BestRES

Best practices and implementation of innovative business models for renewable energy aggregators

# Enabling national legal and regulatory framework for business models for renewable energy aggregation

**Authors: Maximilian Wimmer & Fabian Pause**
**(Stiftung Umweltenergierecht - Foundation for Environmental Energy Law)**

**February 2019**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

## Acknowledgement

This document had been produced within the BestRES project "Best practices and implementation of innovative business models for Renewable Energy aggregatorS".

The logos of the partners cooperating in this project are shown below and information about them is available in this report and at the website: www.bestres.eu

This report had been written by Maximilian Wimmer and Fabian Pause (Stiftung Umweltenergierecht - Foundation for Environmental Energy Law). The authors thankfully acknowledge the valuable contributions from all project partners.

## Disclaimer

## Contacts

### Project coordinator

Silvia Caneva, Ingrid Weiss & Pablo Alonso
WIP – Renewable Energies
Sylvensteinstrasse 2, Munich, Germany

Email: silvia.caneva@wip-munich.de
Email: Ingrid.weiss@wip-munich.de
Email: pablo.alonso@wip-munich.de

### Authors

Maximilian Wimmer and Fabian Pause
Stiftung Umweltenergierecht - Foundation for Environmental Energy Law
Ludwigstraße 22, 97070 Würzburg, Germany
Email: wimmer@stiftung-umweltenergierecht.de
Email: pause@stiftung-umweltenergierecht.de

### Co-Authors

Jana Nysten and Victoria Roux
Stiftung Umweltenergierecht - Foundation for Environmental Energy Law

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

# Table of Contents

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

# Tables:



# Figures:

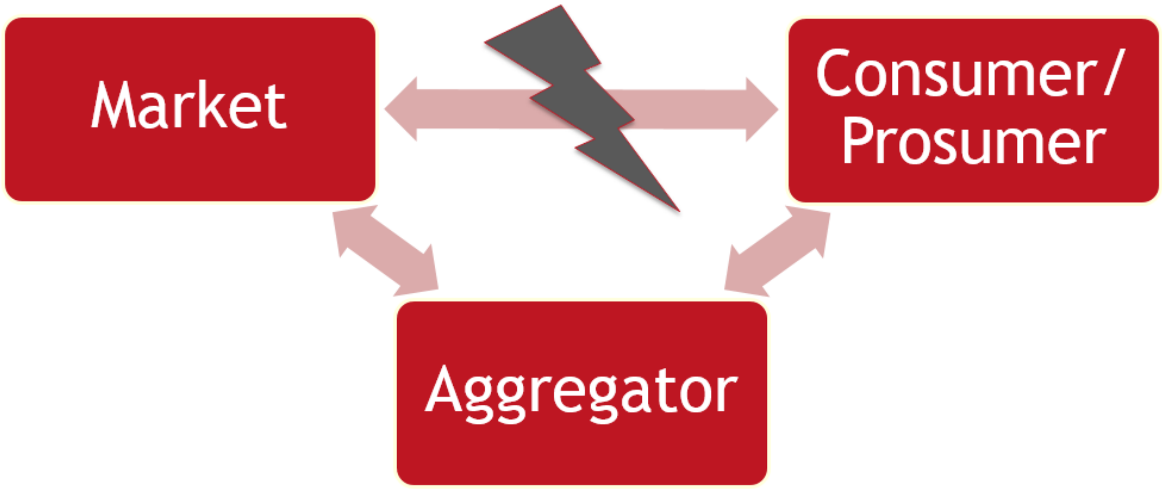


BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

# A. Executive summary

The BestRES project aims to develop Business Models for integration of renewable energy sources by aggregating distributed generation such as wind, PV, biogas, biomass, hydro, Combined Heat and Power and combining this with demand side management and energy storage. Aggregators are likely to play an important role in the sectors of demand response, generation and balancing services as enablers for consumers and prosumers. Aggregators commonly perceive lower prices on control reserves and wholesale markets as a key advantage since more units are participating. For providers of aggregation services, the potential benefits include increased revenues and a reduced energy bill. Aggregation has the potential to lower balancing costs and decrease the energy costs for prosumers.

**Figure 1:** Aggregators as enablers for consumers/prosumers




Hence 13 improved Business Models that are concerned with aggregation were developed in the BestRES project to be analysed, examined, and eventually implemented in the energy market. However, these Business Models encounter various barriers on their way, be it of economic, technical or legal nature (For a more detailed analysis of the barriers see "An assessment of the economics of and barriers for implementation of the improved business models", deliverable D4.1 of the BestRES project).

Solutions to reduce or eliminate these barriers can be achieved on two different but connected paths. On the one hand, there is the legal framework on EU level, on the other hand there are possibilities on national level to facilitate aggregation in the energy market.

During the BestRES project the EU finalised the "Clean Energy for all Europeans" Package (Clean Energy Package), which contains various provisions that are likely to facilitate aggregation in the future energy market and help to reduce the identified barriers. These aspects are discussed in detail in "Enabling European legal and regulatory framework for business models for renewable energy aggregation", deliverable D5.3 of the BestRES project. However, the legal analysis led to the result that there are still several barriers left, which are not addressed sufficiently or at all by European law and therefore have to be approached on national level. In order to provide solutions for these national barriers, with this document (deliverable D5.2) the development of relevant aspects for an enabling framework for aggregators on national level is in the centre of the analysis.[1]

**Figure 2:** The connection between European and National law in respect of barriers for aggregators


Below, the most relevant aspects that are described in detail in subsequent analysis of the target countries are presented, to give an overview of possible contents of an enabling framework for aggregators on national level:

**Regulatory & market design:**

- The market design should be as simple as possible.
- The regulatory framework should be clearly defined and unambiguous, to reduce the room for interpretations for market participants.
- Processes should be clearly defined and unambiguous as well.
- Extensive testing could avoid the need of changes of the regulatory framework and processes.

**Access to the balancing market:**

- Harmonization of the access modalities is very important.
- The balancing market should be open for all technologies, no matter if they are big or small market players.

[1] This analysis is based on the consolidated trilogue outcomes from December 2018, thus the final wording of the legislative acts of the Clean Energy Package may vary in minor aspects, especially regarding the numbering of individual provisions.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

- The balancing market (especially the aFRR market) should be accessible for smaller market players without the need of specific MW thresholds for each installation → pooling is a positive aspect that should be honoured.
- Merit order instead of pro rata activation would be a positive aspect for aggregators.
- Data availability is a critical success factor for the new challenging environment.

**Customers' data:**

- Easy access to customers' data is crucial for aggregators in order to effectively participate in the energy market.
- Investments in technologies in order to gather real-time quality data are necessary.
- Harmonization and simple & fast possibilities to make contracts with customers are necessary → in particular with a view on the GDPR.
- With many different market participants, the amount of interfaces should be reduced.
- Extensive tests of rules and processes under real market conditions → the sooner processes are tested under real market conditions, the better.

**Network charges/Grid tariff flexibility:**

- The market design should reward the use of flexibility, not prevent it.
- Network charges and grid tariffs should foresee benefits for the use of renewable energy and in particular for renewable self-consumers → such a design is necessary to facilitate the activation of renewable self-consumers.
- Aggregators can be important enablers for the consumers'/prosumers' participation in the upcoming energy market and therefore should benefit by the network charges/grid tariff design.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

# B. Introduction

## I. Methodology

### 1. In general

The general methodology for the development of legal recommendations and an enabling framework for aggregators has to take into account both, the European and the National legislation. Thus, the following structure is used:

#### I. Update: Analysis on barriers

- Which legal/regulatory barriers were identified when placing the 13 improved Business Models (BMs) in three groups, especially regarding group 2 and 3? (see B. in D5.3)

- Result: Overview of existing barriers, with emphasis on groups 2 and 3 (and group 1). (see B. and D5.3)

#### II. Clean Energy Package: Which barriers are addressed?

- In which way are these barriers addressed by the Clean Energy Package? (see F. in D5.3)

- Evaluation of the Trilogue negotiations and their results, starting with COM proposal as initial point, followed by the positions of Council and the European Parliament. (see C. and D. in D5.3)

- Analysis: (see D. to F. in D5.3)

  - Which barriers are not/insufficiently addressed?

  - Which barriers cannot be addressed on EU-level (e.g. for competence reasons)? → **National policy recommendations (see C. to G. in D5.2)**

#### III. Result: Concrete recommendations related to still remaining barriers

- Overview: Which barriers are already sufficiently addressed by the Clean Energy Package? (see E and F. in D5.3)

- **Evaluation of the final Version of the Clean Energy Package. (see F. in D5.3)**

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

## 2. The national level

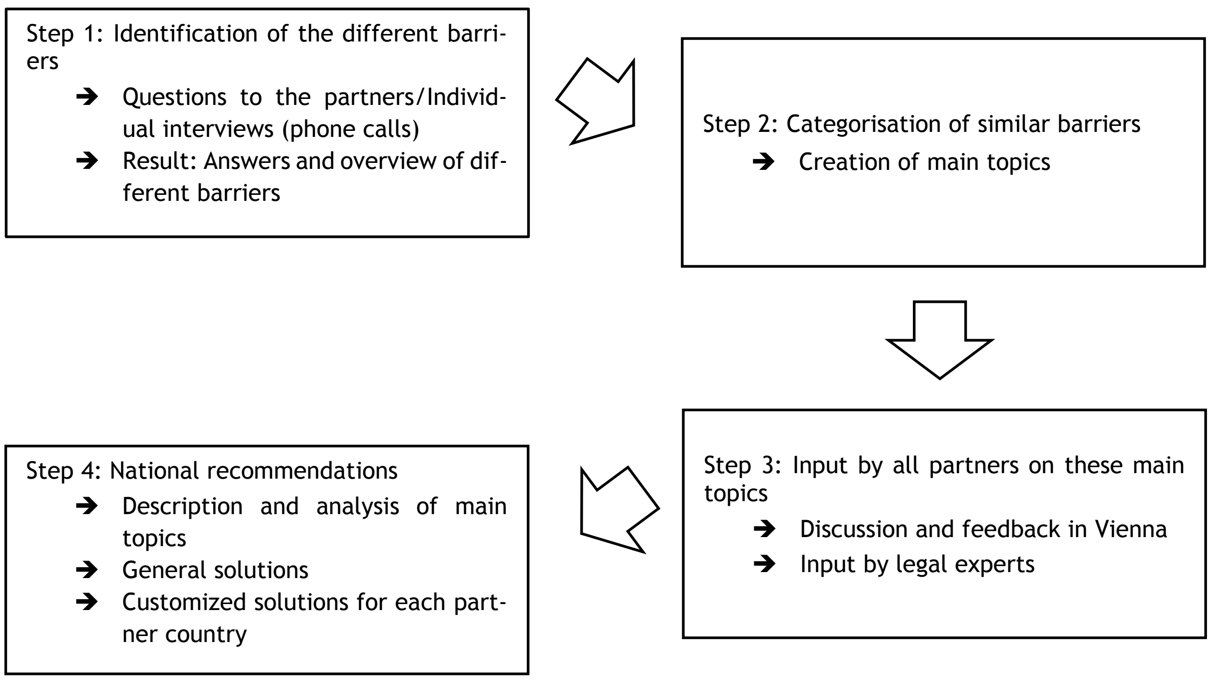
Overall objective of this document is the development of national recommendations/an enabling framework to address policy makers/stakeholders and regulatory bodies, and to raise awareness in the countries covered by the BestRES project. The recommendations shall focus on how to implement the proposed business models or on how to overcome the barriers which are preventing their implementation. This task foresees a strong involvement of all aggregators. Two general questions are in the focus of this analysis:

1. With a view on the legal and regulatory barriers on EU level being addressed in “Enabling European legal and regulatory framework for business models for renewable energy aggregation”, deliverable D5.3 of the BestRES project, what are the legal and regulatory barriers existing on national level, specified to the several partner countries?

2. With a view on the general objective to develop national recommendations, it is important to know who the relevant policy makers and stakeholders on national level are, and which would be the best way to raise their awareness?

In conclusion it is important to develop recommendations that can be seen from a general point of view, but also are specified to individual countries, where the identified barriers occur. In order to offer an in-depth analysis for each target country, the following way of proceeding was chosen to develop these recommendations in a co-working process with the concerned aggregators:

**Figure 3**: Way of proceeding




BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

# II. Overview of national barriers

The aforementioned way of proceeding led to the following main problematic topics that are located in the partner countries:

**UK (BM 1 and 2):**
No relevant national barriers
The network charges topic is an EU level barrier and regulated in the RED II

**Germany (BM 3 and 4):**
Grid tariff flexibility is a national problematic aspect

**France (BM 5):**
Access to the aFRR market is partly an EU level barrier and regulated in the IEM-Reg. and GL-EB
Pro rata instead of merit order activation problem seems to be solved

**Italy (BM 6):**
National implementation of the GL-EB in a central dispatch system is a problematic aspect, especially with a view on access to the aFRR market

**Belgium (BM 7 and 8):**
Access to aFRR markets is partly an EU level barrier and regulated in the IEM-Reg. and GL-EB
The current system with a fixed payment per year per kW of solar panel does not encourage flexibility

**Austria (BM 9 and 10):**
The problematic access to data is a relevant barrier
The multi apartment block model was cancelled because it is not economically feasible

**Portugal and Spain (BM 11 and 12):**
Access to data is a barrier needs further development
Participation in the aFRR market is interesting and is another reason that response in real time is needed

**Cyprus (BM 13):**
Barriers on several levels exist

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

**Figure 4:** The BestRES partner countries and their business models

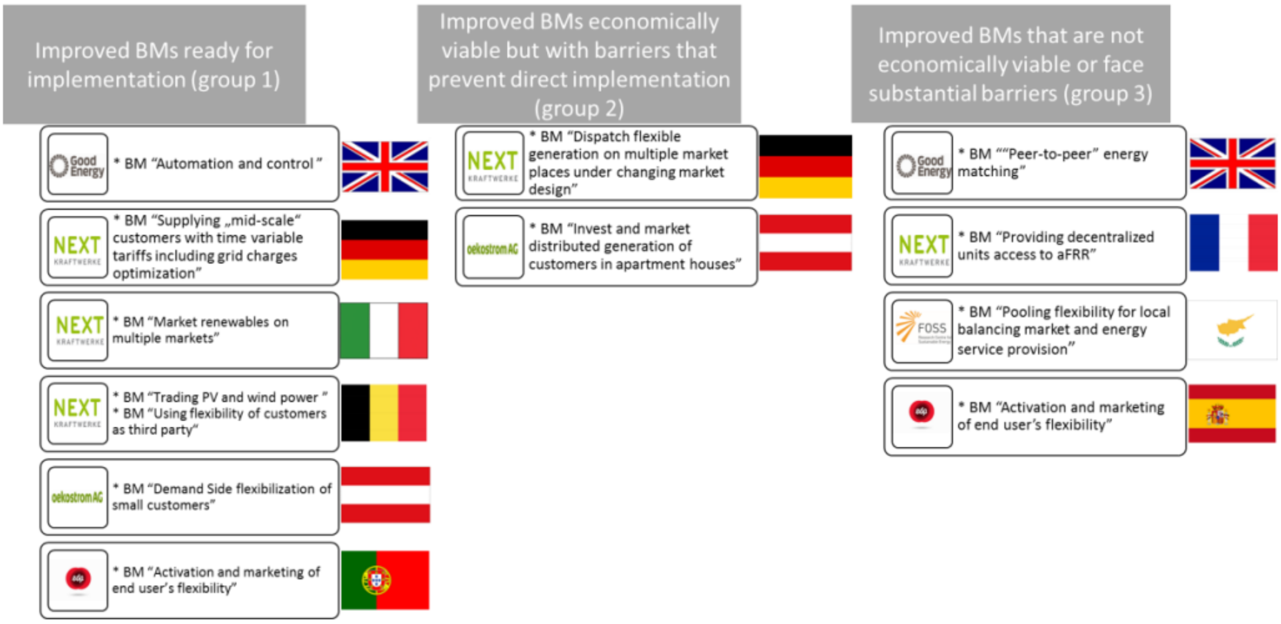



**Table 1:** Main barriers in the partner countries

| | Access to the balancing market | Customers' data access | Network charges/Grid tariff flexibility |
|---|---|---|---|
| UK (BM 1 & 2) | | | X |
| Germany (BM 3 & 4) | | | X |
| France (BM 5) | X | | |
| Italy (BM 6) | X | | |
| Belgium (BM 7 & 8) | X | | X |
| Austria (BM 9 & 10) | | X | |
| Portugal & Spain (BM 11 & 12) | X | X | |
| Cyprus (BM 13) | | | |


This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

# C. Access to the balancing market

## I. General description

The balancing market is a very important sector for aggregators, especially for those that are working with customers' flexibility. The problem in this area is that it can be rather tricky for smaller market players to access the balancing and especially the aFRR market due to regulatory barriers.

In this context the national development with a view on the upcoming European legislative acts, e.g. the regulation on the internal market for electricity = IEM-Reg. and the guideline on electricity balancing (GL-EB), is important.

**Problematic aspects are:**

- Particular MW thresholds have to be reached in order to be a prequalified market player that is allowed to enter the aFRR market (e.g. 25 MW in Belgium).
- Specific market rules or systems exist, which are likely to hinder the participation (e.g. "Obligations system" in France).
- Existence of different market designs, i.e. "self-dispatching model" and "central dispatching" model.
- Bid combination possibilities between different markets (FCR and aFRR) are likely to hinder the effective participation of smaller market players.
- Pro rata activation instead of merit order can be a negative aspect for the participation of aggregators as smaller and cheaper market players in the market.

## II. The situation in the target countries (especially France, Italy, Belgium & Portugal)

### 1. France

#### *a) In general*

The frequency ancillary services incorporate the primary "réglages primaires" (FCR) as well as the secondary reserve "réglages secondaires" (aFRR[2]) of the frequency[3]. Both constitute the system services "services systèmes". The tertiary

[2] aFRR, automatic frequency restoration reserve introduced recently as the European term. Currently in Europe, the FAT as the Full Activation Time of aFRR (period between the setting of a new setpoint value by the LF Controller and the corresponding activation or deactivation of aFRR) is throughout Europe ranging between 2 to 15 minutes (5 minutes in Germany and 15 minutes in France). The planned European harmonization will inter alia harmonize the FAT in Europe. See E-Bridge, IAEW, Impact of merit order activation of automatic Frequency Restoration Reserves and harmonized Full Activation times, on behalf of ENTSO-E, 23. December 2015, p. 4.
[3] The frequency (fréquence) should be clearly distinguished from the voltage (tension). While the frequency pursues a permanent adjustment between the production and consumption demand, the voltage regulation injects or absorbs the reactive power on the network in order to maintain

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

reserve "réserves tertiaire" is called the adjustment mechanism "mécanisme d'ajustement" (balancing mechanism) and is the third type of reserves used by RTE as the French TSO[4] to resorb the imbalances between production and consumption. While the primary and secondary reserves are activated automatically and constitute the "services systems", the tertiary reserve constitutes a manually activated adjustment mechanism, which is only used to complete the secondary reserve in case of insufficiency or depletion or to anticipate an upcoming imbalance. As soon as RTE takes notice of the imbalance through its real-time monitoring of the balance of the electrical flows, the primary reserve reconstitutes the power deficit in less than 30 seconds through the participation of all productions group connected to the network. It is followed by the secondary reserve that confines the consequences of the disequilibrium to the network manager "gestionnaire de réseau" at the origin of the disruption and brings the stability back to its nominal state (50 Hz) in 15 minutes maximum[5]; the tertiary reserve permits the network manager to lastingly restore the lacking power or to prepare himself to foreseeable developments regarding production and demand. The current French activation time is 15 to 30 seconds for primary and 400 seconds for secondary reserve. The activation time of the reserves will be affected by the implementation of the GL-EB and its "standard product". According to Art. 2 (28) GL-EB "standard product means a harmonized balancing product defined by all TSOs for the exchange of balancing services".

The costs resulting from the constitution or reconstitution of the reserves, be they of primary, secondary or tertiary nature, as well as regarding national congestions, are supported through the user tariff of public electricity networks TURPE "tarif d'utilisation des réseaux publics d'électricité" and thus borne by the final consumer.

A significant injection of current electricity from intermittent sources will increase the need of system services. Renewable energy installations are still not sufficiently adapted to the regulation of the frequency (and tension), although they can already contribute to the energy services such as the primary and secondary reserves that balance supply and demand in very short delays[6]. The Clean

---

the required voltage on the network. Even though both the regulation of the frequency and the voltage constitutes the ancillary services "services système", only the frequency in its secondary ancillary is part of this analysis.

[4] RTE is the French electricity transmission network "réseau de transport d'électricité" and as such the French TSO, that ensures the availability and implementation of the necessary reserves for the operation of the network, while compensating losses that are related to the transmission of electricity.

[5] Since the activation of the primary adjustment will still leave a difference in frequency when compared with the frequency setpoint (f0), as well as create differences in the exchanges between the countries of the synchronous interconnected system (given that all countries participated to the primary adjustment even if the disruption did not happen in their territory), the role of the secondary regulation is to solicit essentially the secondary reserve in the sole control area where the disruption appeared in order to bring the frequency back to its setpoint value and to restore the primary reserve engaged in its entirety.

[6] CRE, deliberation 22 June 2017, p. 42.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

Energy Package also works towards a better access of the renewable energies in order for them to derive additional revenues[7].

### *b) System Services Rules "Règles services système"*

Before 2014, the participation in the balancing reserves was contractually defined between RTE and the generators, whereas since 2014, it is RTE and the CRE[8] (French Energy Regulatory Commission) that cooperate to establish different versions of rules. These different versions of rules aim to improve the function of the balancing reserves, for example through the permission of cross-border exchanges of reserves.

The French "system services rules" specify the technical, financial and legal conditions for the acquisition of suppliers for the participations to the system services of various qualified installations by RTE[9]. The rules of participation and settlement of the frequency ancillary services[10] have to be objective and based on non-discriminatory criteria. They are proposed by RTE and approved prior to their implementation by the CRE in compliance with article L. 321-11 of the French Energy Code[11]. Since 2015 these rules authorise the participation to balancing of all production groups, including the renewable energies that are connected to the transportation or distribution network. Yearly updated and adapted, the last version was approved by the CRE on the 25 October 2018.

