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Analysis of results from dissemination activities during the first three years

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Table of acronyms

Acronym	Description
ACER	Agency for the Cooperation of Electricity Regulators
aFRR	Automatic Frequency Restoration Reserve
BSP	Balancing Service Provider
CMOL	Common Merit Order List
DG	Distributed Generation
DR	Demand Response
DSO	Distribution System Operator
EB GL	Electricity Balancing Guideline
FAT	Full Activation Time
FCR	Frequency Containment Reserve
ICT	Information and Communication Technology
LMOL	Local Merit Order List
mFRR	Manual Frequency Restoration Reserve
MARI	ENTSO-E implementation project of mFRR
PICASSO	ENTSO-E implementation project of aFRR
RR	Replacement Reserve
SCADA	Supervisory Control and Data Acquisition
SOGL	System Operation Guideline
TSO	Transmission System Operator
T&C	Terms and Conditions for BSPs

Glossary

Refer to ENTSO-E glossary, <https://www.entsoe.eu/data/data-portal/glossary/Pages/home.aspx>.

The aim of the FutureFlow Project

Four European TSOs of Central-Eastern Europe (Austria, Hungary, Romania, Slovenia), associated with power system experts, electricity retailers, IT providers and renewable electricity providers, propose to design a unique regional cooperation scheme: it aims at opening Balancing and Redispatching markets to new sources of flexibility and supporting such sources to act on such markets competitively. By means of a prototype aggregation solution and renewable generation forecasting techniques, flexibility providers – distributed generators (DG) and commercial and industrial (C&I) consumers providing demand response (DR) – are enabled, to provide competitive offers for Frequency Restoration Reserve (including secondary control activated with a response time of 30 seconds and full activation time of 15 minutes). Retailers act as flexibility aggregators and pool the resource in order to provide the products required by the TSO. A comprehensive techno-economic model for the cross border integration of such services involves a common activation function (CAF) tailored to deal with congested borders and optimized to overcome critical intra-regional barriers. The resulting CAF is implemented as a cloud solution of a prototype Regional Balancing and Redispatching Platform, which makes research activities about cross-border integration flexible while linking with the aggregation solution. Use cases of growing complexity are pilot-tested, going from the involvement of DR and DG into national balancing markets to cross border competition between flexibility providers. Based on past experience with tertiary reserve, participating C&I consumers and DG are expected to provide close to 40 MW of secondary reserve. Impact analyses of the pilot tests together with dissemination activities towards all the stakeholders of the electricity value chain will recommend business models and deployment roadmaps for the most promising use cases, which, in turn, contribute to the practical implementation of the European Balancing Target Model by 2020.

Project Partners

No	Name	Short name	Country
1	ELES DOO SISTEMSKI OPERATOR PRENOSNEGA ELEKTROENERGETSKEGA OMREZJA	ELES, d.o.o.	Slovenia
2	AUSTRIAN POWER GRID AG	APG	Austria
3	MAVIR MAGYAR VILLAMOSENERGIA-IPARI ATVITELI RENDSZERIRANYITO ZARTKORUEN MUKODO RESZVENYTARSASAG	MAVIR ZRT	Hungary
4	COMPANIA NATIONALA DE TRANSPORT ALENERGIEI ELECTRICE TRANSELECTRICA SA	TRANS	Romania
5	ELEKTROINSTITUT MILAN VIDMAR	EIMV	Slovenia
6	ELEKTROENERGETSKI KOORDINACIONI CENTAR DOO	EKC	Serbia
7	ELEKTRO ENERGIJA, PODJETJE ZA PRODAJO ELEKTRIKE IN DRUGIH ENERGENTOV, SVETOVANJE IN STORITVE, D.O.O.	EE	Slovenia
8	GEN-I, TRGOVANJE IN PRODAJA ELEKTRICNE ENERGIJE, D.O.O.	GEN-I, d.o.o.	Slovenia
9	SAP SE	SAP SE	Germany
10	CYBERGRID GMBH	CYBERGRID	Austria
11	GEMALTO SA	GTO	France
12	3E NV	3E	Belgium



1 Executive summary

Within the FutureFlow project TSOs are the most important stakeholders and at the same time the creators of the project. The balancing and redispatching concept under development within FutureFlow must respect the framework given by the Network Codes and must fit into the TSO and market environment. Therefore the comments and recommendations expressed by the TSOs having participated in dissemination activities during the first three years of the project and other knowledge gained and experiences exchanged with non-project TSOs are very valuable.

The comments and recommendations expressed by the regulators are also essential since regulators represent entities that approve any change of the national as well as the cross-border design of the balancing market. The comments and recommendations expressed by the Advisory Board, represented also by ACER, are summarized to make sure that the potential development and deployment of the project results is compatible with regulators expectations. At the moment, national TSOs are in the process of approving Terms and Conditions for Balancing Service Providers (BSP) according to the Commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing (EB GL). The knowledge and experiences gained within the FutureFlow helped a lot to re-design adequately the national electricity balancing markets within some of the the areas concerned, while permanent contacts with the TSO community and regulators assured the compatibility with TSOs and regulators expectations. Namely, proper and harmonized design of the national balancing markets in a first step is the precondition for opening of the cross-border balancing and redispatching markets as the final target of the FutureFlow and EU Directives.

Among TSOs and regulators, the non-regulated players such as retailers, aggregators, generators, traders and consumers are also very important stakeholders. Their findings arising out of their participation in the field pilot test, comments and recommendations represent valuable input for the exploitation of the project results.

2 Introduction

The communication and dissemination activities are essential for the overall recognition and success of the project and also of great importance for receiving feedback from main stakeholders. The FutureFlow consortium prepared a detailed Communication and Dissemination Plan to:

- outline main objectives of the dissemination activities;
- identify target audiences for each communications objective;
- define tools and channels to be used and the activities required to reach targeted audiences;
- identify the dissemination KPIs, useful to measure the effectiveness and efficiency of the activities conducted;
- explain how the dissemination activities will support the exploitation activity;
- define how the dissemination activities are administrated and
- define two categories of events where FutureFlow project partners should promote project activities and results (priority 1 events are events that have been recognised as events, where participation of FutureFlow is essential and priority 2 events that are all other events where project partners find it useful to promote the project).

Event	Channel	Priority
FutureFlow Advisory Board	Advisory Board	1
Reference Group of TSOs	FutureFlow RG	1
Bridge - STORY	EU funded project's cooperation group	1
InnoGrid 2020+	Conference	1
European Electricity Ancillary Services and Balancing Forum	Conference	1
European Utility Week	Conference	1
Energy Community related events	Conferences, meetings	1
ENTSO-E implementation project Picasso	ENTSO-E	1
ENTSO-E implementation project MARI	ENTSO-E	1
SEERC CIGRE	Conference	2
CIGRE Paris 2018, 2020	Conference	2
RSEEC Bucharest	Conference	2
IEEE PES Innovative Smart Grids Technologies Europe 2016	Conference	2
PIES 2016 (www.pies.si) - IT conference Slovenia	Conference	2
International Conference on Condition Monitoring, Diagnosis and Maintenance 2017	Conference	2
National Conference on Energy 2017, Romania	Conference	2

14th Edition of World Energy Council - Central & Eastern Europe Regional Energy Forum - FOREN 2018	Conference	2
GEN-I's day for customers	Conference	2
Vitel 2017 (http://www.drustvo-sikom.si/dogodki/vitel-2017/), Brdo, SI	Conference	2
Cigre-Cired (http://www.cigre-cired.si/tag/maribor/), Maribor, SI	Conference	2
IntSikt2017 (http://www.intsikt.ba/index_en.html), Tuzla, BiH	Conference	2
AKOS, Agency for communications, Ljubljana, SI	Workshop	2
Agencija za energijo (Energy Agency), Maribor, SI	Workshop	2

Table 1: List of events

Within this report, feedbacks from different stakeholders from above mentioned events and other opportunities for information exchange with the shareholders are elaborated.

3 Comments and recommendations by TSOs

With the constant increase in distributed renewable generation and storage, and the expected rise of active customers engaging in demand response and electric mobility, the key question is how to integrate the flexibility services provided by these new assets and actors into the energy market. For TSOs the use of their balancing services, whilst ensuring efficient and reliable system operations and enabling the market uptake for flexibility resources is a key target.

A framework is needed for structuring the discussion around market integration on congestion management and further on balancing. According to ENTSO-E it is essential that this framework that unveils this flexibility potential is based on an integrated electricity system approach that considers the following principles:

- The electricity system is essential for modern societies and thus shall be sustainable, reliable and affordable for all customers.
- The customer shall be empowered and put at the center, have freedom to connect to the system and participate in all available markets on a level playing field.
- A market design with low entry barriers which on the other hand respect the needs for TSOs to ensure reliable and secure grid operation shall be available for providers to bid in their capabilities.

In that context, TSOs need to coordinate closely with the stakeholders, in particular DSO's, aggregators and potential balancing service providers for the use of flexibility to fulfil our missions as defined in the regulation, whilst creating conditions for the uptake of new services without endangering the reliable provision of electricity. In this respect, the FutureFlow project analyzed various elements of a so called Active System Management (ASM) as a key set of strategies and tools performed and used by TSOs in cooperation with DSOs for the cost-efficient and secure management of the electricity systems. The ASM involves the use and reinforcement of smart grids, operational planning and

forecasting processes and the capacity to modulate in different periods. Generation and demand flexibility potential is aggregated mostly through market-based flexibility instruments to tackle challenges affecting system operation, thus ensuring proper integration of Renewable Energy Sources (RES) and a high share of Distributed Generation (DG) in the flexibility services.

3.1 Pilots and demonstration projects

The provision of ancillary services including flexibility services from DR&DG for balancing and redispatching has been the core of numerous research and development projects. These examples, and more to follow, provide already very useful insights to the foreseeable TSO-DSO coordination schemes or regulatory changes to unlock the potential of distributed flexibilities for congestion management or balancing provision. These examples include the following:

- EU wide R&D projects
- Member State pilot projects
- Member State regulatory frameworks

In Europe, many pilots are taking place today, reflecting that we are still in a learning phase, which is stimulated by the European Commission (H2020) and the Member States. ENTSO-E is getting useful feedback from local and national pilot projects as they allow testing different strategies within a fast-evolving framework. Therefore, the challenge is to allow pilot development offering concrete solutions and fostering innovation, while respecting common guidelines early enough in the process, as to avoid too heterogeneous and misaligned developments leading to market fragmentation. FutureFlow is one of these projects that examined carefully different aspects and provide valuable feedback on TSOs recommendations.

3.2 FutureFlow links with ENTSO-E

FutureFlow has established a direct link with ENTSO-E via the Reference group of TSOs and direct participation in some dedicated ENTSO-E working bodies. FutureFlow was presented and discussed at the Reference Group meeting, in the Research and Development Committee, Working Group Ancillary Services and Working Group System Frequency as well as in the framework of PICASSO and MARI projects. Although known very well four TSOs are actively involved in the FutureFlow project, this fact has to be pointed out once again at this point to emphasise the power of informal communication with other ENTSO-E TSOs and knowledge exchange.

Four FutureFlow TSOs (APG, ELES, Mavir and Transelectrica) are actively involved in pilot tests of prototype platform for the aggregation of distributed generation and demand response and prototype of the regional balancing and redispatching platform. In the following chapter some ENTSO-E recommendations are evaluated and commented based on first-hand experiences from the operation of DR&DG units in the real-time aFRR process.

