting a sample of 30 DSOs for the survey.

Finally, the SWG deals with the concept of **local flexibility markets, the trading of flexibility** and the stakeholders involved in such local markets. It is important to mention that current wholesale markets provide flexibility, to some extent, to market participants and Transmission System Operators (TSOs) to integrate ever changing market and system conditions. Nevertheless, there are no yet comparable market-based mechanisms on the local or regional level. This work is being led by the

GOFLEX project in which 'FlexOffers' are being tested using a local flexibility market platform. The process to do that consists of 3 stages: Planning, Trading and Billing. This SWG will be challenging the BRIDGE projects tackling local flexibility markets issues by using a questionnaire.

To sum up, the Regulated Activities SWG has already achieved to deliver conclusions and recommendations about some of the topics related to the use of smart technologies at DSO level and data enabling innovative business models. On the other hand, the SWG is deploying efforts to propose recommendations on market design issues and in particular related to flexibility products and the stakeholders involved in these new markets. To achieve this, the SWG is using questionnaires to perform **surveys** and a business model **tool** to continue enriching the knowledge generated about these topics.

Business Models for Local Energy Management

The SWG related to "Business models for Local Energy Management" analyses the scope for business models revolving around consuming self-generated electricity (prosumage) individually and collectively. Previously, self-consumption was more associated with a financial loss rather than an economically feasible alternative for prosumers. Today, households, Small-Medium Enterprises and cooperatives are playing an increasing role on energy system and self-consumption is financially more interesting for prosumers. The SWG is also interested in technologies enabling self-consumption bringing new opportunities to this matter such as storage systems, and information and communication technologies (ICT) enabled innovative solutions such as blockchain.

Regarding **Individual self-consumption**, this BM SWG states that in most countries, the cost per kWh of residential systems is lower than the retail price, but taxes and levies on electricity play an important role for prosumage so as financial support is still required towards this aim. Moreover, that technological progress and smart devices (e.g. smart meters, storage devices, smart-home controllers…) are fundamental to optimise prosumage. The SWG emphasizes that not all candidate prosumers judge purely on financial terms; some of them place significant value on their ecological footprint. Thus, other attributes come into play.

For instance, findings expressed by this SWG state that benefits from individual self-consumption are important when high retail prices are present, solar irradiation is available, usual demand of buildings exceeds production (i.e. offices) or buildings have temporal overlaps of production and load curves (such as residences with pensioners), etc. Furthermore, third-party entities can achieve significant cost savings due to economies of scale, such as ESCOs[1] and RESCOs[2]. These players would need to be involved in the dimensioning, financing and possibly managing of the excess energy to have viable prosumer's business models. Benefits could also be achieved when prosumer's production is combined with storage systems (e.g., batteries). It is highly recommended that regulators regularly update supporting policies to be cost-efficient and provide the appropriate investment signals, without distorting the market. Furthermore, prosumers would need to participate in a fair manner to the network expansion and management costs, e.g., by introducing capacity-based network tariffs (instead of those that are purely based on energy volume) so as regulated players, like DSOs would need to provide transparent, localized and up-to-date information to facilitate prosumage. In case of sufficient quantity of storage, energy arbitrage should lead to lower overall electricity prices and reduced volatility. In addition, there is the potential to reduce congestion in the distribution and the transmission grid. However, there are also potential downsides with grid-connected local storage. First, local storage is an additional condition in the operation of the overall system. While from the private and business perspective there is scope for profit, the cost of the overall system increases.

[1] Energy service company (ESCO)
[2] Renewable Energy Service Company (RESCO)

Moreover, the SWG focused on **collective self-consumption** business models characterized by complex legal rights, management issues and technical challenges. Collective self-consumption has been dealt in the Clean Energy Package as collective schemes and community initiatives have been emerging with increasing frequency in different Member States. The SWG highlighted two cases for their analysis, when prosumers are part of the same legal entity (**Entity criterion**) and when prosumage is happening on the same location (house, building or building block) (**Location criterion**). For instance, the SWG recommends that wherever the building is owned by one entity and inhabited by tenants, then policy makers would need to provide clear regulatory frameworks for shared investments and more standards are required for technologies fostering collective self-consumption. In addition, subsidies and tax rebates are efficient measures to promote prosumage. New players at local level providing energy services for collective self-consumption could foster prosumage at EU level. DSOs could have benefits from this situation as well.