### *c) French market design for secondary reserve*

RTE defines the secondary reserve[12] as a centralised automatic mechanism (at the level of the national dispatching of RTE) intended to adjust the production or the consumption of the Reserve Entities subjected to maintain the initial exchange programme on interconnections and the nominal frequency[13]. In order to ensure this constant balance between energy production and consumption, RTE implements both the primary and the secondary reserve through the soliciting of the automatic reserves of active power[14] that are constituted at the level of the installations of the network users. This way, the secondary reserve restores the production-consumption balance within the area of regulation incumbent to RTE.[15]

[7] Etudes de l'Ifri, Le paysage des énergies renouvelables en Europe en 2030, Michel Cruciani, juin 2017, p. 34.
[8] Commission de Régulation de l'Energie.
[9] "Réseaux publics de transport et de distribution".
[10] "Services système fréquence".
[11] Commission de régulation de l'énergie. See law n°2000-108 of the 10 February 2000, Art. 15 III, alt. 1, 2.
[12] Named in French: "réglage secondaire fréquence/puissance (f/P) or Téléréglage (ou RSFP) or « Réglage Secondaire de fréquence".
[13] RTE, Règles Services Système Fréquence, version 26 October 2018, p. 17 "Dispositif automatique centralisé (au niveau du dispatching national de RTE) destiné à ajuster la production ou la consommation des Entités de Réserves assujetties de façon à maintenir le programme d'échange initial sur les interconnexions et la fréquence nominale".
[14] "Réserves Automatiques de puissance active".
[15] RTE, Règles Services Système Fréquence, version 26 October 2018, p. 7: The goal is to automatically cancel the differences between the exchange programs with all the other adjustment zones in relation to the programmed values, as well as to restore the frequency to its setpoint value.


This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

Generally spoken, in France, the provision of frequency ancillary services is open to all players previously certified in mainland France, regardless of their technology or connection point to the grid[16]. While contracting for the primary reserve is carried out through cross-border tendering, the secondary reserve (aFRR) is under national contracting and carried out by mandatory participants at a regulated price of about 18 euros per hour and MW.[17] The secondary reserve under the French system is obliged to contribute between 540 MW and 1180 MW of power within the European expectancies[18] and as of now, only big production groups with more or equal to 120 MW have the obligation to participate[19] and to react to RTEs signal through a 400 seconds activation time[20]. The exchange on the secondary market between actors is possible at free price (pay what you want: “prix libre”) for both types of reserves[21]. RTE proposes to producers a participation contract to the system services that enables them to spread out the requested reserve between their production installations and to transfer between them all or part of their obligations through exchange on this secondary market[22]. All participants must sign and commit to the rules of the participation agreement to access participation in the market[23]. The participation to balancing reserve is operated

[16] RTE, Services systèmes, http://clients.rte-france.com/lang/fr/clients_producteurs/services_clients/services_systeme.jsp.

[17] In general, Art. 16 (6) GL-EB foresees that “the price of the balancing energy bids or integrated scheduling process bids from standard and specific products pursuant to paragraph 4 shall not be predetermined in a contract for balancing capacity”. However, a derogation is possible, where TSOs may alternatively “activate the balancing energy bids from specific products locally without exchanging them”. RTE has applied for such a derogation since the energy delivered as part of the provision of system services are currently subject to a financial settlement at spot price, which RTE considers as derogating to the rule in article 16(6) Gl-EB only for the secondary reserve. RTE’s arguments that the energy delivered through the primary reserve is not a balancing energy within the meaning of the GL-EB. The derogation is requested until the end of 2020, when France should establish the activation of the secondary reserve according to the economic precedence. According to RTE, only then the transition from the energy remuneration associated to the secondary reserve at a free price will be possible.

[18] On the 10 January 2019, France and the European Union came close to a black-out, when about 9 p.m. and even though the temperatures were not very cold, the frequency of the French and European electric system went under 50 Hz. RTE has demanded of the interruptible industrial consumers “consommateurs industriels interruptibles” (including the big electricity consumers that have a few minutes to ascertain RTE of their participation to the endeavor to resume the equilibrium) a reduction of their electricity consumption amounting to more than 1500 MW in order to get the frequency back up, which was a success. See L’Energeek,”électricité: la France et l’Europe ont frôlé le black-out”, 14.01.19 https://lenergeek.com/2019/01/14/electricite-france-europe-black-out/.

[19] CRE, “services système et mécanisme d’ajustement”, 14 June 2018, p. 2.

[20] In reaction to the continuous signal from RTE. See deliberation CRE, 22 June 2017, p 31. Although in an emergency situation when the adjustment imbalance is greater than 1800 MW, the obligated facilities have to follow RTEs instructions in 66 seconds (1.1 minute). This emergency ramping is usually used twenty times per year. See deliberation CRE, 22 June 2017, p. 31.

[21] http://clients.rte-france.com/lang/fr/clients_producteurs/services_clients/services_systeme.jsp.

[22] Arrêt Powéo, CA Paris, 7 sept. 2010, RG n°209/22255.

[23] List of current frequency ancillary services providers in France: ACTILITY SA, ALPIQ Ltd, Compagnie Nationale du Rhone, DIRECT ENERGIE SA, Electricité de France, Uniper global Commodities SE, Energy Pool Développement SAS, ENGIE, Pont-sur-Sambre Power, Restore France, Smart Grid Energy. See RTE, Liste des responsables de réserve au 1er janvier 2017.

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

through bilateral contracts between RTE and each producer. The remuneration prices are fixed by RTE, as well as the services that are quality-monitored under penalty.

This “obligations system” is a relevant barrier for aggregators in the French market, as in fact, they can enter the aFRR market only through these obligations they have to buy on the secondary market, because they are usually smaller market players (at least < 120 MW).

The “Arrêté” of the 23 April 2008[24] sets out in its article 14 para. 3 the necessary 120 MW limit needed from the production installation in order to participate in the secondary reserve “réglage secondaire”.

The obligation through mandatory participation[25] was furthermore confirmed in the decision of the French Cour d’appel de Paris on the 7 September 2010, “*société Powéo*”[26]. The Paris court of appeal stated in this decision, that the participation of producers in system services is compulsory, given that the transmission system operator[27] is free to choose (in accordance with competitive, transparent and non-discriminatory procedures) the producers whose services he considers necessary to perform his missions[28]. In this decision, the Powéo society supported that an error of law was committed, by ruling that the participation of producers to the system services[29] was obligatory and brought forward the directive 2003/54/CE of the 26th June 2003 as well as the dispositions of Art. 15 para. 3 of the law of the 10 February 2000. However, the court mentioned that Art. 15 para. 3 of the law 2000-108 of the 10 February 2000[30] disposes that the TSO has the

[24] Arrêté du 23 avril 2008 relatif aux prescriptions techniques de conception et de fonctionnement pour le raccordement au réseau public de transport d’électricité d’une installation de production d’énergie électrique », version consolidée au 21 janvier 2019. See also Arrêté du 30 décembre 1999 (limit < 120 MW) relatif aux conditions techniques de raccordement au réseau public de transport (réseau à 400 kV exclu) des installations de production d’énergie électrique de puissance installée inférieure ou égale à 120 MW », JORF n°12 du 15 janvier 2000 page 727 texte n°45 and the Arrêté du 4 juillet 2003 (limit > 120 MW) relatif aux prescriptions techniques de conception et de fonctionnement pour le raccordement direct au réseau public de transport d’une installation de consommation d’énergie électrique.

[25] Article L. 342-5 of the French Energy Code lays down the obligation for mandatory participants through RTE (“prescriptions”). See also Ordonnance dn°2016-130 du 10 février 2016 portant adaptation des livres Ier et III du code de l'énergie au droit de l'Union européenne et relatif aux marchés intérieurs de l'électricité et du gaz.

[26] “Arrêt Powéo, CA Paris”, 7 sept. 2010, RG n°209/22255.

[27] “Gestionnaire du réseau de transport”.

[28] *“La CA a précisé que la participation des producteurs aux services systèmes est obligatoire, le gestionnaire du réseau de transport disposant « de la faculté de choisir (selon des procédures concurrentielles, transparentes et non discriminatoires) les producteurs dont il estime les prestations nécessaires pour accomplir ses missions”*, French Energy code 2018, p. 294.

[29] “Services systèmes” in French.

[30] Modified by the law 2006-1537 of the 7 December 2006; the law n° 2000-108 of the 10 February 2000 on the modernization and the development of the public electricity service, ensures this “obligation” in its Art. 15, III stating that « *the public transmission system operator ensures the availability and implementation of the services and reserves necessary for the functioning of the network*” and that to this end he negotiates freely with producers and suppliers of his choice the necessary contracts for the execution of the missions (in the previous subparagraph, in accordance with competitive, non-discriminatory and transparent procedures, such as, in particular, public

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

choice to decide with whom to contract, as long as all the producers were solicited in a competitive, non-discriminatory and transparent procedure. This interpretation is compliant to article 9 c)[31] of the directive 2003/54/CE on common rules for the internal electricity market, letting the court to conclude that in order to master the system services, the participation of the producers cannot have a voluntary character, and is therefore obligatory. [32]

### *d) Summary*

Although in general, the French balancing mechanism is already open to aggregated electricity generators, however smaller market players have to act on a secondary market because of specific MW thresholds. The lowering of the 120 MW threshold is not foreseen at the moment, it seems. Neither is an opening of the primary market to all technologies. This constrained participation in the aFRR market through the purchase of obligations on a secondary market is a problematic aspect for aggregators.[33]

## 2. Italy[34]

### *a) Introduction*

In Italy, one specific theme of analysis is related to the understanding of the impact of the Regulation (EU) 2017/2195 of 23 November 2017 (GL-EB). For Italy, in particular, the issue is related to the fact that a "central dispatching" model is affected by the content of the regulation, which is based on a "self-dispatching model" that is widely diffused in Europe:

---

consultations or the use of organized markets (...).); See also the Arrêté of the 23d April 2008 **"Arrêté** relatif aux prescriptions techniques de conception et de fonctionnement pour le raccordement au réseau public de transport d'électricité d'une installation de production d'énergie électrique" in its Art. 31 and 32, as well as in the Art. 27 du cahier des charges de la concession du réseau public de transport.

[31] Art. 9 Directive 2003/54/CE: "Each transmission system operator shall be responsible for (…) managing energy flows on the system, taking into account exchanges with other interconnected systems. To that end, the transmission system operator shall be responsible for ensuring a secure, reliable and efficient electricity system and, in that context, for ensuring the availability of all necessary ancillary services insofar as this availability is independent from any other transmission system with which its system is interconnected;".

[32] Another argument of the court concerns the DRT "documentation technique de référence" as the necessary technical regulation, as each producer must make available its control capacities on the installations to RTE and would be deprived of its scope if the participation to the "services systèmes" was only optional.

[33] Over the counter exchanges are enabled for the mandatory participants with not mandatory participants that are qualified in providing ancillary services. This is also the case for the first reserve. See RTE, services systems and CRE, "Evolution of ancillary services regulation; opening the possibility for new market players to participate in maintaining the system stability", Office franco-allemand, 3 November 2015, p. 8.

[34] The input regarding the Italian market (barrier analysis and development of possible solutions) is based on a report by Fichtner Italia Srl (under Massimo Andreoni's guidance) compiled as part of the BestRES project.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

- "Self-dispatching model" is a scheduling and dispatching model where both the generation and consumption schedules, and demand facilities are determined by the scheduling agents of those facilities.
- "Central dispatching" the production and consumption programs of the facilities are determined by the TSO (Terna) as part of the Integrated Scheduling Process (ISP)

On May 28, 2018, Terna published a proposal for "Balancing terms and conditions (pursuant to Article 18 of Commission Regulation 2017/2195) establishing guidelines for balancing the electricity system" aiming to receive feedbacks to the contents by the end of June 2018 from operators/stakeholders. The feedback results have not been published yet, but in the document relevant changes that are under development in the day-ahead and balancing market are foreseen. It is worth mentioning that the ACER document "Report on the implementation of the balancing network code" published August 2018, shows that in Italy the level of imbalances of shippers and the level of interventions of the TSO on the balancing market are among the most significant in Europe. This innovation in balancing regulation at EU level has to deal with at least two main issues ongoing in the Italian energy market:

- The application of a capacity mechanism for power generation (for capacity higher than 10 MVA)
- The pilot project on aggregators/demand response business model (for capacity lower than 10 MVA) UVAM (Unità virtuali abilitate miste → Eligible virtual mixed units)

### *b) Changes in the national market*

The Italian Electricity market has experienced a substantial transition in the recent years. The increased participation to the National power generation from RES (Renewable sources) has caused the conventional generation units to pay the price of innovation (in the last few years, in fact some 13 GW of conventional thermoelectric power have been abandoned, being no more economically sustainable) and research show that the trend towards clean energy sources will continue and even increase.

Consequently, the Italian TSO Terna has been dealing with the renewal of the regulatory framework in order to let the transition go through and still guarantee the stability of the System: first major consultations begun in 2013 when ARERA (the Regulatory authority for energy networks and the environment) issued the DCO (Consultation document) 354/2013 that was really opening the public debate to the reform of procurement methods for the dispatching services, including the discussion on the opening of such services to the distributed generation and to the plants powered by non-programmable renewable sources. Debates have followed and now the official reform of the MSD (the Italian Market for the negotiation of Dispatchable Services with which Terna procures the resources needed for the operation and maintenance of the electricity system) is ongoing and has recently institutionalised the first opening of the MSD to the electricity demand to the production units using renewable sources (which were not enabled) and to the

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

storage systems, including the setup of some pilot projects of “virtual production and consumption units” (UVA- *Unità virtuali* aggregate- see details in Table 2) through an aggregation entity (Resolution AEEGSI 300/2017/R/eel).

**Table 2**: Different types of aggregators

| | Aggregation sources | Markets | Imbalance settlement | Other |
|---|---|---|---|---|
| **UVAP (Virtual Enabled Production Unit)** | • Non-relevant (<10 MW) production units<br>• Storage units | • Ancillary service (MSD)<br>• Balancing (MB) | Same as non-relevant production units (according with current regulation) | - |
| **UVAC (Virtual Enabled Demand Unit)** | Demand units (currently all not relevant) | • Ancillary service (MSD)<br>• Balancing (MB) | Same as non-relevant demand units (according with current regulation) | “Interruptible and super interruptible loads” ex Res. 301/2014 and Res 1/2016 are excluded from the participation |
| **UVAM (Virtual Enabled Mixed Unit)** | • Non-relevant (<10 MW) production units<br>• Storage units<br>• Demand units | • Energy (MGP, MI)<br>• Ancillary service (MSD)<br>• Balancing (MB) | To be defined by AEEGSI | - |
| **UVAN (Virtual Enabled Nodal Unit)** | • Production units (both relevant and non-relevant)<br>• Storage units<br>• Demand units (all located in the same node of the network) | • Energy (MGP, MI)<br>• Ancillary service (MSD)<br>• Balancing (MB) | To be defined by AEEGSI | “Interruptible and super interruptible loads” ex Res. 301/2014 and Res 1/2016 are excluded from the participation |

The mentioned pilot projects started already in mid-2017 and are fully operative for all the three types of Enabled Virtual Units: they can be consumption/load units (UVAC), production units (UVAP), both types (UVAM, "mixed" units) (However, today only the UVAM project is operational, as it is the natural evolution of UVAC and UVAP). These three virtual units have been introduced to extend the participation to the National flexibility services market and are basically some non-significant production and consumption (or mixed) units whose participation to MSD has been enabled on an aggregate basis, according to appropriate geographical location criteria ("aggregation perimeters"). The participation of such entities is, however, bounded to some limitations as, among others, the minimum modulation capacity of 1MWp, the capability to increment (reduce) the input or modulate in reduction (increase) the withdrawal within 15 minutes from receipt of the dispatching order of Terna for congestion resolution services, restoration tertiary reserve and balancing service, and support this modulation for at least two consecutive hours.

### *c) Impacts of the guideline on electricity balancing*

The European Commission is guiding energy transition and has been promoting the development of a fully functioning and interconnected Internal Energy Market (IEM). Since 2009, Regulation 714/2009 has defined some early rules on capacity allocation for interconnections and transmission systems affecting cross-border electricity flows, which paved the way to the Commission Regulation (EU) 2017/2195. (GL-EB)

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

This regulation, which is aimed to “establish an EU-wide set of technical, operational and market rules to govern the functioning of electricity balancing markets”, has put pressure on national TSOs to set a route to the conversion of respective energy markets to a standardized European model capable of supporting the IEM introduction. The newly ENTSO-E network codes, such as the Capacity Allocation and Congestion Management (CACM) and the Electricity Balancing (EB) regulations, in fact, do envisage a greater involvement of the renewable generation.

The progressive EU markets integration that will be achieved through the establishment of some Intraday and balancing integrated platforms (, TERRE, MARI, IGCC and PICASSO projects will enable the exchange of balancing energy supplied by the reserves for the restoration of the frequency.[35] These platforms in fact will guarantee the cross-border exchange of balancing energy for:

a. replacement reserve (TERRE → TransEuropeanReplacementReserveExchange)
b. manual activation reserve (MARI → MaualActivationReserveInitiative)
c. automatic frequency restoration (PICASSO)

Central platforms in which the European participating TSOs will share and exchange their respective energy balancing offers are likely to have the following impacts:

- Uniformity of the “gate closure”, being the closing time of the bargaining sessions;
- The launch of standardized products easier to be exchanged;
- A shift to marginal pricing which determines the compensation for the energy exchanged for the balancing based on a clearing mechanism (not yet approved by national regulatory authorities), and
- Non-limitation to any cap or floor to the prices negotiated.

With the self-dispatching model as the reference model in the Regulation 2017/2195, the Italian TSO Terna which operates in the market through a central dispatching model[36] can still be applicable as an exception.

### aa) Implementation of Terre and impacts on Central Dispatch

In December 2019 the implementation of the TERRE (Trans European Replacement Reserve Exchange) project for cross-border exchange of balancing energy from tertiary Replacement Reserve (RR) is foreseen for the Italian market. In order to

[35] In the Italian Electricity market, Replacement Reserve (RR) is translated in Riserva terziaria di sostituzione, Manual Frequency Restoration Reserve (mFRR) is translated in Riserva secondaria manuale, Automatic Frequency Restoration Reserve (aFRR) is translated in Riserva secondaria automatic.

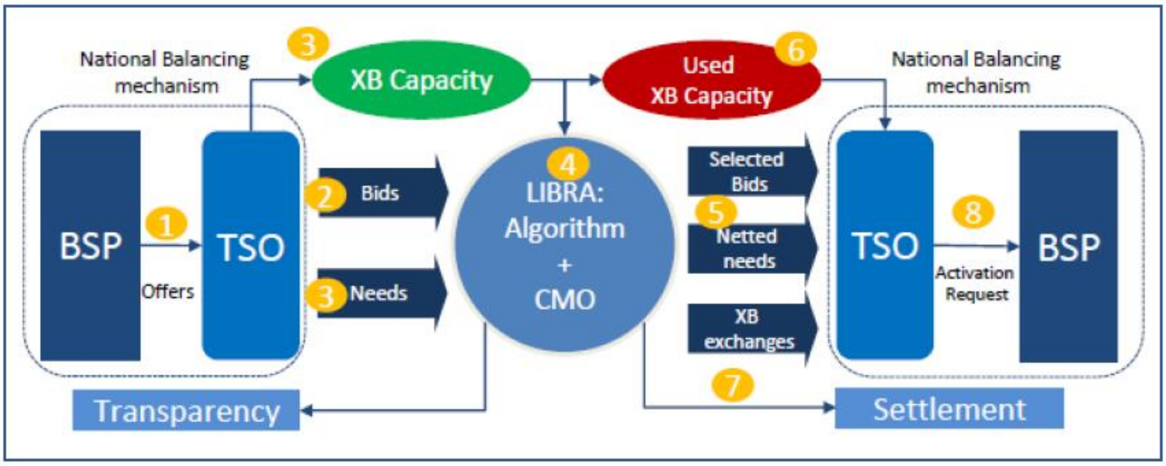
[36] Central Dispatching model: meaning that it directly determines, through the Integrated Scheduling Process – ISP the generation and consumption schedules as well as dispatching of power generating and demand facilities.

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

harmonize the gate closure timing for all TSOs, the EU Regulation 2017/2195 requires that bid offers are as close as possible to real time and that they do not precede the gate closure of the intraday market. The process of offering selection will be hourly based, therefore offers will last maximum for 1 hour.

TERRE will be compatible with other projects for the development of platforms for the exchange of balancing resources (mFRR, aFRR); the LIBRA platform will manage the TERRE process and could also be used for the exchange of other balancing resources in the future.

**Figure 5**: LIBRA, the process (source: Terna)




**1.** Terna receives the offers from the authorized operators for each market area (H-60 '). **2.** Terna sends to LIBRA offers that are consistent with the standard product of the RR (conversion of offers) (H-40 '). **3.** Terna calculates and sends its own RR requirement for each internal zone and the residual ATC between the market areas (H-40 '). **4.** LIBRA optimizes the activation of offers and the fulfilment of requirements while respecting the constraints. **5.** LIBRA communicates to each TSO the accepted offers, the fulfilment of needs and the relative prices (H-35'). **6.** LIBRA sends the XB schedule and the remaining ATC to the TSOs. **7.** LIBRA calculates the commercial flows between the different market areas, defining the settlement between the different TSOs. **8.** Terna informs the operators of the results of the optimization (together with the remaining operations carried out on MB) (H-30 ').

In particular for the “Central Dispatching” system, Terna will use the ISP to offer balancing services towards other TSOs, meaning that Terna has to convert, in terms of volumes, the offers of the operators presented on the ancillary market in offers of standard products on European platforms. Operators become therefore capable to offer services at European level with respect of the fairness, both of volumes requirement and clearing based on marginal price. This is one of the main themes that the Italian market has to face, provided that the situation is based on a system of “pay as bid” auction and the EU balancing is based on “marginal price” clearing.

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

## bb) Balancing terms and conditions

On May 28, 2018, Terna has published a proposal for "*Balancing terms and conditions (pursuant to Article 18 of Commission Regulation 2017/2195) establishing guidelines for balancing the electricity system*" in which the design of the new market functioning is described.

The overview of the changes foreseen in the transition is divided into two subsections: "**Changes on Italian market**", and then "**Requirements to comply with EU balancing market**".