3.3 TSOs recommendations

- TSOs and distribution system operators should realize an integrated system when developing new solutions, and avoid any isolated solution.

The SO GL specifies in Art. 182(1) TSOs and DSOs shall cooperate in order to facilitate and enable the delivery of active power reserves by reserve providing groups or reserve providing units located in the distribution systems. Further on SO GL defines in Art.182 (3) that the prequalification process for balancing resources connected to the distribution level shall rely on rules concerning information exchanges and the delivery of active power reserves between the TSO, the reserve-connecting DSO and the intermediate DSOs. DSOs shall have the right to set, in cooperation with the TSO, limits to or exclude the delivery of active power reserves located in the distribution system during the prequalification process. Further, each reserve-connecting DSO and each intermediate DSO can set, in cooperation with the TSO, temporary limits to the delivery of active power reserves before their activation.

TSOs and DSOs shall agree with their reserve connecting DSOs and intermediate DSOs on the applicable procedures. The goal of the cooperation is reliable, efficient and affordable operation of the electricity system and grid as well as non-discriminatory and efficient market operation. Thus, the main focus is on usage of flexibilities that are effective, efficient and suit system and grid needs. At the same time, a high degree of market liquidity should be ensured in order to maximize economic efficiency and to use the potential of flexibilities to its full extent.

Experience from the FutureFlow project shows that DR/DG connected on distribution level can provide significant amounts of flexibility for ancillary service markets, which are usually operated by the TSO.

For the operator of DR/DG units or a BSP it is an administrative burden to contact both DSO and TSO during the prequalification process. (This includes adaptation of limits of frequency protection relays in the distribution grid to guarantee the DR/DG unit's ability to provide the service over the required range of frequency.) We recommend to standardize the procedures of DR/DG prequalification between TSO and DSOs as far as possible and to enable the TSO to act as the single point of contact for the prequalifying party, where efficient.

Since the BSP is facing penalties for underperformance it is crucial to deal with flexibility limitations from the distribution grid in an appropriate way. The BSP must have a chance to react on announced flexibility limitations. Thus, any flexibility limitation must be communicated by the DSO at least 1 h before the gate closure of the ancillary service markets. In case a limitation results from an unexpected event in the grid which could not be communicated in advance, then any underperformance of the ancillary service provision caused by short-term limitations of the distribution grid should be considered as force majeure.

- Information on flexibilities that are prequalified or are seeking participation in congestion management and balancing should be made available for affected system operators on a national level. This could be implemented by means of a flexibility register according to national specifications (Art. 182 SO GL). The concept of a national flexibility register could be acknowledged at European level. Nevertheless, the implementation should be decided on national level.

Power grid security is the main concern and daily business of the TSO/DSOs. Novel technologies and energy markets are emerging which are helping energy stakeholders to propose new energy services to keep the national and international power grid safe and secured. It is important to say that technology shall not constitute a barrier for participation in future flexibility markets as long as the requirements for the respective services can be met. .

A national flexibility register could facilitate the participation of DR/DG units in any kind of flexibility markets. From communication perspective, entries to the flexibility matrix and daily operation should be realized by a single point of contact. In addition, activation of flexibilities based on entries in such registers will also require a single point of communication for online data and activation commands related to different services. TSOs can be suitable operators for this kind of real-time communication gateway, since grid operators are regulated and monitored and proved to be able to deal with high amount of data traffic. In any case, the operator of the real-time communication gateway must guarantee that connection of BSPs is not hindered by inadequately high connection fees and that all connecting BSPs are treated in a fair and equal manner.

- Products for congestion management should comply with the needs of system operators and take into account the possibilities of the market parties. A general EU harmonization of the products for congestions management is not required. However, different products for portfolio optimization, balancing and congestion management should be sufficiently aligned to allow an efficient market-based allocation of flexibilities. This implies standard national requirements of the congestion management product.

A local congestion is by definition a local operational grid situation, and it is usually solved by local specific solutions. The generation sources diversity, including small renewables ones (as domestic photovoltaics sources) impose changes in the philosophy of local congestion management, including the control possibilities of small sources and of prosumers. Taking into consideration that the majority of small generation/demand and prosumers use equipment based on the same standards as controller's manufacturers, it is recommended that basic functions are aligned respectively. As consequence, harmonization of products in terms of general control functions should be intended. In this way, the small generations, prosumers and consumers can participate by offering harmonized products in the congestion management process even if there might be local specifications or requirements.

- Prequalification could take place on an aggregated/portfolio level if technically acceptable

With respect to the type of aggregation, as 'reserve providing unit' - an aggregation of power generating modules and/or demand units connected to a common connection point or as 'reserve providing group' - an aggregation of power generating modules, demand units connected to more than one connection point, the prequalification process shall take into account the specific characteristics of the respective entities. In any case real time measurements, tests or -if applicable - results of simulation models as well as continuous monitoring of real activation are of utmost importance.

4 Comments and recommendations by regulators

In general, the representatives from national regulatory authorities are not actively involved in H2020 projects. According to the info from Innogrid2017, only in one H2020 project the NRA is a consortium partner. We believe that the absence of regulators active involvement in research and development projects, results in a poor percentage of project outputs implemented into real life.

Further, FutureFlow project experiences rather modest involvement of the NRAs in the public dissemination events. However, the NRAs have been widely involved and informed about the FutureFlow findings and outcomes thanks to the public consultation process that is currently undergoing in Austria, Slovenia, Hungary and Romania.

The FutureFlow project has assured the involvement of ACER via the Advisory Board. There are some recommendations and comments expressed by the ACER representative in the Advisory Board meetings. It seems the FutureFlow project addresses three different targets at the same time:

- a) to find out whether the new approach is economically justified,
- b) find a quick solution to be implemented,
- c) interest to influence the selection of the target model on EU level.

ACER suggests defining the focus on at least mid- (2 years) or preferably long-term solution. It justifies this opinion with reference to the dilemma between marginal and pay-as-bid pricing methods and believes that the current FutureFlow proposal to implement pay-as-bid method reflects our intention to find fast implementable solution, while the long-term solution should favor marginal pricing.

FutureFlow short term goal is to identify and analyse different concepts which allow partners to further develop and propose methodologies requested by different NC to NRA.

Through the FutureFlow pilot tests we have gained valuable experience. Three out of four countries (SI, HU, RO) had very limited experiences with DR&DG sources participating in aFRR so far. Findings were especially important since TSOs are according to EB GL (entering into force on 23. November 2017) obliged to propose the terms and conditions related for balancing no latter as six months after that.

Regarding the long-term solution, FutureFlow partners are closely observing activities in

EU market, especially PICASSO project, where APG, ELES and MAVIR participate.

The marginal pricing method is identified as the final solution for the pricing. Pay-as-bid method is currently in place in 3 out of 4 FF countries (Austria, Hungary, and Slovenia), so it could be easier for FF target model implementation. Also, as Littlechild¹, although favours marginal pricing (uniform pricing) still sees it as vulnerable to unpredictable prices, a thin market and manipulation of bids and offers. Due to the lack of experiences and non-perfect market environment (possible limited liquidity), pay-as-bid method is foreseen at the beginning. On long term, marginal pricing is a final goal of participating TSOs, as marginal pricing provides market fairness.

5 Standardization recommendations

To implement Regional Balancing (and Redispatching) IT platform with the aFRR Common Activation Function in a manner that vendor-independent solutions for future emerging market could be used seamlessly, the interoperability for the data exchange between related software solutions and modules should be addressed.

The important aspect of the project has been to investigate, how the new solutions could be integrated into the existing TSO's IT environment according to the European Smart Grid Reference Architecture (SGRA) which was defined by the CEN-CENELEC-ETSI Smart Grid Coordination Group in the context of the EU M/490 standardization mandate.

Analyzing the deliverables of the group, especially the "SGCG/M490/G_Smart Grid Set of Standards" and "SG-CG/M490/L_Flexibility Management", it was found, that there are no use cases related to cross-border balancing and redispatching. A description of a use case is essential for development of standards which allow seamless integration and are a basis for identification, evaluation and maintenance of Smart Grid standards.

In accordance to the sustainable standardization process defined in the "Sustainable Processes" deliverable, use cases should be collected by standardization organizations and saved in the Use Case Management Repository. Use cases should be described according to the methodology defined by IEC 61559 set of standards using the IEC 62559-2 standard template (actors, data types, data flows, requirements...). Based on this, the standardization organizations can do gap analysis (Figure 1) and develop possible missing standards.

¹ Littlechild (2007) Electricity Cash Out Arrangements (NETA: Review of Electricity Trading Arrangements: Proposals, Offer, July 1998, para 4.49.)

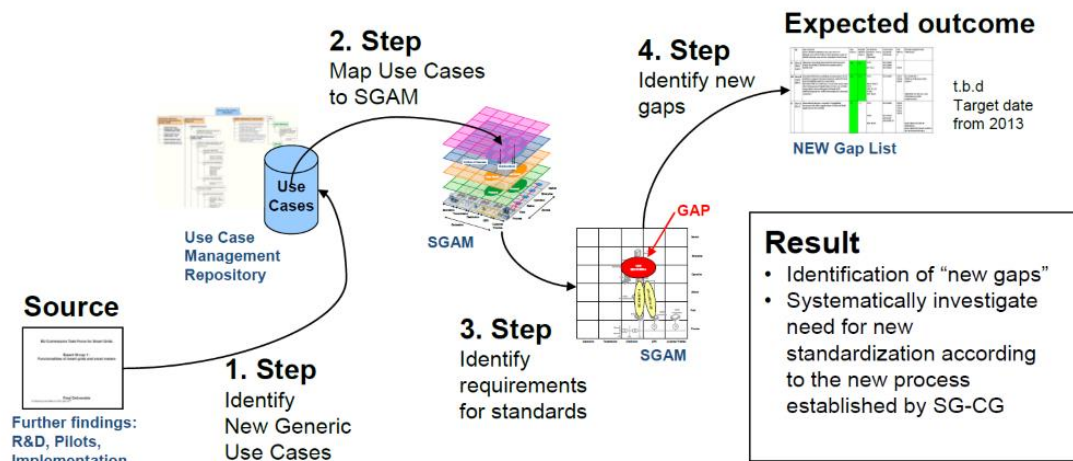


Figure 1: A sustainable standardization process using the SGIS Toolbox

Use cases for cross-border balancing and redispatching which were described in accordance with the IEC 62559-2 standard in the scope of the FutureFlow project, were submitted to the IEC.