Technologies enabling **peer-to-peer (P2P) energy trading** at the DSO level are also tackled by this SWG. It refers to the direct energy trading among consumers and prosumers in distribution networks, which is developed based on the "P2P economy" concept (also known as sharing economy). For instance, **blockchain**, allowing the use of automated transactions, could have an important impact in the energy sector by performing verification and authentication of transactions between parties, specially at local level. Technical challenges and some other are non-technical issues such as regulation, technological uncertainty, energy consumption, cybersecurity and integration with existing systems might still be important obstacles to allow blockchain to reveal its potential in the energy sector.

On the other hand, **batteries and other storage components** would bring business opportunities and technical challenges linked to their own nature (raw materials and manufacturing, longevity, safety, recycling…) **for self-consumption**. Within the project Netfficient, environmental assessment of storage equipment indicated that resource use and end-of-life treatment need to be considered to make the solutions sustainable, Resource efficient design of components contributes to potential environmental benefits. Strategies for treatment of discarded equipment would need to be prepared by policy makers to align this potential issue with waste management policies and in particular with the Circular Economy Package.

Business Models for Energy Storage

The SWG focused on **Storage** issues and explains that storage devices usually: support the business case of renewable energy supply; help balancing the e-grid; and may favour self-consumption of energy (typically in cases of high retail prices and without sophisticated business models using Virtual Power Plants - VPPs technologies). The development of a clear regulatory framework encouraging the development of flexible hybrid power plants (renewable energy systems-RES + storage) at generation side is desirable both at the National and European level. Also, financial incentives for operators of distributed storage are needed in coordinated schemes (such as VPPs).

It has been emphasized that ICT and technology providers would need to be involved more when designing BMs dealing with storage applications in connection with RES and demand response (DR) technologies. When multiple storage devices are deployed the role of an ESCO or a third party can in some cases be useful in identification revenue streams.

Regarding batteries, it is recommended that financial incentives and regulation evolve encouraging RES development. If a massive deployment of battery energy storage systems (BESS) will occur, effective stimulation of a battery market can enhance investment in accompanying technologies (software and hardware), decrease prices and favour market penetration. Lack of investors and 'regulation' towards battery investment may cause other promising types of storage and storage actors to become competitive. Another risk for battery storage is the competition with potentially less expensive flexibilities, and/or other storage energy carriers. The SWG highlights that it is important to

continue to invest in new technologies at national and European levels, and to define public policies that will facilitate innovative battery and other storage technologies to get to the market.

In order to foster the development of a flexibility market, the SWG recommends that centralized batteries should not belong to regulated entities, because if they operate their flexibilities (batteries included), there will be less room left for flexibility market development. Customers and aggregators may then have difficulty with getting a satisfactory return of investment (ROI) or adequate payment for their services. This issue would be compatible with the Winter Package proposals aiming at having the "customer at the centre of the energy system".

There is a general risk that without sufficient storage capacity inflexible conventional power generation will distort energy markets such that flexible sources cannot be operated profitably. Unanticipated regulatory barriers, unforeseen technology developments, unexpectedly high energy storage costs for some types of storage, etc. may pose risks paralysing investors and decision makers. The use of tool to support decision making can be helpful in choose scenarios in different BM decision making processes.

Traditional business cases insufficiently incorporate: stakeholder analysis and public acceptance issues; externalities (e.g. safety impact, security of supply effects, distributional implications, non-greenhouse gas (GHG) effects, congestion, etc.); other value chain costs such as those related to energy transport, conversion and storage funded by others; the optimality of storage types and modalities given the existing electricity and gas grid and their spatial patterns; or opportunity costs (e.g. ignoring or insufficiently recognising existing facilities' sunk costs). Therefore, a new generation of business models will need to be developed, capturing all these elements. For instance, much more research seems to be needed on what adjustments in the grid and appliances is needed to make them (better) suitable for syngases.