**Changes on the Italian market (amongst others):**

- **Gate closure next to 1 hour and continuous trading process**

Differently from existing situation where offers on Intraday Market (MI-Mercato Infragiornaliero) for each session are received maximum 4 hours before the execution time, in the To Be model offers are received until 1 hour before. To make this feasible, at European level it is foreseen a continuous trading mechanism in addition to auction based on regional level.

The implication would be:

- Auction sessions will come first, and continuous trading mechanism will allow to adjust positions.
- Continuous trading will be allowed also on aggregation of dispatching points, within the limit of belonging to the same market zone.

- **Pre-nomination of positions**

Since MI sessions will end 1 hour before market executions, there will be no possibility to run ex ante ancillary services sessions (MSD-Mercato Servizi Dispacciamento) to adjust positions. This also means that close to execution time the position of each single dispatching unit must be identified.

The fact that trading during MI sessions will be based on aggregated positions, while 1-hour dispatching would be based on each single unit, implies inevitably to improve the accuracy of the estimation of the dispatching units and therefore some pre-assignment mechanism would be needed.

The implication would be:

- It will be compulsory, at least for the eligible dispatching units, to pre-nominate in MI the volume during continuous trading sessions.
- A dedicated pre-nomination platform should be created.
- Selection by Terna of supply volume on MSD ex ante would not imply, as is today, direct remuneration of the service.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

- **Creation of acceptance ranges and economic value assigned at the end of MI session**

To ensure security of the system, acceptance ranges in the continuous trading sessions would be introduced by Terna with a min. and max. volume. Furthermore, in the To Be model the assignment of the economic value to a certain bid is made after each gate closure of MI session, differently from today where economic value is assigned when single auction is performed. The rationale behind is that the overall final remuneration would not overcome the value of the bid on MI.

The implication would be:

- Today in the MSD ex-ante the operators can adjust every position offered on MGP and MI without any restriction; in the To Be model this would not be allowed anymore and, for the most influencing positions, the adjustment in the MSD would be restricted by Terna. i.e. Terna execute planning to reallocate the bids within the feasibility range
- The assignment of the economic value after the gate closure of MI session is a new step not present today that would allow the identification of a better economic fairness of the balancing sessions.

**Requirements to comply with EU balancing market (amongst others):**

- **Conversion of bids in standard product**

Since the Italian market is based on central dispatching, a number of actions would be required to allow the participation to the EU balancing market without jeopardize security of the systems. The Final Dispatching Programme *(Programma Finale Cumulato)* already includes the positions of the MSD ex-ante session (it must be noted that from a time-line view, the process it is already within the hour-1 to market execution) and no other trading sessions are envisaged in the Italian market. To allow the bid on the EU platform, specific offers for the exchange of balancing energy must be defined (sales/supply) intended as increase/decrease upon the final dispatching programme. The implication would be:

- An adjustment to transfer offer for a *pay as bid* pricing (Italian market) to a *marginal price system* (EU RR platform) is needed. Terna will take care of the conversion of the offers from the dispatching units on MSD into standard product to be negotiated on RR platform. Doing so, Terna will act on two platforms, the national and the EU ones.

- **Adjustment of volume and price for EU-National platform negotiation**

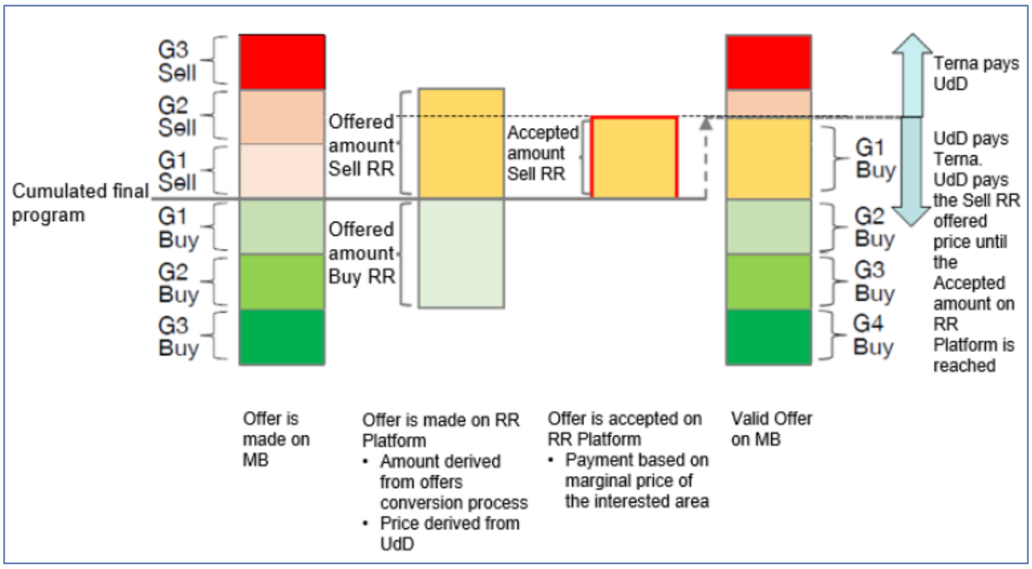
Provided that the bid price on the RR platform is specified by the dispatching unit on the national platform, Terna has to convert volume and prices with the following mechanism:


This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

- Terna converts valid offers for real-time management in the product standard for RR platform.
- Terna makes the aforementioned offers anonymous and transfers them to the RR platform.
- The RR platform LIBRA selects the offers, in order to define the quantities accepted among all those presented to the platform, identifying for each TSO volume and marginal price in purchase and sale for each zone.
- Terna proceeds with the conversion of the volume accepted on the RR platform with the marginal price valorisation and changing the algorithm to determine the remuneration of the bids presented on the national platform.
- This procedure will imply adjustment in price and volume from Terna towards the different dispatching units to redistribute correct volume and price balancing.

These steps are summarized in a schematic way in the following figure:

**Figure 6:** Coordination between MSD and RR Platform. Definition of the amounts offered valid for MB purposes (Art. 4.10.2 - Annex A23 (CdR) Codice di rete – network code).




The implication would be:

- All the activities will be carried on by Terna and dispatching units will receive afterwards the final dispatching programme.
- The complication is related to the very narrow timing of communication of the final Binding Programs (*Programmi Vincolanti*) to the operators, allowing them to act accordingly for the dispatching of the units (Details in the following paragraph).

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

## 3. Belgium

The aFRR product is probably the most important tool for Belgian transmission grid operator Elia to maintain the balance in its control area. Historically, it has always been provided by units that have a so-called CIPU-contract. These are big plants, at least 25 MW and connected to the transmission grid, that are obliged to offer their flexibility in Elia's aFRR market. De facto, only large CCGTs are able to offer aFRR reserve power and the market has been supplied by two to four gas fired power plants operated by two or three companies. One can hence barely call this a real market (Besides the CCGTs, also nuclear plants have CIPU contracts, but they are not flexible enough to do aFRR. They do provide FCR, it seems. There are no coal power plants anymore, leaving CCGTs as only large-scale providers for aFRR).

Until today, it is impossible for plants smaller than 25 MW, and any plant on the DSO-grid, to participate on the aFRR market. The General Framework Agreement (i.e. the contract between BSP and Elia for provision of reserve power) only exists for CIPU units. It is not possible to conclude a contract as non-CIPU unit for provision of aFRR. Thus, smaller aggregators are not able to participate in the aFRR market, if they do not reach this limit with a single installation, although it is possible from a technical point of view (especially through the possibilities of pooling of several loads or generators). It is said that further studies etc. are necessary, although from the view of some market actors, it is clear that it is possible to participate in the aFRR market and that it would lead to benefits for the system and the customer. Especially, there will be advantages from the pooling of multiple loads or generators through aggregators are pointed out with respect to the balancing markets and the flexibility resources.

Elia has conducted a pilot project in the summer of 2017 to investigate the technical feasibility of providing aFRR with a pool of small assets. Next Kraftwerke, among others, participated in this pilot and showed that compliancy was even higher than some of the current providing CCGTs.[37]

Connected to this barrier is the fact that it is possible to make combined bids in the FCR and aFRR markets. Market parties can push through their FCR-bids because the grid operator needs the volume of the connected aFRR-bid to reach its aFRR requirements This leads to the problem that, although the FCR market is open for aggregators, the prices are lower than the average market price, which hinders aggregators to effectively participate in those markets as well. Such a situation is likely to result in a discrimination of aggregators in respect of FCR market access.

Although there are regulatory rules for balancing markets, in particular in the GL-EB, another negative aspect for aggregators is that special products (concerned in Art. 26 GL-EB) are offered by other market players, which then are said to not be affected by the provisions of the guidelines because of their special nature.

[37] The public report can be found here: http://www.elia.be/en/about-elia/newsroom/news/2017/20171222_R2-non-CIPU-Report

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

Elia is now in the process of preparing the opening of the aFRR market for smaller players (Initially planned for December 2019, but already postponed until June 2020). To make it truly fair and competitive, some product design decisions are essential. If designed in a bad way, the oligopoly position of CCGTs will de facto be maintained. Therefore, Next Kraftwerke has been following up the design process closely and provided feedback in all consultation rounds of the last months. There are several national developments by Elia in the "aFRR product design note" at the moment, but a legal basis for an obligatory opening of the aFRR market for aggregators is not known, at least not one that sets a fixed timeframe for this development. The timeframe is related to ENTSO-E's framework (Art. 21 GL-EB).

With a view on Elia's current document it seems likely that in the (near) future there will be a merit order instead of pro rata activation. The document also speaks of a proposal to have a separated procurement for FCR and aFRR. It is questionable if this means that combined bids in the FCR and aFRR markets will no longer be allowed. However, if eventually the two markets are really separated (as they say they will), then it should not be possible anymore to make combined bids. Further the importance to open the aFRR product to other technologies, and more specifically to non-CIPU flexibility is a topic in the document.

## 4. Portugal

The Portuguese demand response aggregator is aimed at utilizing the clients' flexibility for retailer value at the spot market through optimal sourcing of electricity and minimization of deviations. However, other markets could be addressed to create new revenue streams for such business models. The participation in the aFRR market seems to be an attractive option from an economical point of view as the revenues obtained on participating in this service may be higher than the savings achieved from the optimal participation in the spot market and deviation minimization. The aFRR is paid for the available band (up and down) and if it is activated, then it is also paid for the energy itself. Nevertheless, the participation rules in the aFRR services are very demanding, so that they may only be met by some thermal and hydro power plants. Those rules are detailed in the MPGGS - Manual de Procedimentos da Gestão Global do Sistema do Sector Elétrico, April 2014, published by ERSE (Handbook of Procedures for the Global Management of the System of the Electric Sector), namely on Procedure number 12.

For starters, the market players who want to participate in the aFRR must fulfil the requirements specified by the Power System Operator (PSO), which will be assessed through tests performed by the PSO on the units where the technical and operational capability will be evaluated: communications velocity, real energy generated, gradient variation of the energy produced and response to random generation requests. Notice that in Portugal the aFRR is automatically activated by the TSO through an AGC automatism that acts directly in the power plant.

The offers are done on the day before (D-1) for each physical unit (no aggregation is allowed) for each hour of the day D with the following rules (among others):

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

- The ratio between the upward and downward secondary regulation band established by the PSO (currently 2:1) with the tolerance of 5%;
- The PSO shall establish and communicate to all Market Agents the necessary reserve of secondary regulation in the system for each programming period of the following day;
- The offer should have the following information:
  - Offer number, k;
  - Offer for the up-reserve regulation k, MW;
  - Offer for the down reserve regulation k, MW;
  - Unitary price for the aFRR band k, €/MW;

The market of secondary reserve is "Pay as clear". The payment includes the regulation band fee and the energy fee based on market clearing. The regulatory band contracted to each production unit will be valued at the unit price of the last contracted offer for the corresponding programming time. The energy for the aFRR will be remunerated at the price of the last RR offer, in the respective programmed period that was mobilized to complement the secondary regulation. The remuneration will be made at the value of the RR mobilized, in the same regulation direction, up or down reserve.

Another important rule for the provision of secondary reserve is that, according to ENTSO-E, the automatic generation regulators should be PID (proportional–integral–derivative controller), with time constants of 30s, and the time cycle of the controller should be between 1 and 5 seconds.

Also note that the deviations in the service provision will make the producer incur in monetary costs calculated by physical unit and for the different hours of the daily program.

## 5. Comparable situations in other countries

### *a) Secondary market*

In comparison to the French “obligations system”, other BestRES partner countries do not have a secondary market, placing France in an exclusive position in this sector. With a view of harmonization of the EU and the upcoming EU legislation, it would be favourable that France adapts its system to the majority’s system.

### *b) System costs*

In comparison to the French user tariff of public electricity networks TURPE “tarif d’utilisation des réseaux publics d’électricité”, in Germany a separation of the covering of costs relating to balancing energy and balancing capacity is in place. The StromNVZ[38] lays down the obligation for the German TSOs to cover the costs

[38] Regulation on access to electricity supply networks - “Verordnung über den Zugang zu Elektrizitätsversorgungsnetzen“, § 8 II: “Die einzelnen Betreiber von Übertragungsnetzen sind verpflichtet, innerhalb ihrer jeweiligen Regelzone auf 15-Minutenbasis die Mehr- und Mindereinspeisungen aller Bilanzkreise zu saldieren. Sie haben die Kosten und Erlöse für den Abruf von Sekundärregelarbeit

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

of secondary balancing energy “Sekundärregelarbeit”, as well as to charge the balancing responsible party (BRP) for the costs of the provision of secondary balancing capacity “Regelenergie aus Sekundärregelleistung”.[39]

### *c) Merit order vs. pro-rata*

A further distinction between France and Germany is that while the German activation is based on “merit order”, France has a “pro-rata” activation. While the new GL-EB has recommended that the standard bids of aFRR are activated based on the merit order list[40] and also foresees the use of a merit order activation in the future, for now the majority of European countries uses pro-rata activation[41]. Through pro-rata application the TSOs instruct the aFRR providers simultaneously and the requested aFRR is distributed pro-rata to the aFRR providers connected to the LF Controller[42]. On the other hand, fewer TSOs select currently through merit order activation the cheapest aFRR energy bids.[43] Generators activated pro-rata get all their bids activated simultaneously and in proportion to their selected capacity in terms of secondary reserve. This procedure is likely to have a negative outcome for smaller market players like aggregators, as they claim to have the possibility to offer cheaper prices and therefore benefit from merit order. The activation of aFRR[44] also differs between countries with a continuous activation

---

und Minutenreservearbeit sowie im Fall einer nach § 27 Absatz 1 Nummer 21a getroffenen Festlegung auch die Kosten für die Vorhaltung von Regelenergie aus Sekundärregelleistung und Minutenreserveleistung im festgelegten Umfang als Ausgleichsenergie den Bilanzkreisverantwortlichen auf Grundlage einer viertelstündlichen Abrechnung in Rechnung zu stellen.”

[39] On a quarter-hourly billing basis regarding the balancing groups; definitions in Art. 2 GL-EB:

> “(4) balancing energy (Regelarbeitsmarkt) means energy used by TSOs to perform balancing and provided by a balancing service provider”.
> (5) balancing capacity (Regelleistungsmarkt) means a volume of reserve capacity that a balancing service provider has agreed to hold and in respect to which the balancing service provider has agreed to submit bids for a corresponding volume of balancing energy to the TSO for the duration of the contract”.

[40] Article 21 (2) GL-EB: “2. *The European platform for the exchange of balancing energy from frequency restoration reserves with automatic activation, operated by TSOs or by means of an entity the TSOs would create themselves, shall be based on common governance principles and business processes and shall consist of at least the activation optimisation function and the TSO-TSO settlement function. This European platform shall apply a multilateral TSO-TSO model with common merit order lists to exchange all balancing energy bids from all standard products for frequency restoration reserves with automatic activation, except for unavailable bids pursuant to Article 29(14).*”

[41] Countries in Europe that uses pro-rata activation are France, Belgium, Spain, Portugal, Switzerland, Italy, Slovenia, Croatia, Bosnia and Herzegovina, Serbia, Montenegro, Greece, Romania, Slovakia, Czech Republic, Denmark, Norway, Sweden and Finland[41]. Poland has a combination of pro-rata and merit order activation.
Countries in Europe that uses merit order activation are Germany, the Netherlands, Austria and Hungary.

[42] The LF Controller is the central Load Frequency Controller which automatically calculates continuously (every 3 to 10 seconds) the required aFRR. See E-Bridge, IAEW, “impact of merit order activation of automatic Frequency Restoration Reserves and harmonized Full Activation times”, 23 December 2015 Version 0.1, p. 3, 4.

[43] E-Bridge, IAEW, “impact of merit order activation of automatic Frequency Restoration Reserves and harmonized Full Activation times”, 23 December 2015 Version 0.1, p. 4.

[44] There are as well major differences in the different requirements regarding aFRR throughout Europe, notably with some TSOs that will mostly apply manual FRR while others use almost 100% aFRR[44]. aFRR is defined by the Load-Frequency Control and Reserves (LFC&R) as “*the FRR that can*

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

(mostly in countries with a pro-rata activation with the exception of Norway, Sweden and partially Finland) and a stepwise activation (mostly in countries with a merit order activation like Germany and with the exception of Hungary).[45]

It is the GL-EB that will end the pro-rata activation in France as well as in many other European countries from 2020 to 2022 onwards. Indeed, RTE has in its "Green paper on French electricity system the balancing"[46] "proposed to examine, as from 2017, the implementation, as of the first quarter of 2020 in France, of the activation of the automatic frequency restoration reserve based on merit order".[47] However, the CRE considers a selection based on merit order only as not optimal and proposes an inclusion of a pro-rata portion.[48]

### *d) Access to the aFRR market*

Furthermore, regarding access to the aFRR market, Germany allows participation for all market players with a bid size > 5 MW (exceptions are possible). A regulation regarding the size of the installation does not exist (see Art. 21 and 25 of the GL-EB). The difference between prequalification aspects and actual bid size has to be highlighted in this area. Although in Belgium the bid size is not a problem for aggregators, the prequalification aspect is. It is questionable how Belgium (and Italy) justifies its threshold for the access to the aFRR market, and if such a regulation is still up to date with a view on the Clean Energy Package and the importance of aggregators in the future.

Related to this, in 2016 the Bundesnetzagentur in Germany proposed a model for aggregators in order to participate on the aFRR market. This model shall help to achieve a fair risk distribution among the participants, and it shall facilitate the participation of independent aggregators. In September 2017 the Bundesnetzagentur decided that suppliers, BRPs and TNOs are obliged to open balancing markets for final customers. The final costumer shall be enabled to bring the owned flexibility to the energy market. After a test-phase further (final) regulations are planned until 2020. The current decision contains a "corrected model" which enables the customer to be active in the balancing market. Further, there are regu-

---

*be activated by an automatic control device*" (Load-Frequency Controller as the control device that is physically implemented in the TSOs control centre systems by means of a process computer)[44].

[45] E-Bridge, IAEW, "impact of merit order activation of automatic Frequency Restoration Reserves and harmonized Full Activation times", 23 December 2015 Version 0.1, p. 14, 15.

[46] RTE, Feuille de route de l'équilibrage du système électrique français, livre vert, June 2016.

[47] This implementation towards merit order was also commended by the participants to the "Green paper". See deliberation from the CRE on the 22 June 2017, p. 28. another planed switch regarding the aFRR by RTE in its "Green paper" concerns a different activation time of 300 seconds (5 minutes) or 450 seconds (7.5 minutes), which are currently the two main activation times in Europe, while the French activation time amounts to 400 seconds (6.66 minutes): See CRE, 22 June 2017, p. 28.

[48] The CRE in its deliberation 22 June 2017, p. 31 has based its analysis on the ENTSO-E report ("Impact of Merit order activation of aFRR and harmonized full activation times", 29. February 2016, Bridge and Entso-e) and expects RTE to consult with the French market participants.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

lations for the communication between the market players and for the data transmission between supplier and final customer.[49] According to the Bundesnetzagentur, this model relates to similar procedures as already practiced in Belgium and France.[50] The German market design does not limit market participants in the choice of a setup or the type of resources they include in the pool. RES providers under a market-based "direct sale" mechanism are allowed to generate additional profits from participation in the balancing market.[51] The Bundesnetzagentur tries to minimize the number and extent of contractual relations needed for consumers to carry out their activities in the balancing market either individually or with the help of a "third-party" aggregator, thus demand response from industrial and commercial providers is much more actively used in the German context. The Bundesnetzagentur specifically addressed the "intermediate" setups where an aggregator is not at the same time a supplier or a BRP with reference to the provision of balancing products from final consumers.[52]

Concerning the compensation mechanisms between market participants, it has been argued that aggregators' activities cause a higher administrative effort for the BRP due to schedule adjustments and exchanges as well as higher risks for the suppliers of those customers whose units are used for the provision of balancing energy. In Germany the Bundesnetzagentur decided against applying additional charges in these respects. However, while no risk premiums are foreseen, suppliers can still charge customers and, consequently, aggregators disproportionately for schedule exchanges, which can arguably act as a de facto deterrent to their participation in the balancing market. For this reason, in Germany, it is more economically sensible for an aggregator to engage in electricity supply of end consumers to avoid conflicts of interest and possible barriers to entry.[53]

In comparison to this, in Austria the relations between independent aggregator and other market participants are not stipulated in market design rules. Thus, these conditions depend on agreement between these parties. In general, there are no regulatory barriers for aggregators to enter the balancing market.[54]

In Portugal according to the rules set by ERSE consumers with a capacity above 1 MW are allowed to enrol in the current pilot project.

[49] https://raue.com/aktuell/branchen/energie-rohstoffe-und-klimaschutz/aggregatoren-festlegung-beschlossen/.

[50] https://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Energie/Unternehmen_Institutionen/VortraegeVeranstaltungen/Aggregttor_Modell_606.pdf?__blob=publicationFile&v=1).

[51] Poplavskaya/De Vries, A (not so) independent aggregator in the balancing market theory, policy and reality check, Delft University of Technology.

[52] Poplavskaya/De Vries, A (not so) independent aggregator in the balancing market theory, policy and reality check, Delft University of Technology) (Bundesnetzagentur, Beschlusskammer 6, Az. BK6-17-046.

[53] Poplavskaya/De Vries, A (not so) independent aggregator in the balancing market theory, policy and reality check, Delft University of Technology.