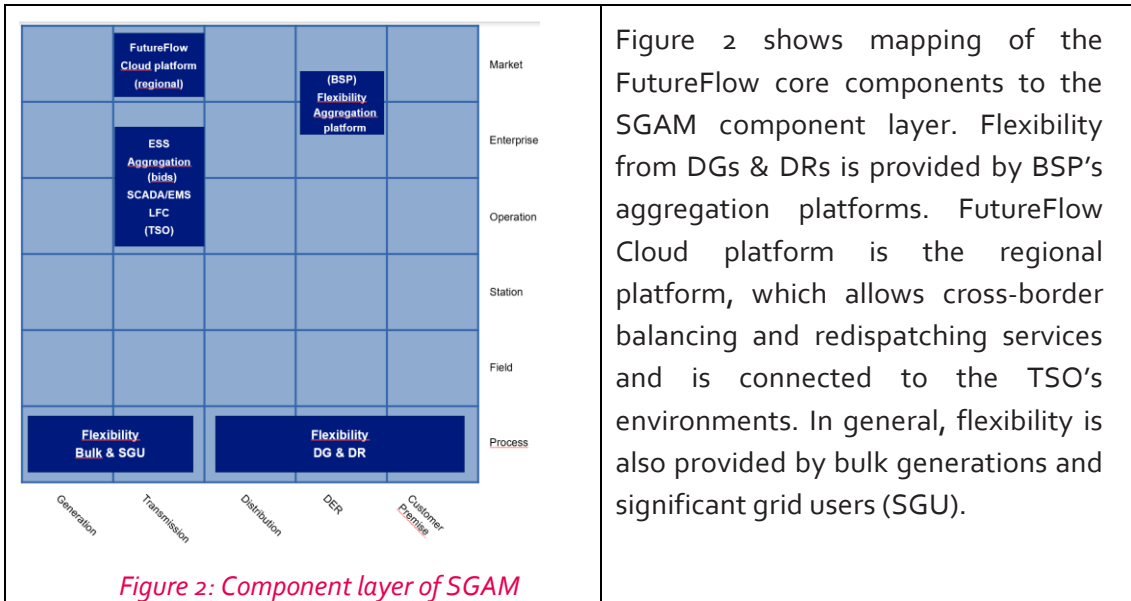
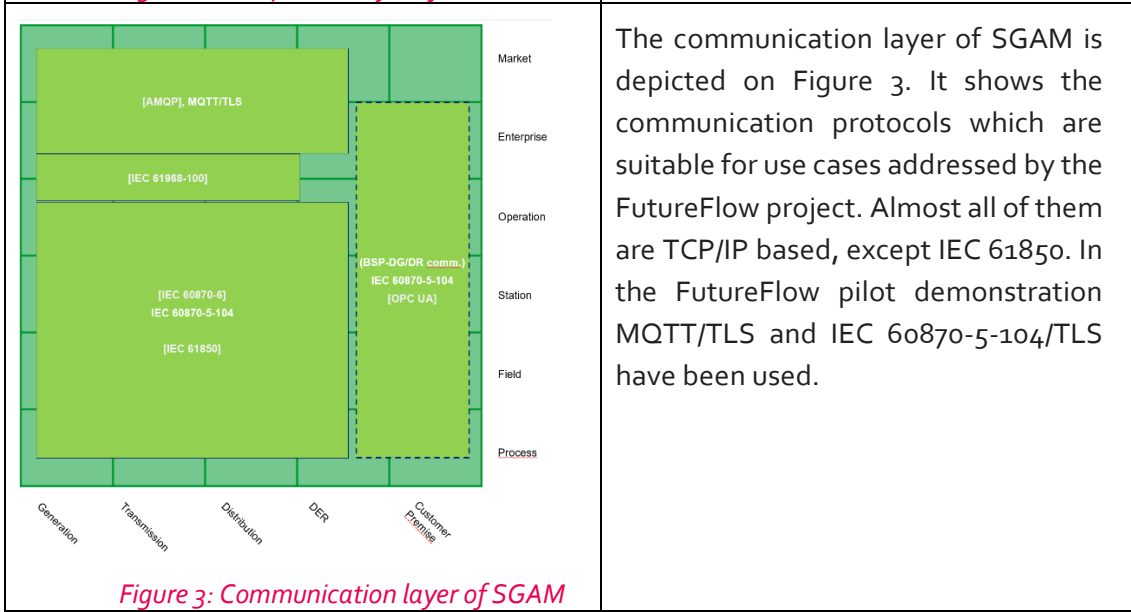


Figure 2 shows mapping of the FutureFlow core components to the SGAM component layer. Flexibility from DGs & DRs is provided by BSP's aggregation platforms. FutureFlow Cloud platform is the regional platform, which allows cross-border balancing and redispatching services and is connected to the TSO's environments. In general, flexibility is also provided by bulk generations and significant grid users (SGU).

Figure 2: Component layer of SGAM



The communication layer of SGAM is depicted on Figure 3. It shows the communication protocols which are suitable for use cases addressed by the FutureFlow project. Almost all of them are TCP/IP based, except IEC 61850. In the FutureFlow pilot demonstration MQTT/TLS and IEC 60870-5-104/TLS have been used.

Figure 3: Communication layer of SGAM

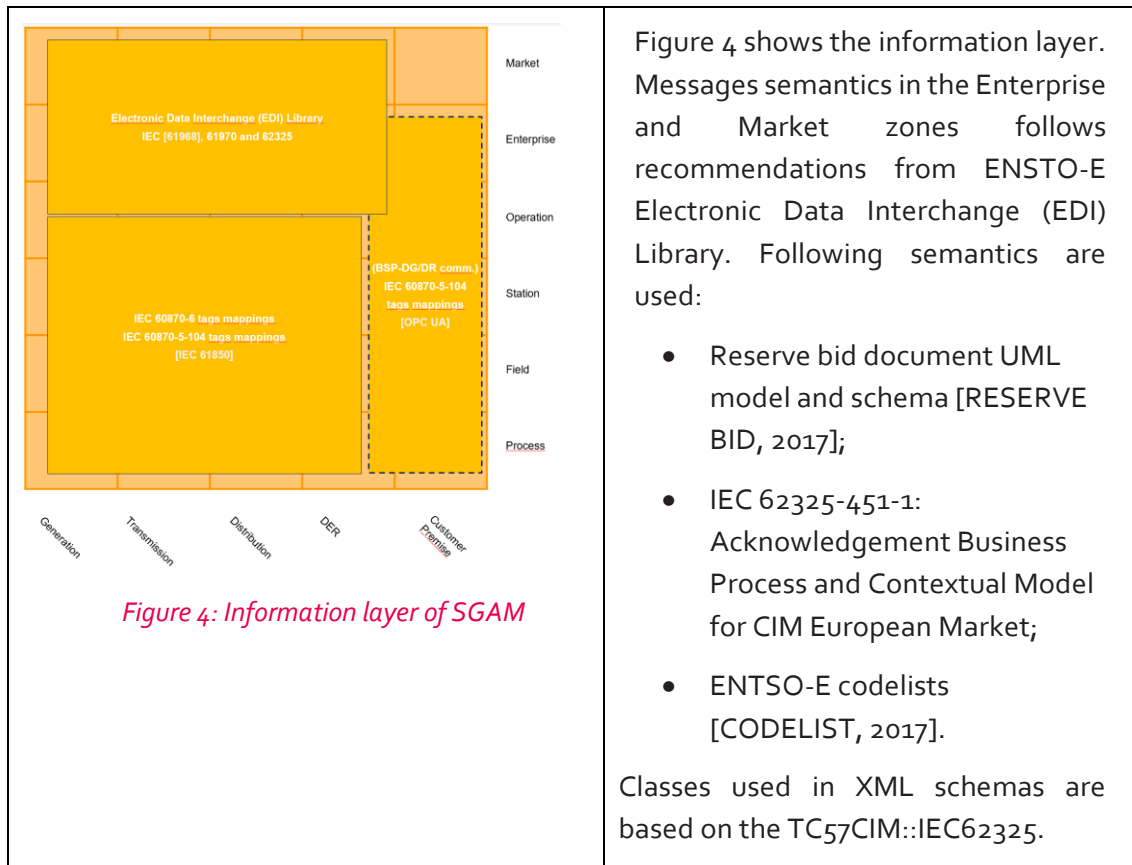


Figure 4: Information layer of SGAM

In the scope of the FutureFlow project the MQTT protocol was used and tested, as well for the real-time data (measurements & control), as also for the market related data (bidding, cross-zonal capacities, acknowledgement business process, etc.). As the MQTT is a data agnostic protocol that can transfer any kind of information, appropriate semantics should be defined. In accordance to SGRA, semantics based on the European Style Market Profile (IEC 62325 set of standards) and ENSTO-E Electronic Data Interchange (EDI) Library should be used.

The MQTT protocol is an IoT protocol, lightweight, open and easy to implement. It can also be well secured (by TLS), as was also proven in the FutureFlow project. It is standardized (ISO/IEC 20922:2016). We recommend, that the MQTT (with CIM based semantics) is considered as an option for applications in the electric power system domain and that it is added to the list of available protocols of SGRA.

6 Comments and recommendations expressed by non-regulated stakeholders

This chapter provides a description of all activities, such as visits, meetings, workshops, direct face to face meetings, and events that took place during the first two reporting periods of the project, until the 36th month.

The aim of this chapter is to get feedback from the customers as the core non-regulated stakeholders. All presented analyses will comprise of the gathered information from the group of fully involved parties in the pilot schemes, and even from these who were only partly involved or did participate for a limited time or way. In general, within this chapter it is expected, that the gathered information from the field will provide conclusions, will define the recommendations, and potentially identify requirements. Even after the end of this project, all gathered information might serve for study purposes, available to other entities such as regulatory authorities, other power system operators, suppliers and other interested parties.

GEN-I in tight collaboration with the market participants, tried to find the answers to four basic questions:

- What is the target group and how to introduce the new services to the potential market participants?
- What is the appropriate approach to convince the market participants for collaboration; enabling/establishing new services?
- How to address the risks associated with external control of the flexible units' operating point?
- What are the other drivers (besides financial benefit), which could encourage the customers to participate; for example, social aspect- or environmental- e.g. lower carbon emissions?

6.1 Methodology

A methodology has to be defined to gather the necessary answers and relevant information that will give a clear explanation on how to approach the newly opened market, which is being established in the frames of this project.

Within the methodology, a clear approach to encourage the new market participants must be described. In this chapter all recently performed engagement activities will be described. The focus will be on the target group of the non-regulated stakeholders, mainly recognized as the electricity prosumers. The methodology must provide the answers which will lead to the results: who to offer the new services to, what is the right manner of presenting the newly developed services of this project, and how to encourage them to decide for the new services.

The first communication, dissemination channel, which was used to engage the prosumers and all other electricity market participants, are the conferences. The second, oriented more to the target group channel, with a clear focus are the workshops. A classical marketing and sales approach are the direct customer's engagement activities which can be defined as the most successful approach on how to involve the interested groups. Finally, as more detailed and specific market research tools, questionnaires were used. The main benefit of the questionnaires is, that they enable a permanent recording and even further analyzing.

6.1.1 Conferences

EU - Wide

Conferences were the first dissemination channel. This channel was chosen because of the possibility of targeting the widest range of the target group, the non-regulated stakeholders. All partners have participated at several conferences. Presenters were the key representatives from each control zone, from Austria, Romania, Slovenia, and Hungary. A lot of effort was put into the preparations to get the opportunity to join. The level of the presentations or submitted scientific papers must be prepared on a high enough level to reach the requirements of the highest academic audience.