Life cycle analysis (LCA) and assessment of the socio-economic impacts must be taken into account systematically in assessing business models in general. Not doing this may lead to sub-optimal storage investment (both in type and size) from a societal perspective. The STORY project, for instance, proposes a 'Framework Matrix' and a Value Analysis Methodology in order to take into account technical, economic, electricity market and modelling parameters of the energy storage systems (ESS) to be tested in several use cases.

Finally, the storage SWG focuses on use cases that would enable ESS to maximize the electricity market related income of the existing assets (e.g. conventional power plants, wind generation…). Namely, ESS are offering the level of flexibility that current markets cannot fully accommodate or take advantage of. ESS would need to be recognised as a new type of market actor at EU level. If participating, ESS can pursue a combination of market strategies that can provide new range of flexibilities to other market actors. However, some market conditions and new markets are still required to foster and enable the participation of ESS and profit of the benefits these systems can bring to the energy system at different levels.

At this stage, this SWG has mostly worked on the characterisation of issues related to storage within the projects of the BRIDGE initiative.

Business Models for Demand Response

The objective of the SWG dealing with demand response is to assess business models' conditions related to a change in the power consumption for a better management of microgrids, by further involving end-users and by working on their flexibility capabilities and costs.

The SWG deals with **consumers' engagement** issues. Experiences from RealValue and SMILE Projects are considered in the analysis of the SWG. It is stressed that the greatest risk for the engagement is the lack of interest or understanding on the part of consumers and / or lack of willingness to understand. For instance, the SWG recommends gaining a thorough understanding of

what is required to engage specific consumer categories i.e. gather feedback from large cohorts of consumers from diverse demographics to identify what would be the most efficient. Also, to increase customer engagement regarding the benefits through appropriate marketing / dissemination activities.

The need for adequate measures to ensure market uptake of innovative technological solutions and services (energy management systems-EMS) is assessed within this SWG. To **enable a fair and open market framework for flexibility services**. It is recommended that flexibility resources should participate in all electricity markets (**demand response access to markets**), that independent (aggregators) service providers need to have access to markets for the healthy growth of market competition around consumer-centric services. Also, that product requirements would need to be redefined to be adapted to the new generation means. Harnessing the European flexibility potential using DR and DG requires the coordinated participation of the full energy value chain, so transparency is fundamental to foster the development of Demand Response programmes. The SWG describes some regulatory steps to enable consumer participation in automatic Frequency Restoration Reserve (aFRR) market for instance.

Finally, the SWG deals with **revenues, costs & ROI of demand response.** To address this issue, it is reminded that there is a requirement for collaboration with TSOs/DSOs to ascertain higher values for flexibility and provide longer term contracts to encourage more investment and technology adoption. Reducing the cost-to-serve customers greatly impacts the ability to create value out of a demand side management (DSM) / demand response (DR) service. Currently costs are prohibitively expensive due to a number of factors, such as the cost for verification, possible inclusion of more sensor hardware (very costly for domestic application), just to mention a few. The SWG recommends creating a forum of EU DSM players to collectively develop standard guidelines and operational standards, in close cooperation with TSOs/DSOs.

Business Models tools

Within the Business Models Working Group, 3 Business Models tools have been introduced to support the work of the working group.

The **Nobel Grid tool** proposed scenarios for the techno-economic evaluation of innovative smart grid technologies and associated business models. Then, the **DOWEL tool** aimed at calculating key performance indicators (KPIs) to shape the socio-economic impacts of use cases/business models of smart grids and energy storage solutions. Two BRIDGE projects, NAIADES and RealValue have tested the DOWEL tool and provided relevant outcomes. As an example, NAIADES stressed that the tool would fit the parameters, function and characteristics of the batteries deployed in the project after studying a specific use case aiming at assessing the different costs (i.e. installation) of the batteries used in the NAIADES project compared with those already commercialised by different companies. On the other hand, the **inteGRIDy tool** aims at helping the business modelling for future cities and technologies. This tool is being developed by the project and it is to be tested by working group volunteers.

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