[54] Poplavskaya/De Vries, A (not so) independent aggregator in the balancing market theory, policy and reality check, Delft University of Technology.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

The current system in the UK foresees no supply license at all in order to enter the aFRR market.

# III. Relevant legislative acts

## 1. The IEM-Reg.

The new IEM-Reg. is part of the upcoming Clean Energy Package and, as a regulation, is applicable in all Member States from the moment it comes into force. It contains several provisions that affect the energy market and inter alia concerns the balancing markets and the prequalification process, especially Art. 5 para. 8 IEM-Reg. is relevant in the aforementioned context.

**COM's version:** speaks of balancing markets and that the procurement shall be based on a primary market and organised in such a way as to be non-discriminatory between market participants in the prequalification process individually or through aggregation.

**Council's version:** The procurement of balancing capacity shall be market-based and organised in such a way as to be non-discriminatory between market participants in the prequalification process individually or through aggregation in accordance with paragraph 4 of Article 40 of the [recast Electricity Directive].

**Final version:** Procurement of balancing capacity shall be based on a primary market unless and to the extent that the national regulatory authority has approved use of other forms of market-based procurement on the grounds of lack of competition in the market for balancing services. Derogations from use of primary markets shall be reviewed every 3 years.

Thus, Art. 5 para. 8 addresses the balancing market, but it does not forbid a system that is based on obligations "expressis verbis". However, there are several aspects that are likely to be collide with the French system.

- First, when the Commission and the final version speak of a procurement, based on a market and the Council speaks of a market-based system, this could lead to a prohibition of a system that is based on obligations. (Although the prices achieved in the obligations-system are connected to the actual market situation). Thus, the first question is, if a "market-based" system does forbid an obligations system. In this context it is important to point out again, that a market still exists, as the obligations are traded on the so-called secondary market. Thus, it could be argued that even the obligations system in France is still related to the market and therefore market-based, at least in respect of the wording in Art. 5 IEM-Reg.
- A second and even more important aspect is the wording in the Commission's position and the final version, as it speaks of a **procurement that is based on a primary market**. In the French system, for smaller market players, only a secondary market exists, where the obligations can be traded.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

> If a primary market is mandatory, the French system may need an adjustment to offer an “open” primary market in the sector of balancing services. A related question is, what “primary” means, and if it does forbid that aggregators can, de facto, participate in the balancing market only through a secondary market. It could be argued that if the bigger market players are included in the aFRR market through primary obligations, this meets the requirements of Art. 5 IEM-Reg. But then again, the obligations system cannot really be described as a primary **“market”**.

In conclusion, it is likely that a system where the access to the aFRR market is restricted to a certain extent (may it be due to an obligations system or to specific MW thresholds etc.) would collide with the IEM-Reg., at least in some aspects (or at least has to be reviewed after 3 years, regarding to the final version of Art. 5 IEM-Reg.). Thus, it can be recommended to alter these existing barriers as soon as possible in order to get the energy markets ready for the future EU legislation.

### 2. The guideline on electricity balancing

Especially the area of balancing services is affected by the Commission’s guidelines and network codes. Those legislative acts provide rules and oblige the TSOs to develop terms and conditions or methodologies which have then to be implemented on national level. These processes are in a progress of development at the moment, and are likely to offer changes, both on national and EU level, in the medium and long term. It is important to highlight that the harmonization mainly targets balancing energy. While balancing capacity procurement is likely to stay a more national topic, in comparison, balancing energy is expecting a rather extensive harmonisation on EU level.

The most important guidelines in the context of this paper are the guideline on electricity balancing (GL-EB) and the guideline on electricity transmission system operation (SO-GL). While the SO-GL is a more technical guideline regarding the prequalification processes that are a requirement to take part on the balancing services market, the GL-EB is aiming to create a balancing market where TSOs can share the resources, and also to allow new players such as demand response and renewables to take part in this market.

It lays down detailed rules on inter alia the establishment of common principles for the procurement and the settlement of frequency containment reserves, frequency restoration reserves and replacement reserves and a common methodology for the activation of frequency restoration reserves and replacement reserves, (Art. 1 of the GL-EB). Some of the main topics are:

- Harmonization of certain features of imbalance calculation and pricing.
- European platform for imbalance netting.
- Common platform and merit order for replacement reserve and frequency restoration reserve (mFRR & aFRR) in the sector of balancing energy.
- Standardization for balancing energy products.
- Terms and conditions related to balancing.

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

Thus, there is multiple impact on aggregation. In general, common merit order lists (instead of pro rata) are positive for aggregators because demand side assets and renewables have usually higher activation costs. Especially the harmonisation helps aggregators to access a rather wide market. However, the remaining barrier is that a lot of things are not harmonized by these guidelines. For instance, how balancing capacity is procured, and the details of prequalification requirements may remain national topics. Member States are not obliged to harmonize balancing capacity procurement on EU level and may keep their national regulation. Therefore, it is likely that the TSO will create a common balancing energy market without creating a level playing field, as in some aspects there will still be a significant difference between the Member States: While balancing energy will be harmonized, balancing capacity and prequalification processes are likely to differ from Member State to Member State.

The problem that obligations are needed to enter the aFRR market may be addressed by the GL-EB in the Terms & Conditions part.[55] Article 18 “Terms and conditions related to balancing” has to be implemented in national law. It is questionable if this implementation is on track at the moment. Art. 18 para. 4 GL-EB states that the terms and conditions for balancing service providers shall:

> “(a) define reasonable and justified requirements for the provisions of balancing services;
> (b) allow the aggregation of demand facilities, energy storage facilities and power generating facilities in a scheduling area to offer balancing services;
> (c) allow demand facility owners, third parties and owners of power generating facilities from conventional and renewable energy sources as well as owners of energy storage units to become balancing service providers.”

- Although these are more general provisions that are not directed to systems with a secondary market – like the French system – particularly, reasonable and justified requirements and the possibility of aggregation in balancing markets are likely to collide with a system that foresees market primary participation for bigger market players through obligations only.
- On the other hand, Art. 34 GL-EB obliges the TSOs to allow service providers to transfer their obligations in order to provide balancing capacity, as it states: “Within the geographical area in which the procurement of balancing capacity has taken place, the TSOs shall allow balancing service providers to transfer their obligations to provide balancing capacity” This (indirectly) concerns the establishment of a secondary market, as it is the case in France.
- Further Art. 21, 25 para. 4 GL-EB in combination with Art. 6 para. 1 lit. b in ENTSO-E’s implementation framework for the exchange of balancing energy from frequency restoration reserves with automatic activation defines

[55] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2017.312.01.0006.01.ENG&toc=OJ:L:2017:312:TOC#d1e1745-6-1)

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

> that each standard aFRR balancing energy product bid shall fulfil the characteristic that the minimum quantity shall be 1 MW. The difference between prequalification aspects and actual bid size has to be highlighted again in this context. There is no provision for a minimum installation size in the GL-EB, which leads to the conclusion that there may not be foreseen a threshold in this area. Thus, if the aFRR market is not open for smaller market players below 25 MW like in Belgium, it would be a breach of the new framework.

To sum up, it is again not clear if the current market designs, especially in Belgium and France, are a breach of the guidelines, but at least problematic aspects exist. In the long term it could be conflict preventing to adjust the market design and to open the balancing market especially for smaller market players.

# IV. Development of an enabling framework

## 1. France

Since 2015, RTE has been asked by the CRE to propose a roadmap for the French electricity balancing with the goal to adapt its national mechanism with the future GL-EB, as well as to encompass France's new energy transitions targets. The result is found in the 2017 formulated orientations from the CRE[56] regarding the evolution of the French electric balancing system. Intermediary stages were given, following mainly the propositions from RTE in its "green paper"[57]. Both the CRE and RTE consider the fundamentals of the French balancing system with its proactive and centralized dimensions[58] to be suitable and relevant for the future and intend to enhance them through the European integration[59]. The willingness "to extend participation in the balancing mechanism to renewable energy[60], demand response and other sources of flexibility such as storage" constitutes a further work in progress[61].

[56] CRE, délibération n°2017-155, „délibération de la Commission de régulation de l'énergie du 22 juin 2017 portant orientations sur la feuille de route de l'équilibrage du système électrique français", p. 1, 2.
[57] RTE, Feuille de route de l'équilibrage du système électrique français, livre vert, June 2016, followed by the deliberation from the CRE on the 22 June 2017.
[58] The French model presented by RTE in its Green paper with its centralized, proactive and integrated balancing management enables him to manage both balancing and local congestion simultaneously, with the broadest possible participation in the balancing mechanism (in order to include inter alia demand response aggregators): See CRE, deliberation n°2017-155, p. 1.
[59] CRE, deliberation of 22 June 2017 n°2017-155, p. 14.
[60] The participation of renewable energy in balancing does not truly take place in France, as noticed by RTE (deliberation 22 June 2017, p. 42), on account of mainly the absence of incentives caused by the support mechanisms for the development of RE. Further, CRE noticed that the current French balancing rules have no real provisions that are favourable to RE, unlike with the aggregation modalities for the participation of demand response. In order to advance the participation of RE in balancing, the CRE wishes for the examination of RTEs proposal to promote its participation through notably the "constitution of capacity separately for upward and downward balancing for the aFRR". See CRE, deliberation 22 June 2017, p. 44.
[61] CRE, deliberation of 22 June 2017 n°2017-155, p. 4.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

The planned European integration through notably the GL-EB does not foresee uniformity of all national balancing mechanisms, which means that the planned harmonization is likely to enable France to preserve its national specificities as long as they do not oppose integration or cause some substantial competition distortions on the European market for example. This could include the further use of the compulsory participation in France, which would mean a continuous disadvantage for smaller actors that can only rely on the secondary trading.

However, the CRE does consider in its review of the roadmap (green paper) that RTE should make more efforts to develop and open the reserve mechanisms, especially regarding the frequency restoration reserve.[62] According to the CRE, the French model of balancing is "set to evolve in the coming years, in order to:

- Strengthen the integration of European markets, as provided for in the European regulation on balancing, by implementing in priority the balancing energy exchanges between the different European countries;
- Support the energy transition, which leads to increased flexibility requirements for the French and European electricity systems in order to integrate intermittent energies;
- In particular to address the questions relating to incentives for different balancing stakeholders, the participation to new flexibilities and the coordination between the TSO and the DSO;
- As well as an improvement of the transparency of balancing mechanisms in order to provide actors with appropriate signals."

This could mean hope for a change of direction in the French aFRR mechanism towards a better European harmonisation in the future.

Furthermore, the GL-EB requires the opening of the participation to separate procurement of balancing capacities[63], which, e.g., should contribute to help enable PV units to provide ancillary services (Art. 32 para. 3 GL-EB).[64] Also, since 2015, RTE pursued an optional participation for asymmetrical capacities[65] where a mandatory prescription system remains symmetrical, with the addition of the opportunity for mandatory participants to schedule their contribution to FCR and aFRR in an asymmetrical way or to bilaterally exchange their prescription in an asymmetrical way. Further, qualified but not mandatory participants who want to offer only asymmetrical reserves, such as PV, need to find an OTC counterpart on their

[62] CRE, délibération n°2017-155, „délibération de la Commission de régulation de l'énergie du 22 juin 2017 portant orientations sur la feuille de route de l'équilibrage du système électrique français", p.4.
[63] Asymmetric procurement, in French: "symétrique" and "dissymétrique".
[64] See also: Art. 5 para. 9 IEM-Reg.: "The procurement of upward balancing capacity and downward balancing capacity shall be carried out separately, unless the national regulatory authority approves an exemption from this principle on the basis of the transmission system operator demonstrating that this would result in higher economic efficiency.".
[65] Beginning of 2016, see CRE, "Délibération de la Commission de régulation de l'énergie du 3 décembre 2015 portant approbation des Règles Services Système", p. 2.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

own.[66] The consequence of the asymmetrical participation is that producers can offer solely decreasing capacities, which is a prerequisite for the renewables to take part in the balancing through the reserve markets. The CRE approved this proposition from RTE, to propose and implement an optional mechanism in order to encompass asymmetrical capacities, underlining the need to comply with the European balancing regulation.[67]

## 2. Italy

### *a) Upcoming system impacts*

The new rules of the Italian energy market and the introduction of the GL-EB transform the Italian electricity sector, regarding the **Overall Systems** and the **Operators**. In the following paragraph the most relevant ones that will or are likely to have an impact on the market in the near future are highlighted:

**Aggregated bids for balancing purposes could enhance system stability/security:**
Even if dispatching would still be based on single unit, the BRP could present bids for aggregation of dispatching units. This change goes in the direction of the UVAM pilot projects by Terna where RR reserve could be optimized merging together production and consumption units: operators could optimize the balancing providing a substation support to Terna in the balancing and security of the system in certain areas by themselves.

**Gate closure next to real time will reduce the need of adjustments through balancing, which will decrease MSD volumes:**
Today, operators bid 4 hours before the execution time. Reducing the time to only 1 hour in advance, there will be the possibility to trade more accurately updated forecast. This will drive to better dispatching plan that will require less adjustment.

**Operators have to optimize their activities to respond to input in very narrow timing:**
The bidding on RR LIBRA platform has even more restricted the timing to market execution only to 30 minutes. This will require the control room and the operations of the plants to be extremely precise and effective.

[66] CRE, "Evolution of ancillary services regulation; opening the possibility for new market players to participate in maintaining the system stability", Office franco-allemand, 3 November 2015, p. 8.
[67] CRE, "Délibération de la Commission de régulation de l'énergie du 3 décembre 2015 portant appro-bation des Règles Services Système", p. 2, 3; the current System services rules from RTE provide a choice between symmetrical and asymmetrical procurement for each type of reserve.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

### *b) Relevant aspects for an enabling framework*

Many technical themes will require time to be fully understood, as well as both Terna and the operators get used to the new functioning. The following recommendations could be useful to try to smooth the change to the new operations as much as possible:

**Capacity remuneration for upward and downward reserve:**
Controllable decentral generation such as hydro or biogas have significant potential to provide downward flexibility. Such units providing downward reserve can avoid conventional must-run capacities. For upward balancing services in the UVAM pilot, a capacity price was already paid. To enable also more renewable generation to provide balancing services, it should be investigated whether a market design including a downward capacity remuneration could make sense.

**Subsidy schemes should not hamper market participation:**
Several subsidy schemes for RES does not allow market participation. In particular, FIT such as Omi Comprensiva hampers hydro plants and biogas energy plants to operate more flexible since electricity is not sold at the markets but for a fixed price. In order to allow more aggregation and market integration also such schemes should be redesigned into a sliding market premium.

**Data availability:**
One of the most relevant change that impact on operations is by sure the timing. Gate closure H-1 and 30’ allowance to receive the final dispatching programme require by Terna a relevant optimization of procedures and algorithm. On the other hand, also the Operators (dispatching units, BRP, aggregators, etc.) need to be adequately instructed on the new functionality. The data availability is critical success factor for the new challenging environment: the information about bids volume and prices would require even more detailed reporting since there will be several themes to be considered:

- Different mechanism (auction and continuous trading)
- Potential correction made by Terna
- Offering made on RR LIBRA platform and conversion algorithm.

The quantity and timing of data availability could therefore play a relevant role in the market and Terna and the Authority ARERA should set a proper balance of information disclosure, considering the possibility that such information might affect the active bidding process of BRP. Price signals are fundamentals to drive choices and should be widely available, taken care also of recent past experience where distortions and speculative attitude have been put in place within a virtuous mechanism system.

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

**Transparency on functioning of algorithm to transfer "pay as bid offers" to "marginal prices":**
Another important aspect is the way in which the algorithm of Terna will put the offer on the RR LIBRA platform, creating standard product and transforming the marginal price of the accepted offer into national system. Transparency of the way in which the algorithm functions will assure the comprehension of opportunity and risks, and consequently affect the BRP's most proper behaviour.

**Neutrality and impartiality:**
Terna has the responsibility to bid on RR platform with standard product, acting at the end on behalf of the operators themselves: maximum guarantee shall be provided in order to be assessed by third party (ARERA as priority) the neutrality and impartiality of mechanism and behaviour. Full access to information should be provided in order to secure that market rules guarantee equality for each participant.

**Simulation tool:**
To facilitate this process, the definition of a simulation tool would be very helpful to create a scenario and understand the overall functioning of bidding, prices setting and volume adjustment. An example of a similar application in the energy sector in Italy has been the standard calculation tool set by MISE (Ministry of Economic).

## 3. Belgium

With a view on the Belgian situation, it would be necessary to make some changes regarding the balancing market. In summary, an open aFRR product should:

- Be open to all technologies on all voltage levels (today: only CIPU units)
- Be procured separately from other reserve products (today: linked with FCR)
- Be procured daily, preferably with 4-hour time blocks (today: weekly product)
- Be procured asymmetric (today: only symmetric)
- Be evaluated using a fair baseline method (today: compares on a unit level, for pools it should be evaluated on pool level of the participating units)

In what follows, these aspects are discussed in more detail:

**A market open to all technologies on all voltage levels:**
This aspect is primordial. Today, it is simply impossible to conclude a contract with any unit that has no CIPU contract. Non-CIPU units need to be allowed to prequalify reserve power and bid it in the aFRR market. This with as little limitations as possible on size, technology, or voltage level the asset is connected at.

**Separate procurement of FCR and aFRR:**
Currently, FCR and aFRR are procured on a weekly basis, with the option to make conditional bids. This means that the CIPU units offering both in the (already-

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

opened) FCR and aFRR market, can put the condition they can only be selected in one market if they are also selected in the other.

Since the CCGT plants control the aFRR market and are highly needed by Elia under the current closed market condition, Elia has no other option then to accept also their FCR bid, even if there are other parties offering FCR at a lower price. This makes the FCR market illiquid, intransparent and unfair and it is difficult for new players to get into the market. On top, this shows that balancing costs are higher for balancing power than they could and should be. The Belgian tax-payer gets the bill.

**Daily procurement:**
Daily instead of weekly procurement will make the aFRR market more liquid, especially with 4-hour blocks. This allows participation of sources of flexibility that are only available during certain days of the week (e.g. in an industrial week-weekend schedule) or certain hours of the day (e.g. electric vehicles parked at a charger and connected to the grid at night). It will also make the aFRR market more efficient: Elia can procure a volume of reserve power that reflects the need on a daily basis, instead of procuring the volume weekly based on the worst foreseen day of the week.

**Asymmetric procurement:**
If the symmetric product design would remain in place, a new market party that only offers aFRR up or aFRR down relies on an offer from another party offering the other side to make a chance to be selected by Elia.

Elia’s current proposal is to have both symmetric and asymmetric offers, while forcing all parties to offer their symmetrical power also in an up and down part (design note article 5.1.2).

> “The opening of the aFRR market to non-CIPU assets requires an update of the bidding obligations in order to give the opportunity to BSPs offering asymmetric aFRR to match with a complementary product. It is assumed that by attracting bids from non-CIPU assets, **it is desirable to have additional bidding instructions for aFRR up and down separately.** Enforcing these additional bidding instructions would make it very impractical from an operational point of view.
> (…)
> **In case of a separated procurement of FCR and aFRR, it is logical and reasonable to impose bidding obligations on the two aFRR directions, i.e. aFRR up and aFRR down to incentivize asymmetrical bids. The bidders would be obliged to split up large symmetrical bids into smaller symmetrical and asymmetrical bids.** It is proposed that the maximum step size is also reduced from 24MW to 10MW in order to make sure that the capacity procurement is not dominated by large indivisible bids. A total cost optimization is applied for the two aFRR directions.”

The bidding rules on the up and down part together still gives the big parties the option to make the asymmetric bids very expensive compared to their symmetric

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

bids with the same plants, exploiting and maintaining their current position of market power. This would make the entrance either impossible or would ask the new entrants to offer their asymmetric products largely below market value. Indeed, if they would want to be selected by Elia, the combination of their bid together with an asymmetric part of the bigger party should be cheaper than the symmetric bid of the bigger party.

Alternatively, the players with market power could bid the asymmetric volume at dumping price at the side (up or down) where they experience most competition from new players. This would allow them to push out the new players out of the market again, while still earning good revenues with the other side.

Some market actors therefore ask that market parties are obliged to offer (at least part of) the total volume of aFRR in the asymmetric products. And that Elia procures (at least part of) the total volume from the asymmetric bids.

**Fair baseline method:**
The baseline is the reference power which an asset (or pool of assets) would have consumed/produced if it would not have been activated for aFRR provision. The difference between the real power consumer/produced and the baseline determines the aFRR provided to Elia. If this does not equal what was committed to by the BSP in the aFRR tender, a heavy penalty will be applied. Hence, the method to determine the baseline is crucial to ensure market are fairly evaluated for provision of the aFRR service to Elia.

Under the current proposal, it is proposed that the baseline is evaluated on the pool of non-participating units (see Article 14 in design note) (there are always assets in the pool who are not activated during aFRR provision, e.g. because only part of the procured volume is activated or because they are part of the safety buffer (the redundancy)). We see several important issues with this approach:

- The aFRR activation will be executed by the “participating delivery points“. A provider selects those delivery points which are available, which are connected, react and can follow the set-point.
- An aggregator must keep a redundancy in case he “loses” some of the participating unit due to an outage or a loss of connection. In that case he can switch non-participating units to become active in the participating pool. This also means that the “non-participating” units are not necessarily not available neither do they not necessarily not react.
- However, the non-participating pool typically hosts also those units with connection losses or outages. Therefore, the baseline of the non-participating pool is not as accurate as the one for the participating units. While the accuracy of the baseline for the non-participating delivery points might be worse for instance due to units starting or having an outage.
- In case the activations are rather small and only a part of the offered aFRR volume is activated this effect will be limited, but as soon as a large volume of aFRR is activated the aggregator typically activates to a large extent those units that are reliable at those moments and switches these to the


This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

participating pool. In such case the non-participating pool still hosts the redundant units, but the share of units that are not available, that have lost connection or that ramp up or down due to start-ups and outages will be larger. In particular the outage and start-up ramps cannot be forecasted and will have a significant impact on the accuracy of the baseline. In these cases, the less reliable or not connected units might dominate the baseline error.