The participation summary at the conferences is that during all three years of this project, all international CIGRE conferences have been covered, additionally many other events with the main topics of ancillary services, demand response energy storage or energy as a global topic, have also been a part of the main theme. More detailed description of all past activities, summarizing all active partners is as written: three CIGRE conferences, organized on the local and international level, four international forums and one event organized as the "Energy days". Austrian Power Grid AG (APG) has participated at 1st South-East European CIGRE conference, 2016, European Electricity Ancillary and Balancing Forum, 2017, 10th energy storage forum, 2017, and in 2018 at CIGRE Session Paris. Transelectrica has participated at EC Central & Eastern Europe Regional Energy Forum - **FOREN 2016**, **CIGRE Regional South-East European Conference RSEEC 2016**, REPOM's 10th edition of Energy Day Brasov, **FOREN 2018** and also with the paper presentation at CIGRE 47 Session - Paris 2018.

The activities of the partner GEN-I will be reported separately, just because of its leading role in demonstration and in establishing the relations to the real electricity prosumers. Every year, GEN-I organizes at least one event, dedicated only to meet their key end customers. The company is aware of the importance of taking care of their customers. At these events one part of the time is dedicated to present the results, their experiences and the activities of the hosting company. GEN-I presented the project FutureFlow at each of the events, because the project is a new collaboration opportunity for both sides; for the aggregator- GEN-I and for the visitors- end customers.

2016

1. GEN-I's day for customers, Krško, 2016

One of the first events, where project FutureFlow was mentioned was in Krško, Slovenia, in April 2016. GEN-I's most important customers were invited and the name of the event was GEN-I's day for customers.

2. Purchasing summit 2016 - Purchasing association of Slovenia

In October 2016 this summit was organized, and the most important and the biggest electricity consumers were invited, the focus groups were sales managers from the industrial and commercial sector. Presenting purchase managers with energy market developments and novelties.

2017

1. 8th meeting of the producers from RES and CHP

This meeting, of the producers of electric power from renewable sources and the co-production of heat and electric power, was held in Krško in November 2017. More than 80 business partners of GEN-I Group were invited and participated.

2018

1. 11th meeting of GEN-I's business partners

GEN-I presents its operating results and current trends on the energy market (15. February 2018). At the 11th meeting of its business partners, GEN-I presented the successful operating results achieved last year and trends on energy markets for the efficient purchase of electricity in the coming years.

2. 9th meeting of the producers from RES and CHP

November 13, 2018; the meeting focused on precarious conditions in the electricity market, the changed rule for obtaining state aid and the presentation of green transformation services: smart charging infrastructure and adaptation of diffused sources production.

6.1.2 Workshops

Workshops could be defined as an event organized for a defined, smaller group of invited people. Usually the organization of the workshops comprises several organization stages: first the definition of the content, second, the selection of the invited people- definition of a target group, third the definition of most appropriate location, further the time and the duration of the event, and of course the visitor invitation procedure. The main benefit of organizing workshops is in managing a smaller group of people, less than 50, the visitors are people with an advanced recognized interest for the event and the organizer can use a more individual approach to each visitor.

Workshops with smaller target groups also promise higher success when gathering the feedback information.

Common workshops/business events for end customers

- In the beginning of June, 2018 the official Invitation to the first workshop with prosumers was sent out and published on the Internet sites. Prosumers from Slovenia, with technical possibilities for offering flexibility and already included in the pilot tests, were kindly invited. It was organized in collaboration with the Chamber of Commerce and Industry of Slovenia (CCIS), at their premises (Dimičeva ulica 13), on the 11th of June 2018 in Ljubljana. The Slovenian project partners, ELES, GEN-I, EIMV, in cooperation with the Energy Industry Chamber of Slovenia organized a first workshop dedicated to prosumers within Work Package 5 and Work Package 6.
- Workshop in Romania: in September 2018, a workshop dedicated to prosumers had been organized. The location of the event was Bucharest. This event was organized

to gather and to inform Romanian customers about the FutureFlow project, how and why to join. It was moderated by EIMV Slovenia.

Individual Workshops at customers' premises and the hardware installation meetings

The initial phase, done during the WP 1, was gathering the information about the potential available flexibility in all countries and regions. This research gave the collaborative partner a basic information about the available numbers of customers, with the respect of knowing the target group. The target group was defined as a selected group of industrial & commercial customers whose yearly consumption is larger than 500.000 kWh per measurement point. Final gathered information gave the research partner, GEN-I the numbers about available flexible power, which was compared to the target (theoretical one) one, defined in the documentation (WP1) of the project. At this very first stage of the research activities the leading partner GEN-I was aware, that the right sample of the customers, is vital for the success of the smart grid project. An insufficient number of participants with the wrong characteristics may result in the inability of the project to achieve the desired effects and results. The recruitment run in a proper time, when all the customers were included and before the pilot execution time.

The field tests preparation phase

The second phase was focused on fostering the high priority customers (these with the highest demand response performances capabilities) to join the project. Many face-to-face meetings have been held to get the confirmation for the participation from the customers. The organizer of all these meeting in all four zones was GEN-I. GEN-I very carefully prepared for all these meetings. They came with the final contract version; they prepared a complete explanation, regarding why it is important to enter or join the project. GEN-I also proposed to the customers what level of their internal expertise or management is necessary to be involved.

The execution of field tests phase

The third period, the demonstration, can be determined as the period of implementation and operation. To bring all pilots into operation, many face-to-face meetings have been held. Different levels of management in the invited companies were involved, from the highest to the operational ones. The minutes and reports about these meetings can serve as a proof or a clarification tool, regarding how difficult it is to select the right approach when setting up the demonstration that meets all requirements.

6.1.3 Direct sales activities

GEN-I engaged their sales representatives as the main contact persons in direct contacts with the customers and when it was necessary, also their key account managers and their legal department experts. The customers' engagement activities consisted of more phases:

1. Making the list of the customers
2. Determination of the responsibility; for each customer from the list, a sales representative was defined.

3. The sales representatives were responsible for establishing the direct contact with the customers.
4. Gathering the results

Main communication channels were defined in advance: the first action was usually done via the phone. For better consistence of the calls and gathering the information a short questionnaire was used. The representatives made notes on identified potential flexibility. In cases where the flexibility potential has been identified, in addition to the short questionnaire, the customers signed a letter of intent to participate in pilot studies. As redundant channel many e-mails were sent. All these communication activities were supported with face to face meetings between the customers and the GEN-I representatives.

Similar approaches on how to establish direct contacts with the customers were also used in preparation and in the execution phase of the field tests. The only difference was in engagement of the involved people. This time GEN-I came with the group of their own, specifically trained people. Same group of experts made visits on the field, at each customer separately. For these tasks, GEN-I prepared three main documents:

1. Tables for the flexibility unit definition (PQ DOCUMENTS Future Flow)
2. Template, prepared for a description of each technical unit/customer Control and Operational Concept of FutureFlow Reserve Unit (Technical report)
3. Contract with the final selected customers

6.1.4 Questionnaires

Three different Questionnaires were prepared and used to gather feedback:

The first one was used in WP1 and comprised of a short and long questionnaire. The main concept was gathering the general data of the preselected companies, with the assumed flexibility capability. General information on the power consumption and generation of the company comprises of the basic and simple questions: Experience with monetizing the power flexibilities in your company, electrical energy, gas yearly consumption, installation of generation units and finally about the flexibility and How long does it take from receiving the notification (activation command) to achieve the possible flexibility? The second, longer part of the same in tables organized questionnaire consists of: General facility information about flexibility, Controllable non-process loads and generation units, Controllable Process loads that are totally or partially switchable. The final version of the questionnaire used on the field, at this stage of research was a combination of questions from both described parts, because the real work with the customers' requests such a little more simplifying first approach.

The second was a flexibility unit definition, necessary for the pilot tests, where the flexibility units have been identified. The questionnaire was totally technically oriented and consisted of two main parts or files: the first file was the so-called PQ DOCUMENTS Future Flow. It requests the answers on many questions as follows: Connection to the public grid, Description of technical units in operation, detailed description of the local and the official

(grid connection) meter, Monitoring the actual effect of activations on the grid and fraud prevention, Measures for ensuring reliability and high availability of reserved capacity, Technical characteristics of technical units, Detailed information on the power flexibility of technical units, Integration of TU into the Virtual Power Plant, Automatic control of technical units (Can the TU follow to continuously changing set-points?, what is the minimum time interval in which the set-point can be changed, e.g. 2s, how can an external hardware device control the output of TU? Is there electronic/remote control possible or already implemented for this TU, what type? Could TU accept external electronic signal to remotely control it? What kind of signal? Are there any upgrades of hardware or software needed in order to integrate TU into VPP - what kind? Where the RTU hardware device could be installed? Are TU (or master PLC/SCADA if automation is implemented) and local /official meter located on the same location/building? What is the distance from TU (or master PLC/SCADA if automation is implemented) to the official meter of the DSO (in meters)?), Provision of power meter data, Installation of the hardware and software components. The following sheet of this first file requests to specify the Data points exchange - Modbus RTU protocol and the third sheet gives the information about Signal list for Digital/Analogue input/output signals. Based on all gathered data, the analyzed customer can together with the technical expert from GEN-I, fill in the second part of the questionnaire, which is a kind of a TU flexibility performance simulation and it was prepared for the graphical presentation of the flexibility process.

And the third, main developed questionnaire was the one prepared for the Workshops. The initial version of the questionnaire was prepared by Elektro Ljubljana, because of their previous experiences obtained during the similar and with the GEN-I collaborative project, the hybridVPP4DSO project (funded by FGG, Austria). The questionnaire was prepared in two languages, in Slovene and in English and consisted of 7 questions. Customers were kindly asked to give the information why did they decide to join the FutureFlow project, what are their experiences during their active participation, what are the positive effects for them, what are the main obstacles, what should be improved, would they propose participation also to other companies, is the award for active participation high enough and finally how much revenue would they expect in case of longer, permanent collaboration.

6.2 Results

6.2.1 Conferences

A reason for going to conferences is to meet likeminded people and industry peers, to establish new connections with other similar projects, to exchange knowledge, to get the confirmation that the presented project is going or is developing into the right direction and finally one of the reasons is also the fact, that all activities done in the project are in accordance with the EU legislation, directives and expectations.

6.2.2 Workshops

The project partners presented the purpose and objectives of the project, pilot tests in which some of the invited prosumers participate and their current results and possibilities in offering system services within new business models. The project partners also exchanged

opinions and discussed with prosumers about their opinions and experiences within the pilot tests. The prosumers shared their ideas about better cooperation and presented some ideas for improvements. Because of the high level of success, expressed by the visitors, project partners decided to organize similar workshops in Austria, Hungary and Romania.



Figure 5: Workshop with prosumers organized in collaboration with Slovenian Energy Chamber.

The main obstacles, which limit the engagement of the end customers are the high level of complexity of the contracts, fear that some obligations or rights are hidden- lack of transparency when reading the contract, necessary engagement of different levels of technical experts, direct access and interruptions of the production process and/or separate units, higher expected revenues, the investment costs, the penalties for unsuccessful activations, rerouting the main focus from the core activities to these. Contrary to all of the negative opinions, the end customers evaluated the project as a new opportunity. The approach of GEN-I's agents to the customers was evaluated as positive and very professional. Following the interviews with all the interviewed entities the collaboration in the project was evaluated as an important source of information of future market development, and a positive influence on the level of knowledge/education. All customers would recommend participation to other participants and a high level of expertise and collaboration offered by the GEN-I was noted.