## 4. Portugal

The most obvious solution for the participation of demand response aggregators in the aFRR services would be the simplification or revision of some of the rules, so the clients' flexibility could be utilised in this market as well. One important rule that may need revision to enable the participation of demand response aggregators is that the assets participating in the aFRR are automatically activated by the TSO. In the case of aggregation, this activation has to be done via an aggregator, and then the aggregator activates the necessary flexibility within his portfolio. Moreover, the obligation of providing the ratio of 2:1 between the upward and downward secondary regulation band may be harder to comply with, so demand response aggregators would have the possibility to offer these bands without any constraint regarding this ratio. However, it may not be easy to combine the goals of this service with less strict rules.

In any case, the Portuguese Energy Regulator, ERSE, has already mentioned that the MPGGS (Handbook of Procedures for the Global Management of the System of the Electric Sector) should be reviewed in the following months in order to incorporate the new European regulation for grid codes under the European Third Energy Package number 714/2009.[68]

Notwithstanding, a more realistic solution may be the participation of demand response aggregators in the mFRR/RR since the rules are less demanding than in aFRR. The rules of mFRR/RR are described in procedure number 13 of the MPGGS. The main rules are briefly detailed above.

- The allowed participants in the mFRR are:
  - All Market Agents having balance areas corresponding to production facilities or to pumping consumption facilities;
  - Other transmission system operators, under the regulatory reserve exchange mechanism.

- The Market Agents identified above are obliged to submit daily offers corresponding to all available reserve of regulation, by balance area, both up and down, for each of the programming periods of the following day.

[68] http://www.erse.pt/pt/consultaspublicas/consultas/Documents/67_1/consulta%20publica_Regras%20do%20Projeto%20Piloto_enquadramento-v2.pdf.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

- In opposition to aFRR, there is no need to register for mFRR/RR provision; if an asset participates on the energy market and has available regulation reserve, then it is automatically qualified.
- Immediately after publication of the aFRR results and until 8 pm of the day before, the market agents should make available to the PSO the information regarding the RR. The offer price for the mobilization of the downwards regulatory reserve has the character of a repurchase price of the energy not produced equivalent. These offers must present the value of the reserve in MW and the respective price in €/MWh. The offered reserve blocks could not be divided.
- The PSO defines the needs for upward/downwards regulations, for each hour of the day, taking into account the demand forecast. There is also an additional reserve that corresponds to the maximum power that can be lost due to any single equipment outage increased by 2% of the demand forecasted for that period.
- PSO will mobilize the provision of RR service with minimum cost criteria, considering the existing offers at the time of mobilization.
- The RR market is “Pay as clear”. In the RR service, only those market agents whose units were mobilized are remunerated, and the remuneration is attributed only for the energy as opposed to the reserve of secondary regulation which is also remunerated by the power availability.
- The mFRR/RR energy is remunerated at the marginal price of the last mobilized offer, whether fully or partially activated, in each direction of regulation (up and down).
- If the capacity is not provided, penalties are applied.

In order to comply with the European regulation and taking into account the request of consumption facilities owners to see a clear regulatory framework for the participation in reserve markets, ERSE has recently launched a public consultation about the rules of a pilot project addressing the demand side participation in reserve market, namely regulation reserve. The results and lessons learned from this pilot are intended to contribute for the new legislation and may pave the way for more attractive DSM markets in Portugal.[69]

Apart from replying to this public consultation, demand response aggregators should organise meeting with the energy regulator to present their position about the participation in the reserves markets, mentioning the benefits for the energy system, both technically and economically. In addition, aggregators should provide a set of rules that are necessary for their participation in reserves, which could be somehow less selective during a first period of implementation. This period should be agreed as well. Some possible recommendations for the participation of demand response aggregators are listed below:

**Eligible participants:**
The main goal is to ensure equal opportunities between consumers and producers who are already involved in the reserve market. However, according to the rules

[69] http://www.erse.pt/pt/consultaspublicas/consultas/Documents/67_1/Regras%20do%20Projeto%20Piloto.pdf.

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

set by ERSE, only consumers with a capacity above 1 MW are allowed to enrol in this pilot. This minimum capacity may exclude potential customers to participate, so a recommendation could be a reduction to 500 kW. In addition, the aggregation of customers' flexibility should also be allowed to ensure the implementation of EDP' business model based on demand response aggregator.

**Offers:**
Regarding the format of the offers, according to the rules it is necessary to offer both up and down reserve. A possible simplification may be the possibility of just offering one direction.

**Response time to the mobilization of the regulatory reserve:**
The time to activate the aggregators' flexibility to comply with the mobilization instruction of the Global System Manager should be defined taking into account the systems that can be installed at customers' side.

**Remuneration:**
The regulation reserve participants are only paid for the activated energy. This could hinder the demand participants because clients do not receive any incentive for their availability. Therefore, it is recommended that demand response aggregators are also paid for the regulation band.

**Non-compliance:**
The demand response aggregators should pay penalties installations in case of non-compliance with the mobilization instruction as defined in MPGGS. Notwithstanding, during a first phase of implementation, the penalties may be slighter lower to incentivise their entrance in this service.

**Relationship with the Distribution Network Operator:**
The participation of aggregators in the reserves markets involves the participation of clients connected to the distribution grid, which has not happened before. Therefore, it is necessary to establish new rules for the coordination and communication between the DSO and the Global System Manager. These rules shall include the DSO responsibility of providing information about technical restrictions on the participation of aggregators connected to their networks to ensure the viability of the mobilization order without entailing any risk to the stability and quality of service of the distribution grid.

**Deviations:**
The calculation of deviations of retailers' portfolio should the exempted from deviations resulting from the participation of their customers in the regulatory reserve market.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

# D. Access to customers' data

## I. General description

For the best outcome of aggregators' business models, it is crucial to gather customers' real time data in order to know how the customers behave and to adapt to this behaviour. Thus, it is problematic if the data acquisition is very time consuming or (real time) data is not available at all, due to regulatory and/or technical reasons.

**Problematic aspects are:**

- Many different market participants (especially local players) which are not really interested in a functioning system for supplier change.
- Many DSOs using different technical systems, which leads to the effect that every process has to be planned and tested individually.
- Monopoly by the market-dominating players.
- Forwarded data is no real time data.

## II. The situation in the target countries (especially Austria, Portugal & Spain)

### 1. Austria

It has become apparent that business model concerning multi apartment blocks (BM 10) is not ecologically reasonable. The following part focusses on the existing problems in respect of demand side flexibilization of small customers (BM 9).

#### *a) Problem 1: Change of the smart meter rollout plan*

The rollout plan for variable tariffs in the area of smart metering has changed. In the year 2009 the EU member states decided to introduce smart metering region wide till 2020. In Austria, the legal framework is regulated in the "Intelligente Messgeräte-Einführungsverordnung (IME-VO)". This ambitious trajectory was changed in 2017 so that to the end of 2020 at least 80% and to the end of 2022 at least 95% of the Austrian electricity customers have to be equipped with a smart meter device.

Thus, referring to § 1 IEM-VO, originally it was planned that:

> Until the end of 2015 at least 10 %, until the end of 2017 at least 70 %, and until 2019 at least 95 % (if technically feasible) of the meter points have to be equipped with smart meters by the DSO.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

The new plan provides that:

> Until the end of 2015 a plan of the future introduction of smart meter devices has to be presented, until the end of 2020 at least 80 %, and until 2022 at least 95 % (if technically feasible) of the meter points have to be equipped with smart meters by the DSO.

This change leads to the effect that the DSOs slow down the development and the introduction of smart meter devices. This is a problem for some market actors because they rely on equipped households etc. to gather customers' data they can work with. It is crucial for aggregators like oekostrom that the development in the smart meter sector is pushed forward, so access to customers' data is no longer a problem because this data is needed to use the customers' flexibility.

#### *b) Problem 2: Development of new platform next to ENERGYlink*

In 2014 ENERGYlink was introduced by E-Control as a platform with the goal to standardize the communication between the market participants to facilitate the easy change of the supplier for customers as the manual data transfer led to mistakes in the former years. The problem is that there are several "gaps" which can be exploited by the market-dominating players.

Recently a second platform, EDA, was developed, which de facto sets a new standard for data transfer in Austria parallel to ENERGYlink and moreover is free of charge. This new platform offers the possibility for workaround processes. As a result, almost all processes of data transfer between DSOs and supplier in the smart meter sector are connected to EDA and not ENERGYlink as originally intended, which leads to a reduction of E-Control's influence on the design of the system and an increase of the influence by market-dominating players. E-control does not/cannot take action against this behaviour.

The problem for oekostrom is that it is very time-consuming to gather data because there are many different market participants (especially local players) which are not really interested in a functioning system for supplier change. Thus, many of the participants did not implement the respective processes (which are partly impractical or in an early state, see below). Moreover, there are ca. 120 DSOs using different technical systems, which leads to the effect that every process has to be planned and tested individually, which again is very time-consuming.

It is important for oekostrom that the modalities of data access and data transfer are standardised in order to gather the customers' data, which is needed for a functioning business model. To avoid a monopoly position by the market-dominating players it is important that the possibility for the customer to freely choose the supplier remains.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

### *c) The customer processes*

The exchange and forwarding of smart meter data is regulated in the so-called "customer processes".

These processes describe several actions that are not regulated on a legal basis at the moment. This is a possibility to define some standards in the smart meter branch. Such a standardisation is a very positive approach from the aggregators' point of view, because these processes are likely to fasten the acquisition of customers' data and help aggregators to work with customers' flexibility.

However, the customer processes are not implemented, as fast as they originally should be (originally the implementation was planned in 2016). This results in a very slow progress for aggregators and oekostrom to implement this standardisation.

### *dd) The customers' power of attorney for the access to their consumption data*

As a supplier, one needs the customers' power of attorney to get access to their consumption data. As the DSO is responsible for measuring, generating and transferring the consumption data, as a supplier, you have to provide evidence that you have the customers' power of attorney. The intention of legislator/E-Control was that it is entirely up to the supplier how the consent to data usage is regulated between the customer and the supplier.

As nowadays the change of suppliers usually is done online by customers, the customers could accept the usage of their consumption data by the supplier by placing a tick mark in a check box "I accept that the supplier is using my consumption data" with additional information for the customer on how the data will be used during the online registration process on the homepage of a supplier. The customer processes would allow a supplier, to submit the information "I have the customers' power of attorney for the access to their consumption data" to a DSO. Nevertheless, some DSOs do not accept this online process and persist that customers have to use a power of attorney that has been designed by the DSO. This makes it impossible for suppliers to set up automated processes.

## 2. Portugal & Spain

### *a) In general*

The Portuguese aggregator is based on utilising the customer flexibility for optimization of retailer's portfolio in two different scenarios: optimal souring of electricity on day-ahead spot market and minimization of deviation. Therefore, it is pivotal to know exactly how the portfolio behaves, so the flexibility can be activated accordingly, which means that reliable and real time consumption data is key for a successful implementation of such business model. This constitutes, in fact, one of the most relevant barriers for demand response aggregators in Portugal: The access to consumption data in real time.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

The data which is forwarded by EDP distribution is not real time data (inter alia, due to technical reasons). For bigger clients, it is known a few days later, for residential customers even far longer (ca. one year). This leads to a situation where the retailers have no idea about the customers' real time behaviour, so the implementation of innovative business models using flexibility is hindered.

There are two main documents that establish the rules for metering activities that were published by the Portuguese Energy Services Regulatory Authority - ERSE[70]:

- **Guide to Measuring, Metering and Making Data Available -** GUIA DE MEDIÇÃO, LEITURA E DISPONIBILIZAÇÃO DE DADOS, January 2016
- **Rules for commercial affairs -** Regulamento de Relações Comerciais, December 2014

### *b) Metering data responsibility*

According to the first document (chapter IV), the distribution system operator is the entity responsible for metering activities of final customers. In Portugal, EDP Distribuição (EDPD) is the only relevant DSO.

The same document (section 8) refers that the local metering systems responsible for measuring the consumption of electricity can be accessed locally or remotely. Then, central systems treat the collected data, namely for billing purposes. It is important to notice that the metering devices were tested by an accredited laboratory to guarantee the quality of data.

### *c) Periodicity and format of the Metering Data*

According to the same document (section 29.2.1), the maximum frequency of metering data depends on the type of client as indicated in the table below, showing clearly that the DSO is not obliged to provide the data in real time.

**Table 3**: Metering data depending on the type of client

| Type of Client | Periodicity of the Metering Data |
|---|---|
| EHV - Extra High Voltage (equipped with telemetry device) | Daily |
| HV - High Voltage (equipped with telemetry device) | |
| MV - Medium Voltage (equipped with telemetry device) | |
| Special Low Voltage (equipped with telemetry device) | |
| Normal Low Voltage (equipped with regular meters or smart meters) | Monthly |

[70] www.erse.pt.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

According to point 54, the data of load diagrams of the final customers collected by the telemetry systems are made available by the respective network operator and have the following main characteristics:

a) Active energy supplied measured, broken down by integration period.
b) Reactive energy measured with the maximum possible discrimination by quadrants.
c) Integration of possible corrections of anomalies of measurement, metering and communication of data in the values to be made available.
d) The integration period is 15 minutes, starting at 0, 15, 30 and 45 minutes each hour.
e) Frequency of availability according to the current legislation.
f) The availability of metering data should be done individually per installation.

***d) Customers with telemetry***

The Portuguese aggregator business model is starting by targeting bigger clients first, the ones that are equipped with telemetry equipment, whose data can be accessed remotely with a delay of one day.

Moreover, although EDPD sends on a daily basis (on the D + 1) the load diagrams to the respective retailers, the current process and systems require a posteriori validation of the collected data, so the availability of data in a real time is not feasible, even for customers with telemetry. Typically, the central system receives the data of an entire day in the next day early morning and then the validation process is run to estimate missing data and validate that the recorded data has no errors. Therefore, only on D+1 around 10 am the data is made available for retailers.

In addition, the equipment installed at customers with telemetry systems doesn’t allow actuation, so they aren’t eligible for demand response purposes. This way, the customers will need to spend money for acquiring other supplementary equipment or the aggregator has to install them, depending on the business model that is implemented.

***e) Customers with smart meters***

Even with smart meters, there is a lack of quality data. The problem is that the customers’ data is only known with a time delay and therefore no real time data is available. Although EDPD tries to develop and implement new technical equipment, it depends on the national regulatory authority (ERC) how much money is available for such purposes.

Currently there are more than six million normal low voltage customers (B2C clients – small customers, mainly residential) in Portugal, of which around 20% already have smart meters that were installed by EDPD. Regarding the smart meters installation, there isn't any minimum target per year defined by ERSE, but EDPD

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

has an internal goal of having 60% of smart meters installed by the end of 2020 and 100% by 2022.

### *f) Imbalance costs*

A connected problem related to consumption data that is not recorded with 15 minutes time step is the attribution of the imbalance costs. Load profiles are known for clients equipped with telemetry and smart meters. For those equipped with regular meters, the available data is an aggregated consumption, depending on how often the consumption data is reported. This means that there is an uncertainty about the real time consumption. Thus, whenever imbalances occur, it cannot be proven who is responsible for the deviation, so retailers must pay according to the share of clients' consumption who are not monitored, even if they are not responsible for the deviation.

### *g) Installation of metering equipment*

According to the second document, articles 239 and 262, the metering system of final clients should be installed by the distribution system operator. These systems belong to the DSO, so EDPD is the responsible for the costs and no renting or restitutions charges can be applied to clients. Furthermore, article 623 mentions that the replacement of equipment and its cost to be performed by the DSO has to be approved by ERSE.

### *h) Investment of real time metering data*

As mentioned above, the entity responsible for the metering activities of clients addressed by the Portuguese aggregator is EDPD, which is a regulated entity, so most of EDPD's investments must be approved and remunerated by ERSE.
However, according to Law 12/2018, meters cannot be remunerated by grid tariffs, but ERSE used to support 80% of the cost because they have some other functionalities. Currently, ERSE is assessing this percentage and the remuneration is suspended. New documents are expected until the end of the year about the tariffs for 2019 and this topic may arise as well.

### *i) EDP Spain*

Regarding the status of EDP Spain the problem with metering data is the following: Retailers do not have real time data from smart meters managed by DSOs, but they can access customers' consumption data on a daily basis with a delay of one day. The measurements are owned by the customer and the DSO is responsible for the metering. The retailer can only access the metering data through the DSO's secondary concentrator, where he stores the metering data of the supply points in its networks. The DSO is not required to make the metering data available in real time.

The roll out of smart meters in Spain should have been concluded until the end of 2018 with a total of 27.3 million smart meters installed by DSOs Iberdrola, Endesa, Unión Fenosa Distribución, EDP HC Energia and Viesgo.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

With the installation of smart meters, both in Portugal and Spain, it is crucial for the suppliers/aggregators to access actual customers' data. Without this data, a reasonable expansion of the smart meter sector will be hindered. Thus, it can be recommended to invest in the smart meter sector, and especially to try to facilitate the access to customers' data in order to tap the full potential in this area.

The obstacle to have real time data is that the communication channel used for smart meters is the power line (PLC). This medium is good enough for a daily reading. For a standard failure communication rate of 85%, one successful daily reading can be obtained easily. But the power line as a communication carrier not suitable for online readings. Spanish regulation does not force DSOs to use PLC: they have chosen it as an industrial decision that fits the requirements specified in regulation. Any changes in regulation to impose a communication technology should include the necessary retribution to new investments.

3. Comparable situations in other countries

The mentioned problems regarding data access are not highlighted in the other partner countries. In some of the countries this may be due to the lack of a smart meter rollout at the moment (Belgium, Cyprus). In other countries, special platforms for the exchange of data exist, which help with the standardisation of the related processes.

In the UK, a Data Communications Company (DCC) was created by the government, which connects customer and supplier as a return for payment. As a supplier you have to offer your customers a smart meter. Such a platform is likely to solve or at least reduce the data access problems.

In Germany the Bundesnetzagentur stated in its annual report 2017 that:

> "Demand-side management can enable larger consumption facilities to supply system balancing energy in the form of secondary control power or tertiary reserve. If the supplier of balancing energy is not also the energy provider or balancing group manager for the respective consumption point, however, the implications of supplying system balancing energy on the energy supply contract must be taken into consideration. This is the case with so-called third-party aggregators, for example. Third-party aggregators collect the flexibility of several installations and market it together. There had so far been no standards in place regulating the implications for energy supply contracts; from a market standpoint, this represents a significant barrier for the marketing of loads as balancing energy.
>
> Based on a proposal developed by industry associations at the suggestion of the Bundesnetzagentur, the Bundesnetzagentur has now established standard terms of contract for supply contracts when loads are marketed as balancing energy. These standard contract terms are meant to give consumption facilities easier access to the balancing en-

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

> ergy market, while at the same time removing distortions of competition for both balancing energy providers and electricity suppliers. This determination gives the companies sufficient leeway to adjust the contractual provisions to their specific needs and to develop them further. Under the Electricity Network Access Ordinance, however, suppliers can also exclude the provision of balancing energy by way of an explicit agreement.
>
> The standard terms of contract for supply contracts apply to market communication, balancing group settlement as well as supply and payment obligations. The determination does not regulate the terms of marketing balancing energy itself, such as pre-qualification of the installations, for example. These are laid out in the corresponding framework agreements of the TSOs, which must apply in a non-discriminatory way to all suppliers of balancing energy."[71]

Further, in Germany a supplier cannot deny the right to provide balancing services to a consumer or aggregator unless this has been explicitly stipulated in the supply contract. No obligation of notification or approval is foreseen with respect to the BRP as neither the end consumer nor their associated aggregator has a direct contract with them. Unless specified, an end consumer can provide balancing services through the BRP of the aggregator and the supplier's BRP is under obligation to "open their group".[72]

In Austria the supplier's consent is needed to if the independent aggregator and the supplier belong to different BRP portfolios. The aggregator has to coordinate with the respective BRPs.[73]

## III. Development of an enabling framework

### 1. In general

The Smart Grids Task Force work programme for 2012 stipulated that the Expert Group for Regulatory Recommendations (EG3) should develop a market reference model exploiting the synergies with the ICT sector and recommend regulatory incentives and obligations that protect and empower consumers and at the same time encourage the rollout of Smart Metering.[74] In the "First Year Report" by EG 3, it is stated that:

[71] Bundesnetzagentur, Annual Report 2017, p. 38 https://www.bundesnetzagentur.de/SharedDocs/Downloads/EN/BNetzA/PressSection/ReportsPublications/2018/AnnualReport2017.pdf?__blob=publicationFile&v=2.
[72] Poplavskaya/De Vries, A (not so) independent aggregator in the balancing market theory, policy and reality check, Delft University of Technology; Bundesnetzagentur, Beschlusskammer 6, Az. BK6-17-046.
[73] Poplavskaya/De Vries, A (not so) independent aggregator in the balancing market theory, policy and reality check, Delft University of Technology.
[74] EG3 First Year Report: Options on handling Smart Grids Data, 2013, p. 6.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

> "the diverse situations across Member States and the impossibility of defining a "one-size-fits-all" model has led EG3 to work on three cases. Based on the "Reference Architecture" for smart grids under the mandate M/490, these three cases should represent different options of handling Smart Grids data, built on the Information Layer of the mentioned architecture. As a result, EG3 has developed three Cases which all have the goal of guaranteeing active management and reliable operation of the grid and its connection points, and which should have customers at their very heart. Meeting these objectives calls for models that allow transparent contact between customers, producers, suppliers and network operators. In addition, these three cases should be easily definable and facilitate referencing against stakeholders' requirements (especially consumers). Each one of them, by itself or combined with elements from the others, should cover all the possible scenarios. It is recognised that variants of these three cases are also credible (e.g. in relation to metering ownership) and in fact can already be seen in specific Member States."[75]

Thus, these three cases/models should lead to a situation in the Member States, where access to data is not a barrier from the view of the deployment of flexibility. The Smart Grid Task Force further states in their report from 2015 that:

> "EG3 recognises that the proposed framework and actions may not be the only option and that other options are possible and may be more effective at EU or national level, depending on the circumstances. However, this work represents a high consensus among various stakeholders of the energy industry, and provides possible solutions in order to introduce demand side flexibility in the full range of energy markets, while creating a suitable framework for all actors involved."[76]

In this report, six recommendations are explained and refined. One of them is "Recommendation 3 on Contractual Arrangements" that contains the objective of a standardized framework. Two of the elements of such a framework are described as:

> "(…) The framework should also describe the standardised processes. From these roles and processes the data exchange, measurement procedures, payments and settlement can be derived. There are four elements to be defined through a standardized framework to allow for healthy market functioning while allowing consumers to choose their aggregation service provider.
>
> Data Exchange: A well-designed standardised framework should enable market participants to compete while protecting consumer rights – for

[75] EG3 First Year Report: Options on handling Smart Grids Data, 2013, p. 6.
[76] Refinement of Recommendations - Annex to EG3 Report "Regulatory Recommendations for the Deployment of Flexibility", 2015, p. 2.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

> example the right to data privacy. Standardisation sets out 'the rules of play'"[77]

The "Data Exchange" part is further described later in the report:

> "Data Exchange: Data exchange is important to ensure smooth market processes and safe consumer participation. The BRP requires data in order to know what is taking place within their portfolios in order to properly maintain balance and forecast their portfolio consumption.
>
> (…)
>
> It is important to define which level of information of data provides the BRP with the necessary information while protecting the privacy rights of the consumer and the commercial information of the aggregator. Each BRP should receive data at the relevant aggregated level concerning the activated demand side volumes on its balancing perimeter.
>
> The aggregated data could be calculated and transferred by a neutral third party. In the Balancing Markets the TSO could be a party responsible for this task. In the wholesale market adequate information exchange framework should be put in place and could be done by a neutral body defined at the national level. Other forms of standardised communication of data that do not involve third parties are also possible.
>
> The distribution of costs of the information system required should be assessed."[78]

Although there is no definite statement on how this data access and exchange shall be designed, it is concluded that, inter alia, data transfer is a critical element in respect of a standardized framework, and that it should be overseen by neutral third parties in order to create an even playing field.[79]

In the same document from 2015, the consumers group also highlights the importance of standardisation of and timely access to real time metering data.[80]

The regulatory group emphasises that the actual status of the grid must be transparent for all the actors in order to support new business models, which will be more dependent upon the state of the grid and/or the provision of transparent

[77] Refinement of Recommendations - Annex to EG3 Report "Regulatory Recommendations for the Deployment of Flexibility", 2015, p. 11.
[78] Refinement of Recommendations - Annex to EG3 Report "Regulatory Recommendations for the Deployment of Flexibility", 2015, p. 13.
[79] Refinement of Recommendations - Annex to EG3 Report "Regulatory Recommendations for the Deployment of Flexibility", 2015, p. 15.
[80] Refinement of Recommendations - Annex to EG3 Report "Regulatory Recommendations for the Deployment of Flexibility", 2015, p. 17, 21 – 25.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

and trustworthy data. They also point out the need of standardisation in order to achieve this objective.[81]

One part of the implementation process should be that:

> "DSOs and TSOs collect data, from grid users connected to their networks and from flexibility providers and BRP's who provide them services and have an open exchange of this data, relevant for their tasks."[82]

In 2017 it was foreseen the Commission will establish stakeholder working groups under the Smart Grids Task Force to prepare the ground for future EU action, for example through network codes, on:

- demand response, including aggregation;
- energy-specific cybersecurity rules; and
- data exchange and settlement rules.

And report on the final results by the end of 2018.[83]

Following the decision of the 2017 Steering Committee meeting of the Smart Grids Task Force, a Working Group on Demand Response is to be formed with the overall task to collect information and investigate the necessary further steps for facilitating demand response at EU level. EG3's work during 2014 and 2015 on the topic of flexibility and demand response and its deliverables were published in 2015 (see above) will form the base for the current work and the relevant conclusions shall be considered by the Group.

The scope of the work is on the deployment of explicit demand response in Europe. This refers to enabling final customers to become active in the market but also to system operators to make best use of flexibility in order to ensure efficient system operation on a regional level. As such, aspects of the work should include but is not limited to:

- Access to flexibility (e.g. demand response products) through organised markets in order to ensure a level playing field between demand side flexibility and generation.
- Use of demand side flexibility by system operators (DSOs and TSOs), including demand response and other flexibility services.
- (Contractual) arrangements between final customers, aggregators, suppliers (or their BRPs) and possibly other actors.

---

81 Refinement of Recommendations - Annex to EG3 Report "Regulatory Recommendations for the Deployment of Flexibility", 2015, p. 31 f.
82 Refinement of Recommendations - Annex to EG3 Report "Regulatory Recommendations for the Deployment of Flexibility", 2015, p. 38.
83 https://ec.europa.eu/energy/sites/ener/files/documents/eg3_-_tor_demand_response_final.pdf.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

Implicit demand response will only be addressed in so far as it affects the deployment of explicit demand response. The objective of the working group is to continue the work on the deployment of demand response at European level by identifying success stories and best regulatory practices across Europe. In this context, the group will also identify and analyse other issues linked to the wider concept of demand side flexibility. The aim should be the identification of remaining gaps that have to be addressed at EU level and propose what should be the scope of further and more specific EU action (i.e. network code) and which should be the areas that such EU actions will have to cover. Relevant outputs of the group, such as use cases, will be disseminated to the European Standardisation Organisations (ESOs), so that standardisation gaps can be identified and addressed.[84]

## 2. Austria

For Austria, the following aspects needed to be highlighted with a view on the development of an enabling framework for aggregators:

- Keep the market design as simple as possible.
- Clear and unambiguous definition of the regulatory framework, to reduce the room for interpretations for market participants.
- Clear and unambiguous definition of processes, to reduce the room for interpretations for market participants.
- If there are many different market participants, the amount of interfaces should be reduced → a central/single point for data exchange therefore could be the best solution.
- Extensive tests of rules and processes under real market conditions. → The sooner processes are tested under real market conditions, the better.
- Try to avoid the need of changes of the regulatory framework and processes by extensive testing.

## 3. Portugal

In Portugal, the DSO is the responsible party for the actual infrastructure for metering and access to data of final customers and forwarding it to relevant energy agents such as retailers. The DSO activities are regulated and the investments on the grid, including metering, have to be approved by ERSE.

Although EDPD has an internal plan for the smart meters rollout, the engagement with the national regulator is pivotal for overcoming this issue. The message should be clear and emphasise the benefits for clients on applying to demand response aggregation schemes. Otherwise, it will not be easy to justify a public investment on the grid infrastructure to enable these business models.

EDPD is the only relevant DSO in Portugal and is a regulated entity. Therefore, it depends on the remuneration received from the national regulator (ERSE). In order

[84] https://ec.europa.eu/energy/sites/ener/files/documents/eg3_-_tor_demand_response_final.pdf.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

to improve the systems and to receive quality customers' data, more money has to be spent on this purpose.

Thus, the current barriers for its implementation shall be highlighted, namely regarding the access of customers' data and how this constitutes a requirement for a real implementation of demand response.

An implementation plan of this business model should be elaborated, mentioning the required investments needed from the DSO. The tangible benefits for clients regarding energy savings should be presented as well.

It should be highlighted that renewable energy aggregation can significantly accelerate the integration of intermittent electricity sources, enhance demand flexibility and decrease the reliance on renewable energy support schemes. Moreover, this business model will contribute to the final consumers' empowerment on energy topics.

On the other hand, aggregators can also try to explore new solutions which do not rely on DSO investments. In that case, they would be responsible to deploy all the necessary systems to proceed with the implementation of the business model. For instance, EDP Comercial (EDP group's retailer) is running a pilot project in one office building to monitor the consumption and to control the flexibility through the management of the HVAC system based on the thermal inertia of the building. This constitutes a proof of concept, both technically and economically. In this pilot, the metering equipment, temperature sensors, ICT equipment to implement the DR project had a total cost of 3.000 €. A possible solution to reduce this initial investment cost would be to seek economies of scale when this BM is implemented widely.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

# E. Network charges/Grid tariff flexibility

## I. General description

### 1. Network charges

If network charges are charged on gross-basis independent of the origin of electricity, for the consumer it does not matter financially if the electricity comes from the grid (and maybe from the other end of the world) or it is self-produced (by the own PV-installation, for example). This can be an aspect that hinders the growth of self-consumption

### 2. Grid tariff flexibility

If grid tariffs rather fit to a steady consumption than the use of flexibility (e.g. consumers are charged both, an energy-based fee and a yearly capacity fee, if they exceed a particular MW threshold) this is a problem for aggregators that work with customers' flexibility. Such a design is likely to hinder business models that work with customers' flexibility.

## II. The situation in the target countries (UK, Germany & Belgium)

### 1. UK

At the moment, Good Energy focusses on the improved business model "automation and control". There are no substantial legal or regulatory barriers regarding business model automatization and control, other than the general data and privacy problems that occur at any project that involves data access and transfer. It has been implemented and is currently running in the UK.

Improved business model "peer-to-peer energy matching" is no longer pursued, at least at the current state. This is due to the fact that the conditions for this business model, or any kind of business model that involves a potential self-consumption component, are not favourable in the UK. This is mainly due to the network charge regulation in the UK.

Generally, in the UK network charges are paid both by producers and by consumers.

For the transmission grid, they are composed of a non-location specific component (the "residual charge") and a location specific component, which takes into account the power flows and the costs for grid investment. The tariffs are calculated based on the user's peak capacity over a given period of time for both production and consumption users: Basically, the average of the three highest demands during wintertime will be used. This has lead grid users, and in particular large industrial consumers to try to forecast peak demand periods and try to manage their consumption during those hours. On-site generation facilities – though by and large

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

conventional energy sources CHP technologies- are in use as well as strategies to simply shift or reduce consumption. Arguably, thus, for the transmission network charges, flexibility through customer behaviour is rewarded to some extent. What is more, those users connected directly to the transmission grid, as they all have "fully firm connections",[85] can theoretically take part in the balancing markets.

As regards the distribution network charges, there are different calculation methods depending on the voltage level the user is connected to. Again, network charges are due for both producers and consumers. The current methodology foresees a basic fee component, a consumption-based component and a peak component. The consumption-based component is based on the DSO forecast of how much capacity is needed for a given user, the peak component reflects how the actual capacity needed exceeded the forecast. In addition, there is a "red band" component, which takes into account the grid situation.[86] The main concern with this system is that – for household customers – the fixed fee and the consumption- or injection-based component determine the gross of the network charges. The potential advantages of peak-shaving can thus hardly be used. This is particularly disturbing for business models around aggregation and consumer flexibility where small self-consumption installations are involved. For them the peak component will not be large enough to be relevant for the actual network charges, it appears. Thus, the benefits of peak shaving and in particular the red band peaks, during which producers would actually get a credit and thus see overall reduced network charges, will by and large not be relevant. Rather, self-consumption is being charged where and when it is seen as production.

Allowing for aggregation business models to scale the consumption and production portfolios might significantly change that situation: as with large grid users connected to the transmission grid, aggregated portfolios of consumers and producers might be able to participate jointly in the balancing markets.[87] Allowing them to engage in (collective) peak shaving or something like peak aggregation (i.e. netting the different peaks of the individual entities in the portfolio) could be methods to incentivize more customer flexibility.

## 2. Germany

In Germany, network charges are to be paid by the user of the grid, which is the electricity supplier. However, suppliers mostly pass them on to their customers. While there is no obligation and suppliers use different methods in doing so, network charges will be an item on the electricity bill that could be used to incentivize flexibility services to the grid.

---

[85] Compare: IndustRE, D2.2 Regulatory and Market Framework Analysis, 2015, available at: http://www.industre.eu/downloads/?page=3 (last visited: 06.02.2019).
[86] See: Distribution and Connection Use of System Agreement (DCUSA), available at: https://www.dcusa.co.uk/SitePages/Documents/DCUSA-Document.aspx (last visited: 06.02.2019).
[87] Compare: IndustRE, D2.2 Regulatory and Market Framework Analysis, 2015, available at: http://www.industre.eu/downloads/?page=3 (last visited: 06.02.2019).

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

Network charges are regulated by the federal regulator, the Bundesnetzagentur (BNetzA). They are based on the revenues of the respective grid operators though and thus differ significantly throughout the country and depending on the specificities of the grid. For example, network charges in rural areas tend to be higher, as there will be less grid access points (i.e. customers) on which the costs for the maintenance of the grid can be distributed. For a similar reason, network charges in the north of the country tend to be higher than in the south.[88]

Generally, the network tariffs consist of three components: A basic price including a settlement fee which is due annually per access point, a capacity price component calculated based on the peak capacity supplied or purchased in a given year and the kilowatt-hour rate.

For household and smaller customers, below 100.000 kWh per year, generally (peak) capacity is not taken into account, so that they pay the kilowatt-hour rate combined with the basic price. For larger customers with less than 2.500 full hours, the network charges will mainly be defined by the kilowatt-hour rate as well. Only for very large customers, with more than 2.500 full hours per year, the capacity component is the defining factor for the network charges.[89]

However, there are several exceptions to the system:

- Large customers with a maximum purchase that predictably and considerably deviates from the annual peak consumption in a given grid can receive what is called “atypical” network charges, i.e. a reduction by up to 80% of their regular network charges (§19 (1) StromNEV).
- Large customers with a very high and stable consumption (7.000 or more full hours with at least 10 GWh) can claim a reduction in network charges by up to 90% (§ 19 (2) StromNEV).
- If a customer uses all the operating equipment for a given grid or frequency level, they will be entitled to what is called an “individual” network charge, based on the real costs of the equipment (§19 (3) StromNEV).
- Certain interruptible customers in the low frequency grid (mostly heating storages and heat pumps) can negotiate reduced network charges as well, compensating them for offering being managed by the grid operator (14a EnWG).
- Storage facilities are exempted – under certain circumstances and for a given time – from network charges as well (§118 (6) EnWG).
- There has been a rule allowing for a fee to be paid to decentralized production facilities, which was adopted according to the idea of “Vermiedene

[88] Consentec, BMWi-Vorhaben „Netzentgelte“: Auswertung von Referenzstudien und Szenarioanalysen zur zukünftigen Entwicklung der Netzentgelte für Elektrizität, 2018, available at: https://www.bmwi.de/Redaktion/DE/Publikationen/Studien/netzentgelte-auswertung-von-referenzstudien.pdf?__blob=publicationFile&v=6.
[89] Agora Energiewende, Netzentgelte in Deutschland, 2014, available at: https://www.agora-energiewende.de/fileadmin2/Projekte/2014/Netzengelte_in_Deutschland/Agora_Netzentgelte_web_101.pdf.

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

Netzentgelte" ("avoided network charges"), i.e. less use and thus less demand for enforcing the higher voltage grids (§18 StromNEV). However, with the growth of (volatile) decentralized renewable energy production, this measure is being phased out in order to account for the shift in the need to enforce the grid to lower voltage levels.

Thus, there are rules that do reward specific services to the grid.

Still, those rules do not provide solutions for business models working with household and smaller customers' flexibility who by and large pay a fixed monthly basic fee plus an added purchase-based component. Those customers would hardly have any interest in shifting their consumption behaviour and thus offer flexibility or participating in aggregation services for that matter. This effect is increased the higher the basic fee component is set.

There have been complaints that with all the exceptions – mostly benefiting large industrial customers – the network charges in Germany are very high. In addition to that, there are several surcharges on electricity consumption. With that, though, one should assume that electricity prices – and network charges as one of their components – could be a very interesting instrument for steering customer demand and supply behaviour. A reform of the network charges is thus something that has been discussed for years.

There have been arguments that the network charge reductions for large industrial customers would be unreasonable and in any event a disincentive for flexibility like peak-shaving. The measure in §19(1) StromNEV has led those customers to rather create very flat and stable consumption portfolios, in order to benefit from the far-reaching reduction in the network charges, rather than experimenting with offering flexibility.

Some criticise the phase-out of the Vermiedene Netzentgelte as this would reduce incentives for customers to become self-consumers or build local energy production facilities in general. The very strict definition of self-consumption has been mentioned as problematic for flexibility and aggregation business models as well: Self-supply under German law requires "the consumption of electricity which a natural or legal person consumes himself in the immediate vicinity of the electricity-generating installation if the electricity is not fed through a grid system and this person operates the electricity generating installation himself".[90] In particular the requirement that it has to be the identical person operating the installation and consuming the electricity makes the concept hard to use in an aggregation setting.

### 3. Belgium

In Belgium, DSO connected units must pay both transmission and distribution grid tariffs. Together they make up to 1/3 of the final price of energy. The distribution

[90] Clearingstelle EGG, EEG Englische Fassung, 2017, Art. 3(19), available at: https://www.clearingstelle-eeg-kwkg.de/files/node/8/EEG_2017_Englische_Version.pdf.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

grid fee is calculated based on the metered energy offtake (volume), where the unit price is determined by the offtake peak (power). The peak power sets the tariff for the rest of the year.

Such tariff scheme discourages provision of flexibility. Take for example a battery installed at DSO-level. When there is large excess of energy in the grid, the battery could charge at full power to alleviate some of the pressure of the system. This pushes up your grid tariff for the rest of the year, while you were balancing the grid at a crucial moment.

While larger consumers (everything bigger than a household) have an AMR-meter for injection and offtake, households still have an analogue Ferraris meters in Belgium. This means that there is no option to steer households on short term price signals, for example on day-ahead or on imbalance. Without proper metering data it is not possible to consider flexibility in any kind of way. Thus, grid operators resort to tariff methodologies that are based on the available data, resulting in tariffs with a capacity and a peak component, or fixed rate payments solely based on capacity, as the tariff in Flanders.

The analogue meters further created problems with the increase in self-production from – in particular - solar PV installations. DSOs were thus faced with fluctuating electricity injection into their grid on sunny summer days, while in the winter or generally at night, (self-) producers consumed electricity from the grid. The analogue meters do not accurately show consumption and injection separately and at the times they occur, but the teller turns and runs backwards in time of injection. They thus do not account for real time consumption data and give DSOs no chance to take into account flexibility properly.

For that reason, Flanders recently introduced a “prosumer” tariff. While this is a questionable policy, as it discourages the (self)-production of PV electricity, the measure was taken due to lack of better options. The tariff was introduced for all small (below 10 kW) renewable electricity production units used for self-production. It is based on capacity of the installation and the exact amount differs depending on the location, i.e. the distribution grid it is connected to. While this is a questionable policy as it discourages the installation of Solar PV installations, it shows the big problem when it comes to network charges in Belgium: Lack of appropriate metering infrastructure.

### 4. Comparable situations in other countries

The aggregation of all peak capacity behind a grid access point, thus before it is passed onto the grid, could allow taking into account customers’ flexibility in systems that do use peak capacity as a component of the network charges. It has been introduced in Italy in order to remove the discrimination of customers in apartment buildings compared to single-family homes. Where people living together in such a building are charged based on the most extreme capacity peak in the building, and not of their own, or the aggregated impact actually delivered to

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

the grid, all incentives for adapting consumption behaviour are taken away.[91] Allowing aggregation, i.e. evening out of the individual peaks before the grid access point, can be a solution for such cases.

One could imagine scaling this to larger customers who do see a peak capacity component within their network charges. Possibly, the aggregation could be done by the BRP. While currently, the BRP only balances the electricity injected and taken out of the grid, one could experiment with allowing them to take the peak capacity measurements of all customers connected in their balancing circle and even them out against each other. That could reduce the peak capacity to be taken into account for all of them, and thus that component of the network charges. However, it requires the installation of several meters (i.e. a main meter for the BRP and sub-meters for the customers) and changes in the billing and administrative practice. In the end, this might be too much effort compared to the financial advantage it might have, in particular where customers in the balancing circle have very similar consumption profiles. It might become more interesting though, the more they differ.

## III. The renewable energy directive (RED II)

Problems, like the ones mentioned in the UK, regarding the network charges can be problematic aspects when it comes to the Clean Energy Package, which aims to facilitate local self-consumption because such a regulation rather counteracts this idea. To identify the colliding aspects in detail, an analysis of the relevant legal basis that is found in the new renewable energy directive (RED II) is necessary.

Regarding to Art. 21 para. 2 RED II, Member States shall ensure that renewable self-consumers, individually or through aggregators, are entitled to generate renewable electricity, including for their own consumption, store or sell their excess production of such electricity, without being subject:

- in relation to the electricity that they consume from or feed into the grid, to discriminatory or disproportionate procedures, and charges and to network charges that are not cost-reflective;
- in relation to their self-generated electricity from renewable sources remaining within their premises, to discriminatory or disproportionate procedures, and to any charges or fees.

Thus, if renewable self-consumers solely use self-generated renewable electricity without access to the grid they cannot be charged in any way, regarding to the upcoming EU legislation. However, Art. 21 para. 3 RED II offers three exceptions to this general rule, where Member States are allowed to apply non-discriminatory and proportionate charges and fees to renewable self-consumers, in relation to

[91] Agora Energiewende, Netzentgelte in Deutschland, 2014, available at: https://www.agora-energiewen-de.de/fileadmin2/Projekte/2014/Netzengelte_in_Deutschland/Agora_Netzentgelte_web_101.pdf.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

their self-generated renewable electricity remaining within their premises in the following cases:

- if the self-generated renewable electricity is effectively supported via support schemes, only to the extent that the economic viability of the project and the incentive effect of such support are not undermined;
- from 1 December 2026, if the overall share of self-consumption installations exceeds 8 % of the total installed electricity capacity of a Member State, and if it is demonstrated, by means of a cost-benefit analysis performed by the national regulatory authority of that Member State, which is conducted by way of an open, transparent and participatory process, that the provision laid down in point (a)(ii) of paragraph 2 either results in a significant disproportionate burden on the long-term financial sustainability of the electric system, or creates an incentive exceeding what is objectively needed to achieve cost-effective deployment of renewable energy, and that such burden or incentive cannot be minimised by taking other reasonable actions;
- if the self-generated renewable electricity is produced in installations with a total installed electricity capacity of more than 30 kW.

# IV. Development of an enabling framework

## 1. UK

In respect of the upcoming changes in the energy market, the situation in UK would likely to be solved by the national implementation of Art. 21 RED II. Although, due to the “Brexit” there will be no obligation to follow a European directive, it can be recommended to implement the relevant aspects in the English market design, in order to facilitate the development of renewable self-consumers’ participation in the energy markets, and to give aggregators the opportunity to work with these customers.

However, independent of the question of facilitating aggregator business models or self-consumption schemes on European level, there are efforts to reform the charging system in order. Those are intended to address issues that have recently arisen in the context of storage and flexible use of the grid. First documents are to be published summer 2019 and the final decision is expected by end 2020.[92]

While thus in the light of the Brexit, there might not be legal obligations on the UK to adopt favourable legislation for aggregation business models focussing on customer flexibility, the reform might lead to an improved situation after all. It is thus recommended to work on those reform processes and create a more flexibility-friendly network charge tariff structure.