The summary of the results is: 10 participants filled out the questionnaires. The 5th and the 6th question, can be analyzed as yes or no answers. The 5th question was about their opinion, would they propose the collaborative work at this project also to other companies. The 6th question was about the award and if it is high enough. Here are the results of the analysis: 10 (100%) participants would propose the project involvement to other companies. Further, only 3 (33%) answers were negative, when the question was about the award for active participation. Opposite to this, 3 (33 %) participants thought that the award for active participation is high enough. The 6th question about the award, 4 (25 %) people left it unanswered or answered with "no opinion".

VPRAŠALNIK

1. Kaj vas je prepričalo za vključitev v projekt FutureFlow oziroma kaj vas zadržuje, da se še niste vključili?
 Vključitev v projekt FutureFlow je sodelovanje in morebitne naše priponosti in razvoj energetike domače.
2. Vaše doseganje izkušnje glede sodelovanja v projektu?
 Konkretnih izkušenj še nimamo.
3. Kaj so po vašem mnenju pozitivne strani sodelovanja?
 Preveriti, ali so naše TN močne in inovativne.
4. Naštejte glavne pomanjkljivosti in ovire oziroma predloge za izboljšave?
 Imamo manjše TN in se nam ne zdi smiselno, da so naše pogovore z manjšimi TN, saj manjše TN potrebujejo posebno več investicij za vzpostavitev v skladu s standardi.
5. Ali bi svetovali udeležbo na prilagajanju odjema za potrebe sekundarne regulacije tudi drugim potencialnim udeležencem?
 DA
6. Ali menite, da je finančno nadomestilo ustrezno za obdobje izvajanja pilotnih testov?
 DA NE
7. Kakšno bi bilo po vašem mnenju primerno letno nadomestilo za dolgoročno sodelovanje?
 vsaj 3x višja kotička je letna cena elektrike; saj za paket projekta oz. sodelovanje zadetava dodatne stroške pripravevnosti, opreme ter dodatno delo (celotno mesto!)

Figure 6: Questionnaire used for the workshop participants (in Slovenian language).

6.2.3 Direct sales activities

The main involvement of the non-regulated stakeholders had been achieved through direct contacts. GEN-I, the leading partner responsible for the customer engagement and demonstration, has put most of their efforts into these activities. The timeline along with the activities was done in accordance to the guidelines "how to recruit the participants", publicly available on the Internet; SC₃ project. By definition, the recruitment is the process of collecting and selecting the participants and in case of FutureFlow, the end customers were recruited with the aim that the demonstration can run in a real-life environment.

The first group of non-regulated stakeholders is represented by the engaged end customers, the so-called prosumers. The customers' engagement strategy activities have been preceded during the whole period of the project. The initial phase was gathering the information about the potential available flexibility in all Slovenian regions. This first research gave the basic information about the available numbers of customers, with the respect of knowing the target group. The target group was defined as a selected group of industrial and commercial customers whose yearly consumption is larger than 500.000 kWh per measurement place. Gathered information gave the numbers of available flexible power, which was compared to the target one, defined in the documentation of the project. At this very first stage of the research activities the leading partner GEN-I was aware, that the right sample of the customers, is vital for the success of the smart grid project. An insufficient number of participants with the wrong characteristics may result in the inability of the project to achieve the desired effects and results. The recruitment runs in a proper time, when all of the customers have been included and before the pilot execution time.

The second phase was focused on fostering the high priority customers (these with the

highest demand response performances capabilities) to join the project. Many face-to-face meetings have been held to get the confirmation for the participation from the customers. The organizer of all these meeting in all four zones was GEN-I. GEN-I very carefully prepared for all these meetings. They came with the final contract version; they prepared a complete explanation, regarding why it is important to enter or join the project. GEN-I also explained to the customers what level of their internal expertise or management is necessary to be involved.

Thanks to the activities that took place over three years, together with the experience and information gathered from the field, it can be concluded, that even at the level of end-customers, the participants, different groups of non-regulated stakeholders might be defined as follows:

1. At each company the management confirmed the final decision; the contracts for the participation have been signed on this level;
2. The financial department experts in the companies; the economic aspect of the contract, analyses of the costs and revenues;
3. The legal department experts in the involved companies, the content of the contract, if there are all necessary articles which assure "a safety" contract:
4. Technological, technical experts in the companies, managers of the technical units or manageable industrial processes;
5. IT experts, or people responsible for SW applications maintenance;
6. ICT experts; how to enable secure information telecommunication connections;

The third parties were also a very important group of non-regulated stakeholders. In many cases the companies have to order some services or equipment by them, because of their own lack of knowledge or experts. The third parties were in many cases the only solution providers, when the connection of a technical unit or an industrial process-system was intended to be made.

6.2.4 Questioners

The first one, was used in WP1:

Sector	Number of pro-sumers	Flexibility in MW
Agriculture	1	0
Carpentry and joinery	2	0
Ceramics	1	0
Chemical	7	60
Coating materials	1	0
El. producer	11	18
El. production from biogas	3	42
Fertilisers	1	16
Foundry	1	1
Lime, sands and gavel production	1	1
Machinery industry	2	11
Manufacture of basic metals	1	20
Manufacture of glass fibres	1	0
Manufacture of motor vehicles	1	1
Manufacturer of electricity equipment	4	4
Metal industry	1	0
No answer	10	25
Petroleum & Oil	1	15
Pharmaceutical products	2	3
Plastic	5	0
Prefabricated Building Materials	1	1
Production industrie	1	0
Production of cement	1	6
Production of Cushion Vinyl floor coverings	1	0
Pulp & Paper	13	42
Quartz and sand production	1	0
Refinery	1	20
Textile industry	5	0
Waste recycling	1	0
Services Sector	37	33
SUM	119	318

Current results	SLO	AUT	HUN	ROM
Number of companies (general list)	955	410	61	813
Material sent & Direct contact	413	410	35	813
Received short questionnaire	57	357	2	19
Positive answers for the capacity	41	40	2	9
Current results	SLO	AUT	HUN	ROM
Contacts established	43%	100%	57%	100%
Recived questionnaires	14%	87%	6%	2%
Positive answers for the capacity	72%	11%	100%	47%

The second was a flexibility unit definition, necessary for the pilot tests. It is considered the most relevant information from the f2f meeting minutes and technical unit description minutes.

Questionnaire prepared for the Workshops:

As a result of this campaign and for the most promising participants, GEN-I organized a one-day workshop (spring 2018). The expected result of this one day closed meeting was, to gather all the positive opinions, concerns, and obstacles from the actual project pilots' participants. A questionnaire was prepared, with the aim to get the general opinion from

the customers.

6.3 Conclusions

After measuring and comparing the success level of engaged customer, it can be concluded that the written aims of this project were achieved, and thus the work done on the customers approach and engagement strategy was worth it.

Furthermore; more and more new industrial and commercial customers are applying to join the project and this confirms the applied strategy is the right strategy and also the right introduction of the new services.

Based on the interactions with non-regulated stakeholders the following main comments and recommendations could be extracted:

- The target providers of flexibility have been found more appropriate in the distributed generation group compared to the demand side group. The reasons seem to be that the small power plants are technically more developed with respect to variable power production. Furthermore their owners seem to be aware of the volatility in the power markets, thus they are quicker to respond to new propositions, such as the provision of aFRR services.
- The appropriate approach to convince the market participants for enabling/establishing new services is to address their concerns, mainly the high level of complexity of the contracts, fear that some obligations or rights are hidden, thus it is necessary to engage different levels of technical experts. In addition, the direct access to control the power production from external sources has to be sufficiently discussed.
- Rather low financial compensation compared to the risks that the unpredictable interferences pose to the core production processes, which is often the case with demand response, is in many cases not sufficient to highly motivate otherwise technically well-equipped providers of aFRR. For such candidates the low product resolution is of important market prerequisite to enable them to participate in line with their ever-changing production process “excess” capabilities.

The main motivation which encourages the customers to participate, is to be prepared for the future markets; even lower as expected extra revenues, cannot convince customers not to participate. Another positive fact is that the customers are also convinced that they could also have a direct influence on lowering carbon emissions.

7 Comments and recommendations from workshops, conferences and other communication with market participants by TSOs

7.1 Austria

Austrian Power Grid AG (APG) has participated to follow major events where has promoted the Future Flow project:

June 2016

1. Presentation on FutureFlow project at “1st South-East European CIGRE conference”, Portoroz, SI
Presenter: APG and EKC

The **focus** of presentation was on general approach taken within the research project as well as expected benefits it might create.

April 2017

2. Presentation on FutureFlow project at “European Electricity Ancillary and Balancing Forum”, Amsterdam, NL
Presenter: APG

The focus of presentation was on analysis related to the different optimization concepts (balancing) and redispatch cost-minimization. The presentation has been followed by intensive discussion with the other TSOs, DSOs and representatives of the utilities that were present at the conference.

Mai 2017

3. Presentation on FutureFlow project at “10th energy storage forum”, Berlin DE
Presenter: APG

The focus of presentation was on general approach taken within the research project as well as expected benefits it might create.

2018

4. CIGRE 47 Session - Paris 2018
Paper presentation: Flexible balancing power services within four control zones, using e-trading platform – Future Flow project, Authors: D. Ilişiu, I Serbanescu- TEL, Z. Vujasinović - EKC, M. Kolec – ELES, E. Kiss - MAVIR , A. Stimmer – APG

7.2 Hungary

15th September 2016

FutureFlow was promoted on the 63rd Conference and Exhibition of the Hungarian Electrotechnical Association, where the project was introduced in a separate section where the expected trends of system operation was the motto.

The presentation was held by Mr. Gábor Alföldi, Director for System Operations

14th September 2017

FutureFlow was promoted on the 64th Conference and Exhibition of the Hungarian Electrotechnical Association, where the project was introduced in a separate section where the motto was the "present and the future of the transmission system operator".

The presentation was held by Ms. Evelin Kiss, Senior Advisor for System Operations

17th November 2017

A workshop of Balancing was held in the premises of MAVIR, where the Hungarian market participants of balancing market were mainly invited. During the workshop, FutureFlow was introduced as one of those projects, which could bring solutions for the challenges of a TSO in the future considering the increasing share of distributed generation.

7.3 Romania

2016

CTEE Transelectrica has participated to follow major events where has promoted the Future Flow project:

1. The 13th Edition of WEC Central & Eastern Europe Regional Energy Forum - **FOREN 2016**, with the theme "Safe and Sustainable Energy for the Region", which took place in Vox Maris Grand Resort, Costinesti, Romania, during 12-16 June, 2016. The event was organized by the WEC Romanian National Committee, under the auspices of the Government of Romania, under the leadership of the World Energy Council and with the support of WEC Member Committees in Central and Eastern Europe.

Paper presentation was: **FLEXIBLE BALANCING POWER SERVICES WITHIN FOUR CONTROL ZONES, USING E-TRADING PLATFORM - FUTURE FLOW PROJECT**

Authors: Doina ILIȘIU, Tania ROMAN CNTEE Transelectrica S.A.-UNO-DEN, Zoran VUJASINOVIC- Head of team for Electricity Market and Software Solutions, Uroš SALOBIR- General Coordinator for System Development.

Comments mostly referred to the technical requirements at level of prosumer and their involvement in the ancillary services. The regulators were interested in the disequilibrium calculation in case of inter TSOs activation of secondary reserve provided by small DR&DG.

2. **CIGRE Regional South-East European Conference RSEEC 2016** (3rd edition) October 10th - 12th 2016, University "Politehnica" of Bucharest, Romania
Paper presentation was: **BALANCING ENERGY EXCHANGE CONCEPT TAILORED TO CONGESTED BORDERS** **Authors:** Zoran Vujasinović (EKC), Nebojša Jović (EKC),

Doina Ilisiu (Transelectrica).

Comments referred to the redispatch mechanism, and to the methodology to real time calculation of remain capacity.

2018

3. REPOM's 10th edition of Energy Day Brasov - one of the most acknowledged conferences on energy in Romania with press conference at Romanian national broadcasting stations, print- and online media.
FF project was presented in the workshop on „virtual power plants“, with participation from: Mr Wojciech Kawecki from NORDEX SE and Prof. Frank Truckenmüller, University of Reutlingen, Germany leader of project "Virtual Power Plant Neckar-Alb" in Baden Württemberg.
Stakeholders comments referred to financial cost distributions inside the DR&DG.
4. The 14th WEC Central & Eastern Europe Regional Energy Forum - **FOREN 2018** with the main theme: „Central and Eastern Europe in the New Era of Energy Transition: Challenges, Investment Opportunity and Technological Innovations“ held in Vox Maris Grand Resort, Costinesti, Romania, during 10-14 June 2018.
Paper presentation was: **COMMON ACTIVATION FUNCTION FOR AUTOMATIC FREQUENCY RESTAURATION PROCESS – SOLUTIONS FROM FUTURE FLOW PROJECT, Authors:** Dr. Ing. Doina ILIȘIU, Ing. Florina AMZA - C.N.T.E.E. Transelectrica S.A, Z. VUJASINOVIĆ (EKC).
5. CIGRE 47 Session - Paris 2018
Paper presentation: **Flexible balancing power services within four control zones, using e-trading platform – Future Flow project, Authors:** D. Ilișiu, I Serbanescu- TEL, Z. Vujasinović - EKC, M. Kolec – ELES, E. Kiss - MAVIR , A. Stimmer – APG

7.4 Slovenia

It should be pointed out that ELES intends to implement as much FutureFlow results in every-day operation as possible. Thanks to FutureFlow the balancing design in Slovenia will be re-designed. In the scope of the preparation of the new Terms and Conditions (hereinafter referred as T&C) for balancing services providers in Slovenia, ELES organized a public consultation within which ELES received 85 comments from various balancing providers in Slovenia.

After public consultation of new Terms and Conditions all comments received from the BSPs were carefully analysed. In general, comments can be classified into two groups: minor comments (editorial, reference and definitive nature) and comments related to technical contents and concepts.

From the context of the latter several key comments received by the BSPs can be emphasized since they are also important in the scope of the ongoing development of FutureFlow concept.

For BSPs the main concern with the upmost relevancy was related to Full Activation Time (FAT). ELES in order to follow FutureFlow results exploitation as well as current European trends, determine that FAT should be 5 min for aFRR. However, the main argument for BSPs against this decision is related to technical capability of achieving such response time of the available units and additional consequently economic impact that might emerge.

Furthermore, several BSPs proposed that time resolution of aFRR balancing energy daily pick and off-pick products should be changed from proposed twelve 12 products to shorter 4 hours products similarly as current market designed defined by Austrian APG.

Within the Terms and Conditions ELES requests that all regulation units (cooperating in aFRR and mFRR) needs to be equipped with metering devices (energy meters) characterised of at least 0.5 class of accuracy or higher. BSPs, especially aggregators are not in favour of proposed accuracy, since this kind of metering devices are expensive. This may in case of a large number of small-size customers involved in curtailment represent relatively large investment costs for aggregators.

To increase the level of aFRR service provision quality ELES decided to re-define the financial penalty mechanisms for BSPs in cases if they are not submitting mandatory aFRR energy bids and for missing balancing energy (deviation). Majority of BSPs believe that proposed methodology for penalty calculation is too strict.

Nevertheless, Slovenian NRA will deliver and present its final position regarding the ELES's response and argumentation of comments before approval of Terms and Conditions final wording.

7.4.1 EU - Wide

One of the important communication activities were also media relations and cooperation with BRIDGE initiative. Through media we reached lay public and present it the project, its mission and its goals.

We also cooperate with BRIDGE initiative where we promoted the project among other Horizon 2020 financed projects and of course to European Commission, as BRIDGE is a EC initiative which unites Horizon 2020 Smart Grid and Energy Storage Projects to create a structured view of cross-cutting issues which are encountered in the demonstration projects and may constitute an obstacle to innovation.

At BRIDGE we were members of two working groups:

- "Customer Engagement" that is working on: 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 behavioural changes (e.g. via incentives); the regulatory innovation to empower consumers and business models.
- "Business Models" that aims at: 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.

Within the working group “Customer Engagement” GEN-I facilitates the work of Subgroup B Barriers to implementation. FutureFlow participated at meetings and was actively involved in the preparation of the document “Customer Engagement Report 2015–2017” where we contributed content for the chapter 2 Barriers to implementation and customer analysis.

Within “Business Models” Working Group CyberGRID was especially active in “Business models for Demand Response Sub Working Group”, with the objective to assess business models conditions related to a change in the power consumption for a better management of microgrids, by involving more the end-users and by working on the flexibility services and costs. FutureFlow contributed with its findings and results to the issue of enabling of a fair and open market framework for flexibility services. The aim is to address the need for adequate measures to ensure market uptake of innovative technological solutions and services. The issue can be addressed by implementing the Winter Package directives into MS regulation based on dedicated recommendations related to specific dimensions: demand response access to markets, service providers’ access to markets, product requirements and measurement and verification, payments and penalties.

We also promoted project inside the “BRIDGE initiative and project fact sheets” and shared news about FutureFlow’s activities for BRIDGE newsletter and BRIDGE LinkedIn profile.

8 FutureFlow influences and changes introduced at TSOs

8.1 APG (Austria)

A very useful part of FutureFlow research activities relates to the concepts of power flow decomposition, which have been analysed and proposed in the part of work related to redispatch optimization concept. Establishment of Power Flow Colouring (PFC) method was an important milestone reached within the FutureFlow project, as the operational implementation of this concept is currently being discussed among TSOs in the different European Capacity Calculation Regions (CCRs). Namely, according to CACM Regulation (EC 2015/1222), TSOs need to establish a methodology, which is going to be used for the sharing of costs related to remedial actions. One of the options how this could be achieved is to determine who (which zone) caused which part of the partial load flow over the overloaded network element, as this overload actually leads to the activation of costly redispatch actions. Within the FutureFlow project an IT solution for the PFC method has been programmed and, at the end, used for the experimentation tests in the different European CCRs, in which different TSOs work together.

Since the balancing market in Austria is already far developed including existing FCR and aFRR cross border cooperation the main input of FutureFlow concerning balancing is considered to be further developed BSP concepts which will facilitate BSP participation.

8.2 ELES (Slovenia)

ELES has very difficult job in terms of efficient ancillary services management, more difficult than other European TSO, due to very limited balancing resources in Slovenia and on the other hand relatively high needs for reserve power. It should be emphasised that the high need for reserves in Slovenia is connected with large power plants (696 MW, 553 MW) compared to peak load (ca 2100 MW). Therefore, ELES is involved in various research projects seeking at new flexibility sources in combination with cross-border exchange of these services. Main goal of the research and development activities within ELES is a step by step transition from existing long-term arrangements with BSPs to more flexible balancing environment where DR&DG balancing units play an important role.

In this Section, motivation and reasons as well as concrete changes related to recent balancing market developments are presented. The FutureFlow project presents an important leverage for ELES starting the reorganisation and introduction of necessary changes in the field of balancing services.

ELES widely uses the experiences from the FutureFlow project at re-designing Slovenian market for balancing services. Products, parameters and other findings from FutureFlow were gathered into new Terms and Conditions for providers of balancing services on the balancing market. The Terms and Conditions were prepared in the scope of EB GL (EU) 2017/2195 [ref] implementation efforts. ELES organised public consultation about the document that took place from 15. May 2018 to 15. June 2018. During this period, ELES received 85 comments from the stakeholders and responded to all comments. Eventually, 37 comments have been accepted. The T&C for balancing services providers on the balancing market are envisaged to be confirmed by the Slovenian National Regulatory Authority, so the regulator is implicitly taking part. The implementation of the T&C concepts and rules a next step.

ELES defined all technical requirements (requirements for units, FAT, tolerances, communication requirements, etc.) as well as market requirements (product definitions and characteristics, auction procedure, etc.) for each load frequency control action (FCR, aFRR, mFRR) that balance service providers need to be compliant with for successful prequalification procedure and eventually service provision.

A prequalification procedure has been established in Slovenia. Such a procedure was not in place in the past and thanks to FutureFlow the procedure has already been implemented. The approach is identical to the FutureFlow concept. The next action worth mentioning is the integration of the Merit Order List into the ELES's Load Frequency Controller. The project has been launched already. Some concrete changes, deriving from FutureFlow findings and recommendations that are in the implementation phase in Slovenia are described in the continuation of this chapter.

➔ Development of Local Merit Order List (LMOL)

For building of LMOL, ELES will use a dedicated ICT application for auctions. All prequalified BSPs will be able to participate in auctions for balancing capacity and balancing energy separately. BSPs who were not successful in the auction will still have an

opportunity to offer voluntary bids (only energy paid). The application forms LMOL that will be forward it to future EU platform once in place - for example the PICASSO platform. After the optimization, this platform will then forward the list of activated bids to the ELES' SCADA load frequency controller. Eventually, in case of decoupling and local market operation the application for auctions sends formatted LMOL directly to the ELES' SCADA load frequency controller. The detailed procedure of preparation of LMOL is illustrated on Fig. 2.

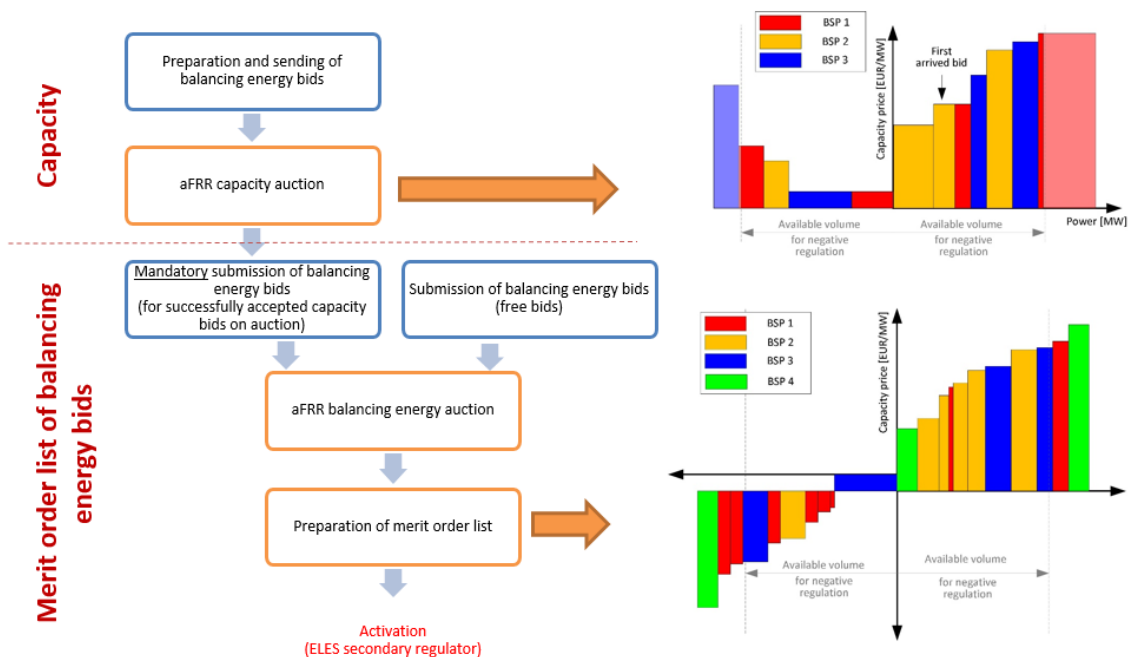


Figure 7: Procedure for generating LMOL.