[92] See: Ofgem, https://www.ofgem.gov.uk/electricity/transmission-networks/charging/reform-network-access-and-forward-looking-charges (last visited: 06.02.2019).

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

## 2. Germany

A reform of the grid use tariff structure is being discussed for several years now and first steps have been taken – however, not necessarily improving the prospects for business models using customers' flexibility. Solutions in this regard could be:

- Time-differentiated prices; or
- The introduction of dynamic prices for customers whose network charges are based mainly on the purchase-based component; as well as
- Shortening the time window for measuring peak capacity;
- Time-differentiated prices for capacity-components for customers whose network charges are dominated by the capacity component.

**Time differentiated prices:**
Smaller and household customers in Germany pay network charges based on their consumption from the grid, their peak capacity not even being measured. In addition, there is basic fee. While one could think of eliminating the basic fee and only charge based on consumption, a reasonable, and not too high basic fee may be justified.[93]

This means that flexibility could best be addressed in the purchase-based component. For example, one could introduce time-differentiated tariffs, which would encourage customers to adjust their consumption behaviours to off-peak hours. Day- and night time tariffs might be an option. Even more differentiation with shorter intervals or – at best - real time pricing depending on the grid situation for short time intervals could turn even purchase-based network charges into a powerful tool to steer consumption behaviour.

**Dynamic pricing:**
"Dynamic pricing", i.e. a system in which the prices are adjusted to the real time situation in the grid, would however require the roll-out of respective metering infrastructure. Smart meters would need to be installed for all customers so that grid operators have the data needed to calculate and apply dynamic prices. This has not happened yet.

While Germany adopted a law in 2016, which set a time table for the smart meter roll-out,[94] there are difficulties with the certification of available metering technologies. However, it is still planned to have all meters replaced by 2032.

**Shorter time intervals for measuring peak capacity:**
Peak capacity is only relevant for larger customers in Germany. To have their flexibility taken into account in the context of this component of the network charges, shortening the intervals over which peak capacity is measured is probably the most effective measure. Taking monthly instead of annual data, would allow

[93] Agora Energiewende, Netzentgelte in Deutschland, 2014, available at: https://www.agora-energiewen-de.de/fileadmin2/Projekte/2014/Netzengelte_in_Deutschland/Agora_Netzentgelte_web_101.pdf.
[94] Gesetz zur Digitalisierung der Energiewende (Law on the digitalisation of the energy transition).

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

for readjustments during summer or winter time, and generally incentivize energy efficiency. Even shorter periods would increase that effect as would capacity pricing adjusted to the grid situation. One could even imagine a system with dynamically priced capacity components. However, there would need to be a proper cost-benefit assessment before diving into the development of such measures.

## 3. Belgium

Changing the grid tariff structures in Belgium in order to accommodate for flexibility services could facilitate the rise of aggregation business models. However, a differentiation between transmission and distribution grid should be considered as well as to the federal structure of the country. In summary, the following actions seem promising:

- No change in network charges in the transmission grid, but rather focus on improving access to the aFRR market;
- Change in network charges in the distribution grid to take into account flexibility offered to balance electricity in the local grid;
- Smart meter roll-out in all regions in order to create the appropriate infrastructure allowing distribution grid operators to value flexibility in the network charges; and
- Create a framework in which distribution grid operators can locally procure balancing services.

### *a) General introduction - Energy legislation in Belgium*

In order to be able to address the barriers for flexibility-based aggregation business models identified regarding network charges, it is necessary to have a look at the legal framework for electricity production, supply and consumption in Belgium. The legislative competence in the field of energy is shared between the Federal legislator and the regions. The Federal legislator has the competence to regulate matters which require national rules due to cross-regional economic and technical impacts. Notably, those include the national electricity infrastructure, i.e. is the Belgian transmission grid, the transmission grid development and the transmission grid tariffs.[95] All other competences in the field of energy remain with the regions.[96] The regions thus regulate their respective distribution grids, their development and the tariffs for using them. Lack of flexibility in the tariff structure thus could be addressed on two levels: nationally for the transmission grid, and regionally for the distribution grid.

[95] This also includes the development of the offshore grid and the interconnectors with neighbouring countries.
[96] See: Art. 6 § VII Special Law of 8 August 1980 to amend the Constitutional Law, also: Nysten, Belgium, in: EU Energy Law Volume III, Renewable Energy in the EU Member States, Claeys & Casteels, 2018, p. 41-71, 41.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

### *b) No change to the network charges in the transmission grid*

Network charges for the use of the transmission grid are paid by the consumers. Consumers directly connected to the transmission grid only pay transmission network charges. When they are connected to the distribution grid, they pay transmission and distribution network charges. However, when they are not using the public grid, for example through on-site self-production, consumers can be exempt from those charges.[97]

The transmission network charges are regulated by the federal regulator and published on their website.[98] They consist of a peak and an offtake component, as well as a compensation for the TSO Elia for the cost of the grid management. They thus currently do not allow taking into account flexibility.

In addition to the uniform transmission grid charges, all consumers who receive their electricity from the public transmission grid have to pay a specific charge, the "federal contribution".[99] The charge covers different cost factors to the energy system, such as the phase-out of nuclear power. Energy-intensive consumers are eligible for a reduction of the federal contribution, but the charge does not incentivize flexibility.

Different measures could be taken to lower the burden of transmission network charges: For installations connected only to the transmission grid, i.e. those which pay only network charges on transmission grid level, one could imagine changing the tariff structure so as to allow taking into account flexibility services. However, the efficiency of this measure is questionable: Are there as many installations to benefit from such a change so as to justify the regulatory effort and put it onto the agenda of the Federal legislator?

One could also think about reductions of exemptions in case a consumer is receiving electricity from a local producer connected to the same distribution grid. However, "local production, local consumption" is a fiction due to the physical nature of electricity. Unless those local units were not connected to the public grid anymore, in which case they would already be exempted under current legislation, the transmission grid would still have to be maintained and managed. That questions the justification of the measure. Such a reduction/exemption would further result in higher network charges for other grid users, which politically is hard to defend.

Thus, for the transmission grid, one might want focus on better access to the aFRR markets and have flexibility rewarded in the course of specific auctions and contracts. As mentioned above, Elia is working on that and while there is not yet a

[97] IndustRE, Model Contracts, 2016, available at: http://assets.industre.eu/media/downloads/IndustRE_D3.1_Model_Contracts.pdf.
[98] See: https://www.creg.be/nl/professionals/toegang-tot-het-net/elektriciteit-transmissie/nettarieven-elia.
[99] Art. 21bis – 21quater of the Law of 29 April 1999 on the organisation of the electricity market – Wet van 29 April 1999 betreffende de organisatie van de electriciteitsmarkt.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

concrete time line for full implementation of the new rules, steps have been taken into the right direction. (As already discussed under C.)

### *c) Possible solutions*

**Changes in the network charges in the distribution grid:**
As with the transmission grid, network charges in the distribution grid are paid by consumers, rather than producers. They are regulated by the three regional regulators (VREG, CWaPE and BRUGEL) and differ not only between but also within the regions.

As mentioned above, the big problem with the network charges in Belgium is that metering data from (household) consumers is not timely and accurate, so that distribution grid operators cannot take into account any flexibility in production and consumption.

In order to change this practice and allow for flexibility to be honoured over the distribution network charges, one would have to first change the metering infrastructure. Only once DSOs have more accurate and timely information over the electricity production and consumption, they could change tariff structures in a way to take into account any flexibility in supply and demand. Smart meters are considered a solution to this problem and there are plans for a roll-out in the different regions in Belgium.

**Smart meter roll-out:**
As this is not a Federal competence, the developments regarding meter replacement in the three regions are different. They also depend on the amount of volatile renewable electricity in the respective grid. In the Brussels region, where renewable energy plays only a minor role,[100] less thought is given to such matters, while in Flanders and Wallonia they may be more of an issue.

Flanders has announced a smart meter roll-out from July 2019 onwards and intends to have replaced all meters by end 2022. Once those smart meters are in place, grid use tariffs shall be based on actual electricity consumption.[101] In particular, the prosumer tariff will then be abolished. Instead, prosumers will pay network charges based on their actual consumption from the grid against which the injection into the grid is netted. The Flemish regulator VREG expects that – once sufficient smart meters are installed – electricity suppliers will respond with the development of flexible electricity products, i.e. a change in the electricity prices. In this context, storage facilities are mentioned and shall after the changes in the tariff structure assist the grid in “peak shaving”.[102]

---

[100] See: Nysten Belgium, in: EU Energy Law Volume III, Renewable Energy in the EU Member States, Claeys & Casteels, 2018, p. 41-71, 43ff.
[101] Decision by the Flemish government to amend the Energy Decision of 19 November 2010 concerning the out-roll of smart meters - Besluit van de Vlaamse Regering tot wijziging van het Energiebesluit van 19 november 2010, wat betreft de uitrol van digitale meters.
[102] See: VREG, Digitale Meters, https://www.vreg.be/nl/digitale-meters##17.

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

In Wallonia, first smart meters have been installed in the course of different pilot projects by the respective grid operators.[103] However, in 2018 the Walloon government decided to amend the law and introduce a roll-out starting 2023 for household customers and in case of meter replacement. By 2029, 80% of the meters shall be smart meters.[104] With the same Decree, the Walloon government has tried to strengthen the role of a “flexibility provider”. While changes in the tariff structures have not been announced, similar to what is happening in Flanders, one might expect the regulator to take the data from smart meters into account when setting the tariff structures.

Sibelga, the DSO of the Brussels region, has started installing smart meters in case of meter replacement or major renovations. In 2018, 5000 smart meters were installed in the course of a pilot project. In fact, Sibelga is installing smart meters since 2017, however, the “smart” functions are currently disabled. There seems to be no systematic roll-out planned.[105]

Those efforts should be supported and once the meters allow for the data needed to be read out, regional regulators should consider setting up grid use tariff structures that allow taking into account flexibility. Suggestions could be:

- Separate metering of injection and consumption and tariffs based on actual consumption;
- If a capacity component is going to be used, tariffs based on 15-minute injection/consumption intervals to allow for peak shaving;
- Time differentiated network charges to take into account customers’ flexibility;
- Possibly even dynamic pricing adapted to the actual situation in the grid.

The Flemish regulator is currently looking into such a reform and open to the idea of rewarding flexibility in some way in the grid use tariff structure. However, their goal is always to have a simple, clear, and transparent tariff scheme first, which certainly is another important aspect for new actors in the electricity market.

**Local balancing service procurement:**
Other suggestions could be allowing DSO to procure balancing services in their local grid. There are attempts at European level to encourage DSOs to become more active in balancing activities within their own grid and the development of

[103] E.g. ORES, Intelligente Zähler, see: https://www.ores.be/privat-und-gewerbekunden/Aktueller-intelligenten-Z%C3%A4hler.
[104] Decree of 19 July 2018 by the Walloon government relating to the deployment of smart meters - Décret modifiant les décrets du 12 avril 2001 relatif à l'organisation du marché régional de l'électricité et du 19 janvier 2017 relatif à la méthodologie tarifaire applicable aux gestionnaires de réseau de distribution de gaz et d'électricité en vue du déploiement des compteurs intelligents et de la flexibilité.
[105] See: https://www.brugel.brussels/acces_rapide/consommateurs-7/les-types-de-compteurs-10.

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

flexibility markets.[106] However, it will depend on the implementation in Belgium, or rather in the three regions, whether such local balancing markets can develop.

[106] Compare Art. 32(1) IEM-Dir., there it says that "Member States shall provide the necessary regulatory framework to allow and incentivise distribution system operators to procure flexibility services, including congestion management in their service area, in order to improve efficiencies in the operation and development of the distribution system. In particular, regulatory frameworks shall ensure that distribution system operators to procure services from resources such as distributed generation, demand response or storage and consider energy efficiency measures, when such services cost-effectively sup-plant the need to upgrade or replace electricity capacity and which support the efficient and secure operation of the distribution system. Distribution system operators shall procure these services ac-cording to transparent, non-discriminatory and market based procedures unless regulatory authorities have established that the procurement of such services is economically not efficient or if this leads to severe market distortions or to higher congestions.".

# F. FOSS Cyprus – case study

In Cyprus the most important players are: the one TSO, CERA (Cyprus Energy Regulatory Authority) and the Ministry of Energy. For FOSS Research Centre, University of Cyprus it is important that demand response is allowed and integrated in the framework, especially for aggregators, and that the storage sector is covered by the new market rules.

At the moment the National situation in Cyprus does not fit well on aggregation, but with a look on the upcoming Clean Energy Package several chances to facilitate this sector arise. Especially FOSS can be seen as a pioneer in the development of future market models. They focus on Local aggregation services for providing flexibility to grid operation including congestion management.

## I. Introduction

Local aggregation services for providing flexibility to grid operation including congestion management is already a possible business case[107] for Cyprus. This process will generate options for flexibility trading in support of the local grid as an added benefit. It is being investigated in Cyprus with two distinct use cases:

- Single mid-scale commercial or industrial consumers through the control of all assets from a single point of connection to the grid; and
- Spread small prosumers who are aggregated through the use of appropriate in-house energy management systems and smart connectivity with the local DSO.

## II. The University of Cyprus campus

This paragraph covers the case of the University of Cyprus as a mid-size commercial consumer with local PV generation and storage. Spread prosumers are also investigated in Cyprus but no simulated analysis is available at present.

The target is to transform the large campus of University of Cyprus (UCY) into a self-consumption controllable microgrid, which will be fed by PV and central and distributed energy storage systems. The campus microgrid will be able to operate either grid-connected, offering at the same time the possibility for ancillary services to the DSO, or isolated in case of a grid fault or other operational necessities. In order to design the campus microgrid, initial simulation tests are carried out. During the simulation work, exhaustive tests on the already existing system are conducted to validate results and assist the simulated analysis work.

[107] Utilising net billing and net metering tariffs with time of use cost elements embedded in them offers options for minimizing energy cost through effective use of local RES generation and storage.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

# III. Definition of the University of Cyprus campus microgrid

## 1. Energy management of the University of Cyprus campus

Currently, the measured peak load of the campus is 2.4 MW, while the locally installed photovoltaic (PV) systems at the rooftop of the buildings have a nominal power of 394.8 kWp. Additionally, each of the campus main buildings is equipped with a different Building Energy Management System (BEMS) that automatically monitors the electrical load demand and controls a range of building services. At the moment, the produced energy is totally fed into the grid following a feed-in-tariff pricing policy, while the UCY electricity demand is covered by the utility grid. In the upcoming years, the UCY plans to install a new solar PV installation of 10 MWp together with a BESS at the university, in order to enhance the self-consumption and enable the provision of ancillary services to the grid. When the whole project will be finished, the university campus will be transformed into a fully operational microgrid, being able to fulfil its own energy consumption by its own RES installations, while it will be connected to the utility grid via a single point of common coupling (PCC). Thus, it will serve as a controllable section of the grid that will be able to disconnect from the distribution grid under emergency or planned operational regimes and operate autonomously, as an independent electrical island.

The university campus is currently undergoing new construction infrastructure, so the investment project and the purchase of the PV and battery equipment will be implemented in the following two phases; firstly, the partial integration of the large PV installation with the properly sized BESS (Battery Energy Storage Systems) in order to enable the microgrid operation and secondly, the rest PV installation with the BESS in order to cover all the newly constructed buildings within the UCY campus microgrid. According to the preliminary study, this installation will be implemented in two phases: in the first phase, 5MWp of PV will be installed combined to 2.35MWh battery energy storage system, in the second phase the rest 5MWp of PV will be installed combined to another 5.15 MWh battery energy storage system. The model developed in this report takes into account the whole-year operation of the university microgrid.

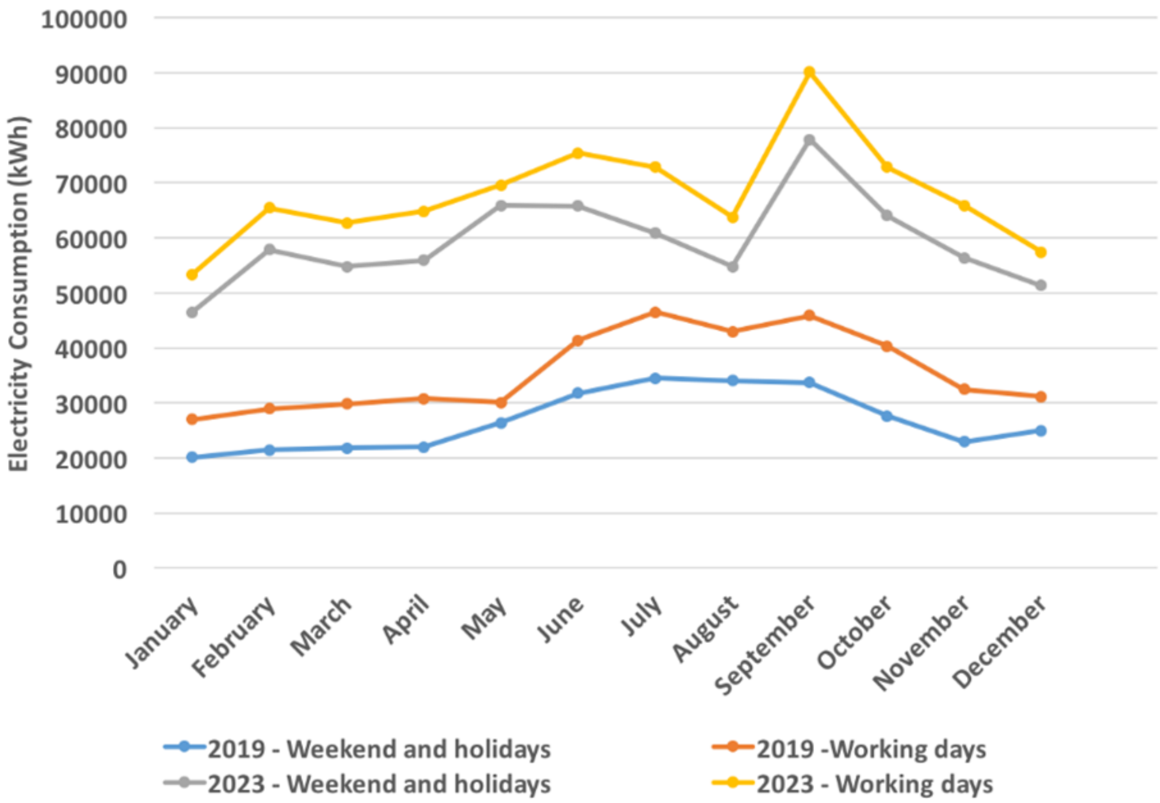
## 2. Electrical consumption

In order to evaluate the possible aggregated business options, the electrical consumption of the UCY campus will be initially presented. For this reason, electricity consumption and demand profiles of the university have been extracted based on measurements provided at the point of common coupling, the distribution substation of the DSO (at the MV busbar of the transformer), with a 15-minute interval, for the year 2016. The UCY is an educational institution with variations in electricity demand across different days of the week and within the seasons, so it is interesting to analyse its load profile depending on the following classification: Working days, from Monday to Friday, and non-working days, such as public holidays, Saturdays, Sundays and non-school days. The analysis considers these two

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

basic classifications in order to distinguish all the possibilities of the consumption profiles. The current and future average daily electricity consumption of the University campus under these classifications can be seen in Figure 13, where a consumption peak in September is obvious. The reason behind the peak is the type of electrical loads, which mainly consist of electrical cooling, due to high temperatures in Cyprus and the occupancy of the campus in this period. The high consumption period is within the working summer months (June-July) and September. Furthermore, the type of heating loads should also be considered. Currently, the fuel oil is used, while in the new buildings electrical heat pumps are planned to be installed. This is an important factor for the future design and sizing of the microgrid.

**Figure 7**: Current and estimated future average daily electricity consumption of UCY campus



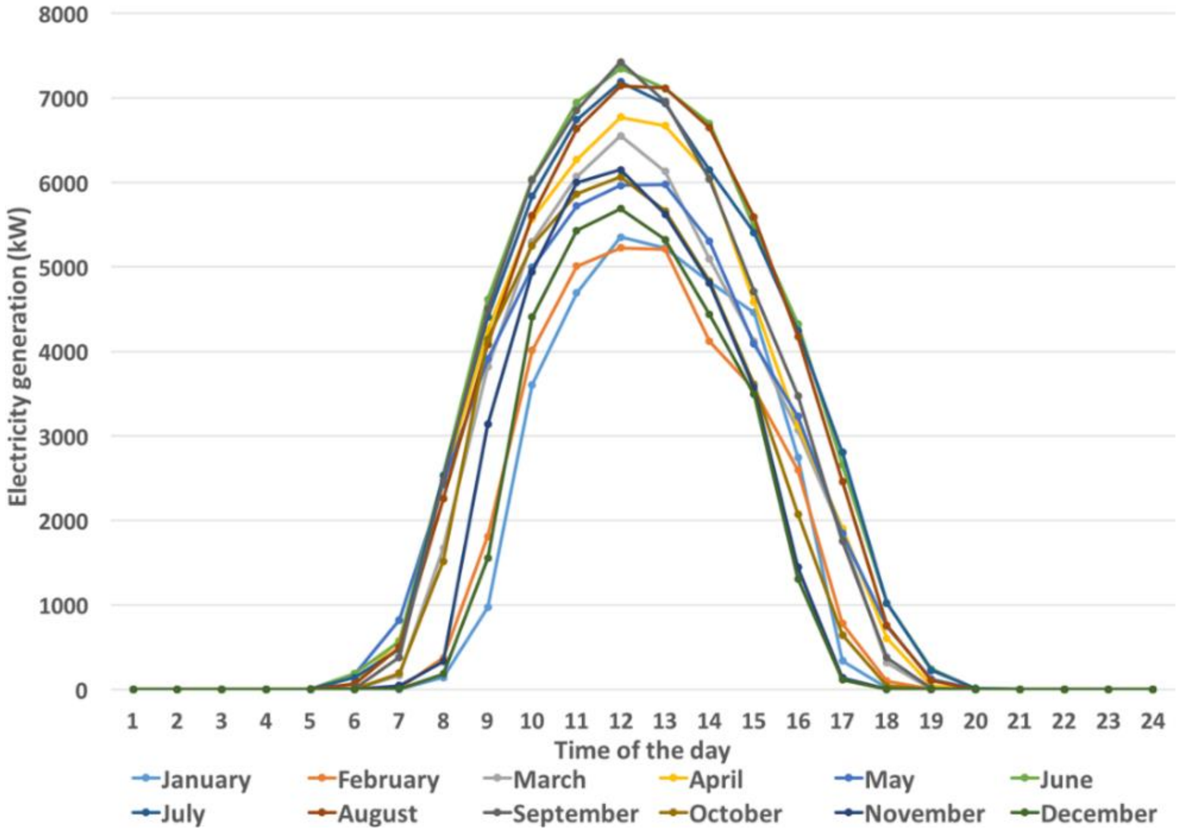

## IV. PV energy production

In this report, actual measurements from the existing PV installation have been used, to extrapolate the expected annual energy yield of a 10 MWp PV system. Furthermore, the unity power factor of the campus load and an annual degradation rate of 1% of the PV systems have been considered in the presented calculations, to estimate precisely the energy yield of the system for a period of 20 years. The generated energy of the 10 MWp system has been adapted to hourly generation profiles and compared with the hourly consumption profiles of the campus for the whole year, to identify the energy excesses and deficits of the PV system along a specific period. Figure 14 shows the hourly PV generation profile of the 10 MWp PV system on the typical day.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

The planning period in the case study is 20 years and the technical considerations of the microgrid design aim at minimizing the cost of energy using local generated energy, storage and future aggregated flexibilities for the benefit of the grid.