As presented on Fig.2, the auctions process is in general divided on aFRR balancing capacity (upper part) and energy auctions (lower part).

➔ Update of ELES's load frequency control regulator

The modification of ELES' SCADA frequency control regulator will be needed due to implementation of mechanism for bids activation based on Common MOL (CMOL) used within common European balancing platforms. It is foreseen that ELES will participate in at least two cooperation's, i.e aFRR and ImbalanceNetting. On Fig. 3 a block diagram of a changed load frequency control regulator is presented.

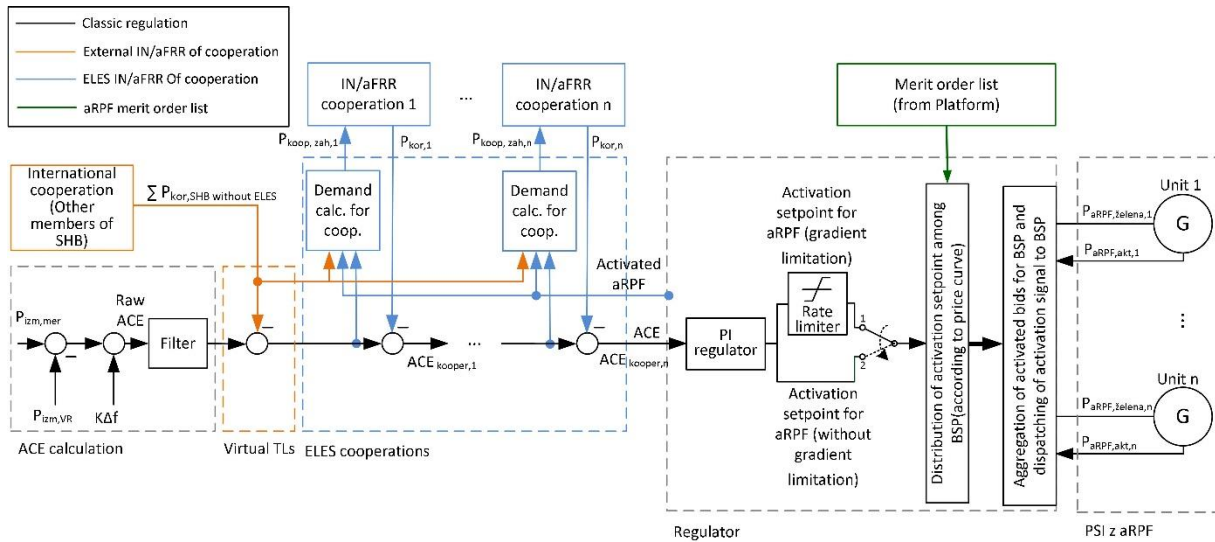


Figure 8: Frequency control regulator block diagram.

➔ **Implementation of LMOL based activations (transition from pro-rata to merit-order activation)**

One of the challenging tasks for ELES is the implementation of LMOL based activation module. Since it represents a major update of current SCADA system several implementation options were identified and evaluated. According to the predefined criteria and risk assessments the modular approach has been selected. A LMOL based activation procedure which will be implemented is presented on Fig. 4. Here is necessary to point out, that by implementing this approach ELES will conduct a transition from pro-rata to merit order list activation of bids.

The bids from all BSPs participating in auction for balancing energy are listed in merit order list from the cheapest to expensive bids (upper left figure). The cheapest bid is activated first. Second cheapest bid is activated when the setpoint exceeded full activated power of the cheapest bid. Similarly, all other bids are activated. The upper right part of the Fig. 3 represents the procedure which bids are activated according to the setpoint signal shape.

Furthermore, in the lower right part of Fig. 4 the aggregation process of activation of a single BSP and dispatching of common setpoint signal to this particular BSP is represented. Additionally, it can be seen which bids of the BSP are activated and that is respected setpoint signal shape. It is necessary to point out that load frequency control regulator during operation is not aware of the bids belonging to individual BSPs, but only recognise unified regulatory range of the units belonging to its BSP. In general, the shape of requested setpoint signal influences on the price of the bids. However, it does not have significant influence on technical operation. Each BSP receives unified activation signal regardless from how many different bids his portfolio offered.

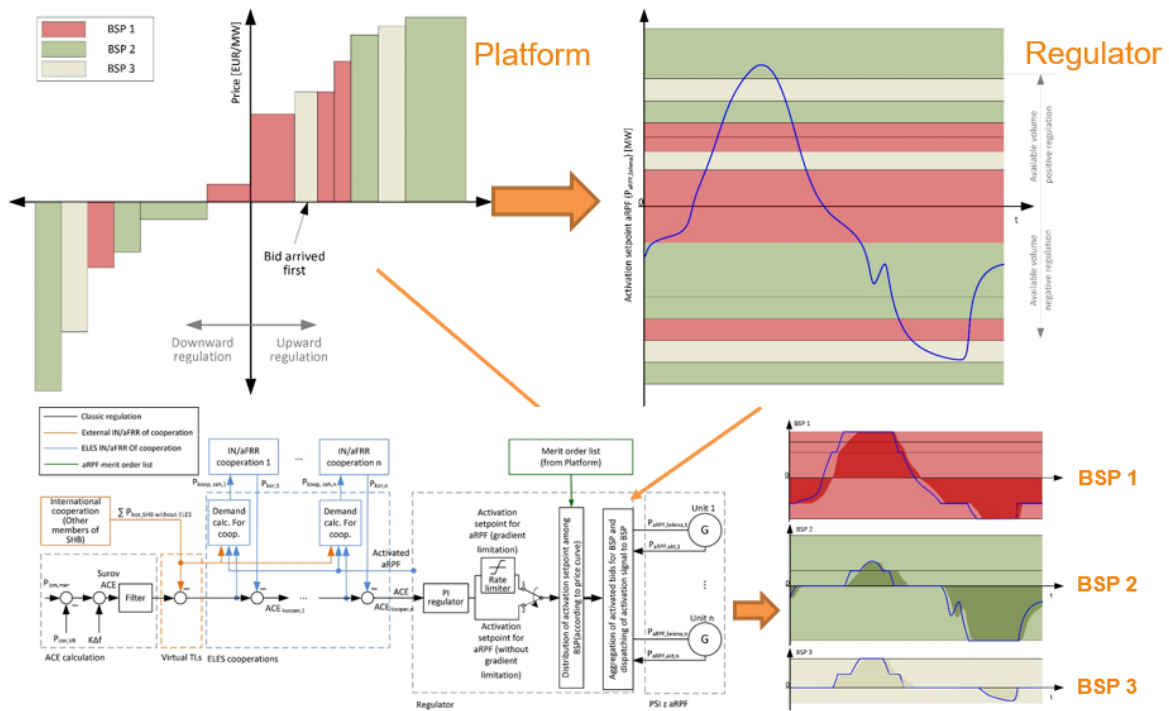


Figure 9: Import of LMOL into ELES' frequency control regulator and distribution of setpoint signal to BSPs.

In the scope of ELES' changes the BSPs will also need to adopt to certain changes related to the technical requirements of the units, auction, communication and activation procedure.

➔ Changes for Balancing Service Providers

The major change for the BSPs offering aFRR services is that ELES' frequency control regulator will only dispatch activation signal to the regulation portfolio of the BSP and not to its individual technical units belonging to the portfolio. This gives the opportunity to the BSP to perform its own optimization of the units during activation procedure. The BSP will need to be able to receive the setpoint signal and distribute it among its technical units.

Pro-rata activation of bids is faster than MOL, however MOL activation has been chosen due to argued reasons. This means that BSPs will need to optimize their portfolio of prequalified technical units in a way that gradients of technical units in case of simultaneous activation of bids and FAT will be respected (Fig. 5).

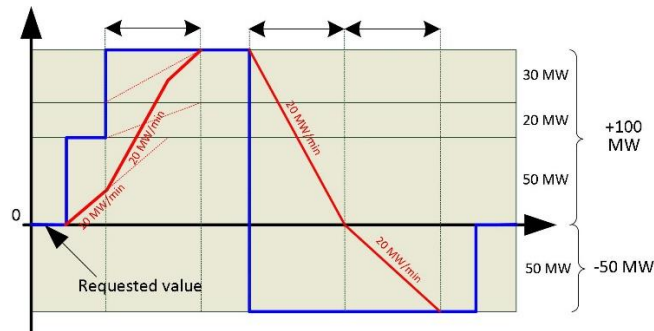


Figure 10: Fulfillment of requested gradients of technical units in case of simultaneous activation of bids.

➔ Establishment of the prequalification procedure

As already mentioned, BSPs will need to perform prequalification of its portfolio for offering balancing services to ELES. The major technical changes for the BSPs is the adoption of commonly agreed 5 - minute full activation time (FAT) that will be more difficult to achieve than the existing 15 – minute FAT. The range within which the unit needs to respond is presented in the Fig. 5 below.

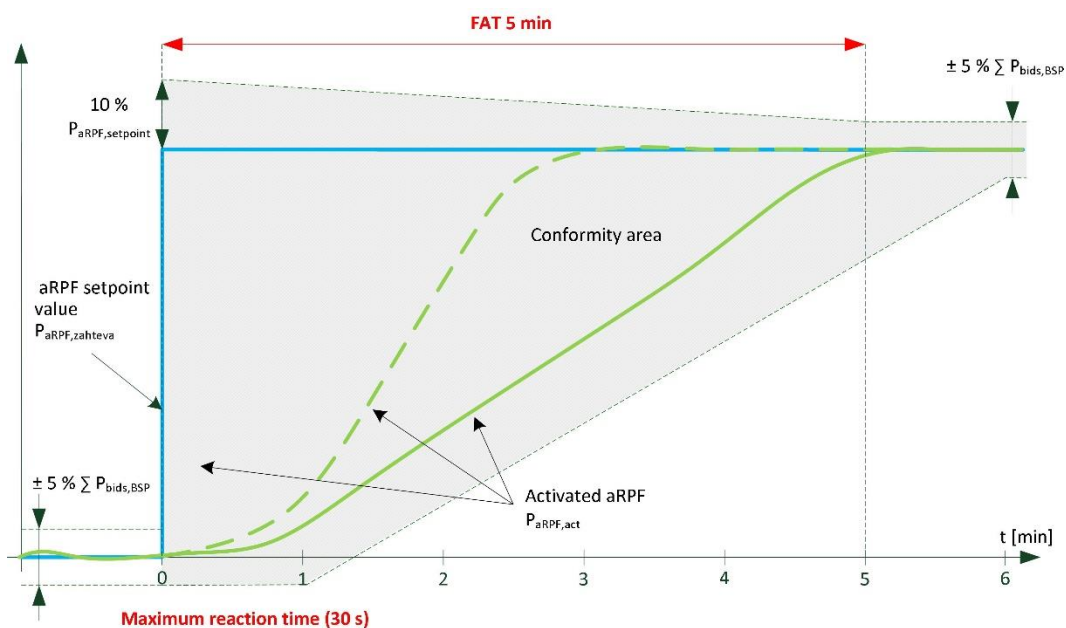


Figure 11: Unit response diagram.

8.3 MAVIR (Hungary)

The useful parts of FutureFlow activities and deliverables are on the one hand the detailed explanation and concept of Power Flow Colouring method as second part of the redispatching concept. As the concept is based on decomposing power flows into its components (loop flows/internal flows and exchange flows/transit flows), it can determine which TSO and in what amount caused congestion on a certain line that eventually led to redispatching. Considering the fact that in accordance with the currently

ongoing debates related to the cost sharing principles of redispatch and counter-trading, it provided useful inputs for the topic from TSO point of view.

The project helped showing that in accordance with Commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing (EBGL), the standardisation of balancing energy and balancing capacity products shall bring many challenges for those TSOs who have slower products, moreover, the availability of cross-zonal capacity is a crucial point of exchanging balancing energy between the LFC Areas.

8.4 TRANSELECTRICA (Romania)

The active participation of Transelectrica in the Future Flow project has influenced some internal activities and have initiated changes in mentalities of small grid users.

The considerable project influence was in balancing market, operational procedures, prequalification sector and technical part – as EMS SCADA developing project.

New operational procedure

A very useful part of FutureFlow activities has detailed the concepts of power redispatch optimization concept. Till now, Transelectrica has not developed this concept. The researches and analyses during the project have created the frame to propose an internal discussion on the possibility to develop a redispatching procedure. All information from the project was the basis of improvement of concept of redispatching in the sense of Future Flow project and the European Regulations.

The Power Flow Coloring (PFC) method developed in Future Flow project, helped Transelectrica in the debates among TSOs in the different European Capacity Calculation Regions (CCRs) regarding operational implementation of this concept. Transelectrica specialists, according to CACM Regulation (EC 2015/1222), are in charge to develop the applicability of this methodology inside our Control Block. The Future Flow project give them the needed information and concrete application in order to be capable to establish a methodology as CACM requires. Very useful are the IT solutions used during the tests, solution with a high degree of applicability.

Increasing of Market products

The Future Flow project gives solutions of sustainment the renewables participation to ancillary services. TSO TEL has for the moment a very good balancing market fluidity, but for assuring a large ancillary services reserves in the next years, and for increasing the flexibility of system in order to permit a large renewable penetration, TEL applies the lessons learned from Future Flow project in some internal procedures. The first step was to create the frame for aggregations. The aggregation procedure was changed in September in order to permit aggregation of all types of renewables, irrespective of technology, in a unit aggregation on the market.

Another benefit of Future Flow project was the creation of the premises for renewables and smaller units participating to ancillary services. TEL was sent to NRA a proposal to decrease the limit for reserve (mFRR and RR) from 10 MW to 5 MW. In same scope, to

allowing the consumers to participate to ancillary services same decrease of minimum reserve offered in market was proposed.

For the first time consumers and small RES units' owners have understood the possibilities to participate to ancillary service including mFRR and aFRR with the scope of improvement of ancillary services market.

New schema of AGC and frequency restoration process

Starting from the experience shared inside the Future Flow project, Transelectrica has developed an AGC schema capable to assure the direct activation of aFRR instead of pro-rata activation. This new concept can be realized in the logical part of sharing the ACE deviation, after the application of integral and proportional term. This solution, presented below, was discussed during the SCADA updating. The manufacturer of EMS SCADA is aware on the intent to introduce as activation condition the result of merit list of units selected for aFRR. This experience obtains from Future Flow project was considered by Transelectrica the most directly benefit.

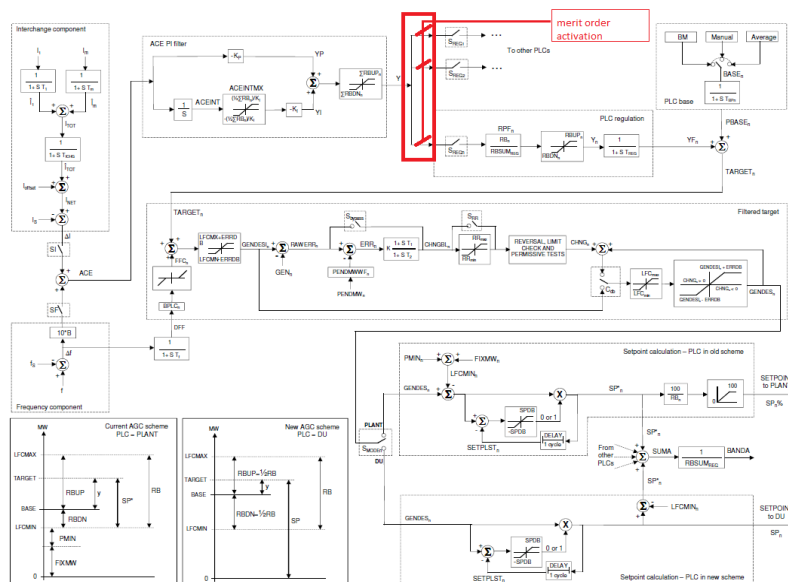


Figure 12: New schema of AGC and frequency restoration process

9 Conclusions

Comments, recommendations and knowledge gathered from TSOs who are not part of the FutureFlow, feedback from national regulators and non-regulated stakeholders that are taking part in the field pilot tests contributed significantly to the design of FutureFlow concept and other deliverables/outcomes of the project. The results of the analysis of the dissemination activities in the first three years of the project, summarized below, can be grouped per stakeholders, namely TSOs, regulators, non-regulated stakeholders and standardization organizations.

TSOs: We believe all relevant TSO knowledge has been used for the development of the

FutureFlow project thanks to TSOs participation in relevant ENTSO-E working bodies. FutureFlow has established a direct link with ENTSO-E via the Reference group of TSOs and direct participation in some dedicated ENTSO-E working bodies. FutureFlow was presented and discussed at the Reference Group meeting, in the Research and Development Committee, Working Group Ancillary Services and Working Group System Frequency as well as in the framework of PICASSO and MARI projects. Although known very well that four TSOs are actively involved in the FutureFlow project, this fact has to be pointed out once again at this point to emphasize the essence of informal communication with other ENTSO-E TSOs and knowledge exchange.

Although FutureFlow is a research project, we did not stay on the level of scientific papers. We have developed IT platforms to execute the field pilot tests with prosumers and to check the developed design of the balancing and redispatching market in real life. However, some TSOs went even further and initiated the implementation of some FutureFlow outputs. ELES for example has decided to implement as much FutureFlow results in every-day operation as possible. It organized a public consultation within which it received 85 comments from various balancing providers in Slovenia. The modified balancing market concept, taking into account BSPs comments, is envisaged to be confirmed by the Slovenian National Regulatory Authority, so the regulator is well aware of the project and its results. The degree of the FutureFlow elements being implemented on the side of the TSO depend on the maturity of the national balancing market. Contrary to ELES, APG is already operating a well-functioning and mature Austrian-German aFRR market and will not enter any changes at this moment.

A very useful part of FutureFlow research activities relates to the development of the redispatching cost-sharing key, i.e. the concepts of power flow decomposition called the Power Flow Coloring (PFC) method. Establishment of the PFC method was an important milestone reached within the FutureFlow project, as the operational implementation of this concept is currently being discussed among TSOs and national regulators in different European Capacity Calculation Regions (CCRs). The PFC method has been widely discussed in the CORE and Italy NORD Capacity Calculation Regions and we are proud that it is one of the proposed cost sharing methods with very good prospects for actual implementation.

Regulators: The involvement of the regulators is two-fold, namely rather poor regulators involvement in the scope of the project. Only ACER was represented in the Advisory Board; however with strong and valuable opinion and inputs for the project's work. But on the other hand strong involvement of the regulators on the national level when discussing and approving the re-design of national balancing markets for the purpose of the integration of these markets in a cross-border environment in the next stage. Also the NRAs involvement in the development of the PFC method should be mentioned, being aware of the numerous hours of discussions between TSOs and regulators in CORE and Italy NORD region tackling this topic.

Standardization organizations: To implement the Regional Balancing and Redispatching IT platform with the aFRR Common Activation Function in a manner that vendor-independent solutions for future emerging market could be used seamlessly, the interoperability for the data exchange between related software solutions and modules should be addressed. The important aspect of the project has been to investigate, how the new solutions could be

integrated into the existing TSO's IT environment according to the European Smart Grid Reference Architecture (SGRA) which was defined by the CEN-CENELEC-ETSI Smart Grid Coordination Group in the context of the EU M/490 standardization mandate.

Non-regulated stakeholders (retailers, aggregators, generators, traders and consumers):

The surveys and feedback from non-regulated stakeholders is equally or even more important than the TSOs and regulators feedback. The non-regulated stakeholders are taking part in the field pilot tests, and are preparing themselves for entering the balancing market. The FutureFlow pays full attention to their experiences, expectations and their way of thinking. The activities in relation to the non-regulated stakeholders were targeted at getting the information why did they decide to join the FutureFlow project, what are their experiences during their active participation, what are the positive effects for them, what are the main obstacles, what should be improved, would they propose participation also to other companies, is the award for active participation high enough and finally how much revenue would they expect in case of longer, permanent collaboration.

The main obstacles, which limited the engagement of the end customers in the project, are the high level of complexity of the contracts, fear that some obligations or rights are hidden- lack of transparency when reading the contract, necessary engagement of different levels of technical experts, direct access and interruptions of the production process and/or separate units, higher expected revenues, the investment costs, the penalties for unsuccessful activations, rerouting the main focus from their core business.

Contrary to all of the negative opinions, the end customers evaluated the project as a new opportunity. The approach of GEN-I's agents to the customers was evaluated as positive and very professional. Following the interviews with all the interviewed entities, the collaboration in the project was evaluated as an important source of information of future market development and a positive influence on the level of knowledge/education. All customers would recommend participation to other participants and a high level of expertise and collaboration offered by the GEN-I was noted. The main motivation which encourages customers to participate, is to be prepared for the future markets; even lower as expected extra revenues, cannot convince customers not to participate. Another positive fact is that the customers are also convinced that they could also have a direct influence on lowering greenhouse gas emissions.

Eventually, when drawing the conclusion and estimating the success of the FutureFlow dissemination activities, we believe we were successful. This statement additionally proves the fact that even more prosumers that initially foreseen took part in the project. The current number of MWs of DR&DG engagement exceeds 50 MW and is still not the final number.

10 References

Littlechild (2007) Electricity Cash Out Arrangements (NETA: Review of Electricity Trading Arrangements: Proposals, Offer, July 1998, para 4.49.)