**Figure 8**: Hourly generation curve from the projected 10MWp PV installation




## V. Market rules in Cyprus: Aggregators and demand response

Although the market is fully open in Cyprus there are no market rules in operation yet. They are currently under preparation and expected to be applied as from July 2019. Aggregators are introduced in the new market rules, but demand response is not incorporated until the market matures and smart meters with associated infrastructure are rolled out. The market rules include the following as guiding principles:

**RES aggregators:**
Entities which undertake to cumulatively represent small RES plants operating outside National Grant Plans (NGPs) towards the MO and the TSO. The cumulative capacity they can represent has a lower limit of 1 MW and upper limit of 20 MW. RES aggregators by default undertake the role of the BRP.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

**Participation in day-ahead market:**
Suppliers and generators provide bid curves to a day-ahead Market (DAM) on a half hourly basis. Orders in the DAM are unit based in the case of generators or per RES plant or per RES aggregator.

**Aggregating RES in the day-ahead market and balancing market:**
New RES plants operating outside National Grant Plans (NGPs) may either contract on a bilateral basis at the forward stage or bid into the DAM pool. RES plants operating outside any support scheme with installed capacity above 1 MW may either directly participate (per plant) into the market arrangements or through an aggregator. An upper limit determined by CERA is introduced to the aggregated quantities. Direct participation to the market involves forecasting responsibilities per plant. RES plants operating outside any support scheme with installed capacity lower than 1 MW may only participate through an aggregator. In either case (either individually or through an aggregator) corresponding operators should take care to install adequate metering facilities that will allow for at least half-hourly metering of their output.

RES plant operators (as well as RES aggregators) which hold appropriate technical capabilities and equipment (in accordance with the specifications and criteria as set by the TSO) allowing them to follow TSO's dispatch orders may participate offering downwards balancing energy from the beginning of market operation. RES plants participation to the balancing mechanism should be initiated on equal terms and obligations compared to those applied to conventional units and dispatchable load. Obviously, this requires that the RES plants hold appropriate technical equipment that will allow the process to treat them under the same arrangements.

Aggregators of RES plants operating outside NGPs for an aggregated size of RES plants from [1] MW up to [20] MW each, should notify the MO of any bilateral energy contracts they hold on a cumulative basis, submit declarations of the technical data of the RES power plants they represent, forecast and nominate physical delivery on a day-ahead basis on a cumulative basis, submit orders to the DAM on a cumulative basis, and hold appropriate accounts for the purposes of the settlements performed by the MO.

It is further clarified that RES plant participation to the BM through bids for downwards balancing energy applies only to RES plants outside any NGPs. RES aggregators, provided that they hold adequate technical capability, may also participate to the BM in which case the total of the RES plants they represent is addressed as one "virtual" plant with specific energy absorption capabilities.

**Demand response to be introduced in the future:**
Demand response will not be applied in July 2019 as Cyprus is an immature market. This will be introduced as technologies are made available that allow demand response.

Based on the principle of avoiding reserves procurement under terms that distort the market and create barriers to entry for new players, the market rules aim to

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

avoid long-term commitments for reserves procurement. This is also suggested by the ACER FG which clearly dictates that TSOs should procure as many reserves as possible in the short term and as close to real time as possible, by limiting the duration of reserve contracts so that it facilitates participation of new entrants, demand response and renewable generators as well as small generators.

Market rules will be drafted so that demand side (dispatchable load) could also participate to operating reserves procurement, provided it holds appropriate technical capabilities to meet activation times set by the TSO under each type of procured reserve.

To this effect, dispatchable load may place offers to decrease consumption i.e. to sell energy to the system. Corresponding offers will be taken into account in determining the upwards balancing energy marginal price. Accepted offers for demand decrease are paid to the supplier, representing the corresponding dispatchable load, by the MO at the corresponding marginal price. Similarly, dispatchable load may place bids to increase consumption i.e. to purchase energy from the system. Corresponding bids will be taken into account in determining the downwards balancing energy marginal price. Accepted bids for demand increase are paid to the MO by the supplier representing the corresponding dispatchable load, at the corresponding marginal price. For simplification purposes during the first phase of the market operation single price-quantity pairs for each half-hourly period are suggested to be placed for demand increases/decreases. This arrangement will be initially feasible for large consumers with appropriate technical characteristics which could provide balancing energy either by also acquiring the status of retail supplier themselves or through their retail supplier.

Demand response is a service that can be provided either by suppliers serving load or by entities (Demand Response Agents) who aggregate smaller retail customers and directly bid corresponding capacity into the wholesale markets. In this respect demand response programs run by the DSO could directly participate in the wholesale arrangements as well. Demand Response Agents should therefore accede to the market rules and become market participants.

In case of demand response, corresponding Agents will also be allowed to offer load curtailment at the DAM stage under arrangements that approximate those of generating units' orders.

As ultimately the income from the corresponding service should be passed to the retail customers, the DR Agent and the supplier (in case these are different entities) should proceed with bilateral arrangements which will provide for the income to be reflected in supplier's retail tariffs to end consumers.

The market rules also clarify that DR Agents may also place offers for FCR, FRR and RR1 availability, provided that the corresponding demand holds appropriate technical characteristics allowing it to respond within the time frame set by the TSO for each type of reserve activation.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

# G. Sum up & relevant aspects and recommendations for an enabling framework for aggregators on national level

## I. Access to and participation on the balancing market

The possibility to access and participate on the balancing market is a very important topic for aggregators that work with customers' flexibility. In some countries access to this market is problematic for aggregators, because particular thresholds have to be reached, or other specific rules exist that hinder the participation of smaller market players like aggregators. Those problems occur in France, Italy, Belgium and Portugal.

### 1. France

**For France, the following aspects have to be highlighted:**

- A change of the French market design seems to be necessary in order to meet the requirements of the GL-EB, which is directly applicable law and aims to facilitate the participation in the balancing markets of renewable energy and demand response, be it directly or through aggregators.
- France should keep working on an open participation to the ancillary services.
- The primary market should be opened for secondary reserves/aFRR for smaller market players, like aggregators → this would mean the abolition or reduction of the 120 MW threshold/the "obligation system" as a whole.
- The CRE takes part in the work of the European regulators that aims to develop European exchange platforms for balancing reserves "reserves d'équilibrage". In the near future, the PICASSO[108] project creating the aFRR-Platform will involve the TSOs in this European platform where the exchange of all balancing energy from aFRR will happen[109].

### 2. Italy

**For Italy the following aspects need to be highlighted in respect of the new/upcoming rules of the Italian energy market:**

- The data availability is a critical success factor for the new challenging environment → the information about bids volume and prices would require even more detailed reporting.

[108] Platform for the International Coordination of Automated Frequency Restoration and Stable System Operation.
[109] Entso-e, „explanatory document to all TSOs' proposal for the implementation framework for a European platform for the exchange of balancing energy from frequency restoration reserves with automatic activation in accordance with Article 21 of commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing, p. 6.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

- The quantity and timing of data availability could play a relevant role in the market and Terna and the Authority ARERA should set a proper balance of information disclosure, considering the possibility that such information might affect the active bidding process of BRP.
- Price signals should be widely available, taken care also of recent past experience where distortions and speculative attitude have been put in place within a virtuous mechanism system.
- The algorithm that creates a standard product and transforms the marginal price of the accepted offer into national system is very important and should be transparent to affect the BRP's most proper behaviour.
- Terna has the responsibility to bid on RR platform with standard product → neutrality and impartiality of mechanism and behaviour shall be guaranteed.
- Full access to information should be provided in order to secure that market rules guarantee equal principles for each participant.
- The definition of a simulation tool would be very helpful to create a scenario and understand the overall functioning of bidding, price setting and volume adjustment.

2. Belgium

**From the view of Belgium, it is recommended that the aFRR market/the aFRR product contains the following aspects:**

- It should be open to all technologies on all voltage levels.
- It should be procured separately from other reserve products.
- It should be procured daily, preferably with 4-hour time blocks.
- It should be procured asymmetric.
- It should be evaluated using a fair baseline method.

3. Portugal

**For Portugal the following aspects are important with a view on an enabling framework for aggregators:**

- The simplification or revision of some of the rules, so the clients' flexibility could be utilised in this market as well, is necessary.
- The assets participating in the aFRR should be automatically activated by the TSO → In the case of aggregation, this activation has to be done via an aggregator, and then the aggregator activates the necessary flexibility within his portfolio.
- Demand response aggregators should not be obliged of providing the ratio of 2:1 between the upward and downward secondary regulation band.
- Another option is the participation of aggregators in the mFRR/RR market → the rules are less demanding than in aFRR.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

- Aggregators should reply to the current public consultation by ERSE, present their position about the participation in the reserves markets, mentioning the benefits for the energy system, both technically and economically, and they should create clear rules for their participation in reserves.

# II. Access to customers' data

Another problem that occurs in several countries is the access to customers' data, especially in the smart meter sector, be it due to technical or other reasons. It is crucial for aggregators to have access to the latest customers' data, in order to work with those customers. Problems in respect of receiving current data occur in Austria, Portugal and Spain.

## 1. Austria

**Recommendations in respect of Austria are:**

- To keep the market design as simple as possible.
- Clear and unambiguous definition of the regulatory framework, to reduce the room for interpretations for market participants.
- Clear and unambiguous definition of processes, to reduce the room for interpretations for market participants.
- To try to avoid the need of changes of the regulatory framework and processes by extensive testing.
- Extensive tests of rules and processes under real market conditions → the sooner processes are tested under real market conditions, the better.
- Harmonization and simple & fast possibilities to make contracts with customers are necessary → In particular with a view on the GDPR.
- With many different market participants, the amount of interfaces should be reduced → A central/single point for data exchange could be the best solution.

## 2. Portugal/Spain

**For Portugal and Spain, it is important to highlight the following aspects:**

- In Portugal, the DSO is the responsible party for the actual infrastructure for metering and access to data of final customers and forwarding it to relevant energy agents such as retailers → The DSO activities are regulated and the investments on the grid, including metering, have to be approved by ERSE.
- EDP Distribution is the only relevant DSO in Portugal and is a regulated entity. Therefore, it depends on the remuneration received from the national regulator (ERSE) → In order to improve the systems and to receive quality customers' data, more money has to be spent on this purpose.
- Although EDPD has an internal plan for the smart meters rollout, the engagement with the national regulator is pivotal for overcoming this issue →

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

the message should be clear and emphasise the benefits for clients on applying to demand response aggregation schemes.

- An implementation plan of the business model should be elaborated, mentioning the required investments needed from the DSO → the tangible benefits for clients regarding energy savings should be presented as well.
- It should be highlighted that renewable energy aggregation can significantly accelerate the integration of intermittent electricity sources, enhance demand flexibility, decrease the reliance on renewable energy support schemes and empower the customers participation.
- EDP Comercial is running a pilot project in one office building to monitor the consumption and to control the flexibility through the management of the HVAC system based on the thermal inertia of the building → a possible solution to reduce this initial investment would be to seek economies of scale when this BM is implemented widely.

## III. Network charges/Grid tariff flexibility

A design that is not up to date with a view on the future role of consumers and flexibility is likely to hinder the possibilities for aggregators to be active in these market sectors. Network charges should be designed in a way that facilitates the growth of self-consumption. Grid tariffs should fit to the use of flexibility than to a steady consumption. These topics are problematic in UK, Germany and Belgium

### 1. UK

While due to Brexit, the UK might not be under an obligation to develop a legislative framework that facilitates the growth of business models around aggregation and self-consumption, **there are efforts to change the network charges to make it account better for flexibility. Recommendations would thus be:**

- Implement provisions similar to Art. 21 REDII allowing for a regulatory framework for self-consumption;
- Exchange – despite Brexit – with EU Member States on best practices;
- And continue with the reform of the network charges both TSO and DSO level, to allow flexibility to be taken into account, whereby the question whether all grid users (i.e. consumers and producers) would need to be charged, or whether focussing only consumers could be an option.

### 2. Germany

**For the German system, the biggest problem would be the lack of metering infrastructure. Once that is in place, one could think of the following solutions:**

- Time-differentiated prices; or
- The introduction of dynamic prices for customers whose network charges are based mainly on the purchase-based component; as well as
- Shortening the time window for measuring peak capacity;

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

- Time-differentiated prices for capacity-components for customers whose network charges are dominated by the capacity component.

## 3. Belgium

**The following actions seem promising for the Belgian system:**

- No change in network charges in the transmission grid, but rather focus on improving access to the aFRR markets;
- Smart meter roll-out in all regions in order to create the appropriate infrastructure allowing distribution grid operators to value flexibility in the network charges;
- Change in network charges in the distribution grid to take into account flexibility offered to balance electricity in the local grid; and
- Create a framework in which distribution grid operators can locally procure balancing services.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

# Annex: Definitions

The following chapter provides an overview of relevant definitions regarding the discussed topics in the BestRES project. It shall help to understand the following analysis.

## I. IEM-Reg./Dir.

**In general:**
(…) this is because most generation from renewables can only be accurately forecasted shortly before the actual production (due to weather uncertainties). **The creation of markets which allow participation at short notice before actual delivery (so-called "intraday" or "balancing" markets)** are a crucial step to enable RES-E producers to sell their energy at fair terms and it will also increase liquidity in the market. (…)

(…) It also sets out the main legal principles for electricity trading rules within **different trading timeframes (balancing, intraday, day-ahead and forward markets)** (…)

**Recital 7 IEM-Reg.:**
Regulatory frameworks have developed, allowing electricity to be traded across the Union. That development has been supported by the adoption of several network codes and guidelines for the integration of the electricity markets. Those network codes and guidelines contain provisions on market rules, system operation and network connection. To ensure full transparency and increase legal certainty, the main principles of market functioning and capacity allocation in the balancing, intraday, day-ahead and forward market timeframes should also be adopted pursuant to the ordinary legislative procedure and incorporated in a single act.

**Art. 2 No. 37 IEM-Dir.:**
**'Ancillary service'** means a service necessary for the operation of a transmission or distribution system **including balancing and non-frequency ancillary services** but not congestion management;

**Art. 2 No. 38 IEM-Dir.:**
**'Non-frequency ancillary service'** means a service used by a transmission or distribution system operator for steady state voltage control, fast reactive current injections, inertia for local grid stability, short-circuit current, and black start capability and island operation capability;

**Art. 2 para. 2 lit. i) to m) IEM-Reg.:**
**'balancing'** means all actions and processes, in all timelines, through which transmission system operators ensure, in a continuous way, maintenance of the system frequency within a predefined stability range and compliance with the amount of reserves needed with respect to the required quality;

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

**'balancing service provider'** means a market participant providing either or both balancing energy and balancing capacity to transmission system operators;

**'balancing energy'** means energy used by transmission system operators to perform balancing;

**'balancing capacity'** means a volume of capacity that a balancing service provider has agreed to hold to and in respect to which the balancing service provider has agreed to submit bids for a corresponding volume of balancing energy to the transmission system operator for the duration of the contract;

**'balance responsible party'** means a market participant or its chosen representative responsible for its imbalances in the electricity market;

**Art. 4 para. 1 IEM-Reg.:**
All market participants shall be responsible for the imbalances they cause in the system. To that end, the market participants **shall either be balance responsible parties or contractually delegate their responsibility to a balance responsible party of their choice**. Each balance responsible party shall be financially responsible for its imbalances and strive to be balanced or help the power system to be balanced

**Art. 2 para. 2 lit. q) IEM-Reg.:**
**'prequalification process'** means the process to verify the compliance of a provider of balancing capacity with the requirements set by the transmission system operators;

**Art. 2 para. 2 lit. r) IEM-Reg.:**
**'reserve capacity'** means the amount of frequency containment reserves, frequency restoration reserves or replacement reserves that needs to be available to the transmission system operator;

**Conclusion:**

- Ancillary service includes balancing services and non-frequency ancillary services.

- Balancing services in the earlier regulation and directive are now called ancillary services.

- Ancillary service' means a service necessary for the operation of a transmission or distribution system.

- Balancing markets (as well as intraday markets) are markets which allow participation at short notice before actual delivery.

- Balancing, day-ahead, intraday markets and forward markets are markets that have different trading timeframes.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

- To enter balancing markets, a prequalification is necessary ('prequalification process' means the process to verify the compliance of a provider of balancing capacity with the requirements set by the transmission system operators).

- 'Non-frequency ancillary service' means a service used by a transmission or distribution system operator for steady state voltage control, fast reactive current injections, inertia and black start capability.

- aFRR = automatic frequency restoration reserve.

- 'reserve capacity' means the amount of, inter alia, frequency restoration reserves that needs to be available to the transmission system operator.

## II. The guideline on electricity transmissions operation (SO-GL)

The terms FCR, aFRR and mFRR are defined/mentioned in the SO-GL by the Commission. It says:

**In Art. 3 para. 2:**
No. 6: ’frequency containment reserves’ or **‘FCR’** means the active power reserves available to contain system frequency after the occurrence of an imbalance;

➔ This is the first step, activated within seconds, to contain the system frequency.

No. 7: ‘frequency restoration reserves’ or **‘FRR’** means the active power reserves available to restore system frequency to the nominal frequency and, for a synchronous area consisting of more than one LFC area, to restore power balance to the scheduled value;

**aFRR** = automatic frequency restoration reserve

➔ This is the second step, activated within a few minutes, to restore the system frequency.

**mFRR** = manual frequency restoration reserve

➔ This is the third step, if aFRR is not sufficient to restore the system frequency; mFFR requires a manual activation.

No. 12: ‘load-frequency control area’ or **‘LFC area’** means a part of a synchronous area or an entire synchronous area, physically demarcated by points of measurement at interconnectors to other LFC areas, operated by one or more TSOs fulfilling the obligations of load-frequency control;

BestRES This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 691689.

No. 42: 'frequency restoration process' or **'FRP'** means a process that aims at restoring frequency to the nominal frequency and, for synchronous areas consisting of more than one LFC area, a process that aims at restoring the power balance to the scheduled value;

**Article 145: Automatic and manual frequency restoration process:**

- para. 1: Each TSO of each LFC area shall implement an automatic frequency restoration process ('aFRP') and a manual frequency restoration process ('mFRP').

- para. 4: The aFRP shall be operated in a closed-loop manner where the FRCE is an input and the setpoint for **automatic FRR** activation is an output. The setpoint for automatic FRR activation shall be calculated by a single frequency restoration controller operated by a TSO within its LFC area. For the CE and Nordic synchronous areas, the frequency restoration controller shall: (…)

- para. 5: The mFRP shall be operated through instructions for **manual FRR** activation in order to fulfil the control target in accordance with Article 143(1).

**Primary balancing power:**
In the event of a power imbalance within the entire UCTE network system, the primary balancing power is enabled automatically according to standardised criteria. Consequently, there is no information on the primary balancing power actually accessed by TenneT TSO GmbH.

**Secondary balancing power:**
The secondary balancing power for a control area is requested by automatic access by the transmission grid operator that is affected. The amount of secondary balancing power accessed by TenneT TSO GmbH is shown under the actually accessed secondary balancing power.

**Tertiary control reserve:**
The tertiary control reserve is requested by telephone and based on a timetable by the affected transmission grid operator. The amount of tertiary control reserve accessed by TenneT TSO GmbH is shown under the actually accessed tertiary control.[110]

Primary control reserve (PCR) is the product that can be activated the soonest. Activation is automatic, decentralised and frequency-controlled. The primary control energy provided is not measured and settled. In case of a power plant outage all suppliers of PCR within the European synchronous area activate PCR without an intervention of the TSO. The balancing area with the outage receives the missing energy from the other PCR delivering balancing areas. This results in a system balance deviation.

[110] https://www.tennettso.de/site/en/Transparency/publications/network-figures/use-of-balancing-power.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

In case of system balance deviations, the **secondary control reserve** (SCR) is used. This is a central and automated process (load-frequency controller) controlled by the (German) transmission system operators. The use of secondary control energy should not only result from the complete failure of installations. Continuously occurring deviations between forecast and actual current are also covered with secondary control energy. If the demand for secondary control reserve is too great or if it does not decrease, **tertiary control reserve** (TCR) is activated. SCR is then available again. The interaction between the different control reserves and the procurement process are described on regelleistung.net.[111]

[111] https://www.50hertz.com/en/Markets/Balancing.

BestRES This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

# Technical References

| | |
|---|---|
| Project Acronym | BestRES |
| Project Title | Best practices and implementation of innovative business models for Renewable Energy aggregators |
| Project Coordinator | Silvia Caneva<br>WIP<br>silvia.caneva@wip-munich.de |
| Project Duration | March 2016 – February 2019 (36 months) |

| | |
|---|---|
| Deliverable No. | D5.2 - Preparation of legal and regulatory recommendations for the target countries |
| Dissemination level* | PU |
| Work Package | WP5 – Recommendation for the uptake of existing market barriers |
| Task | T5.2 – Development of legal and regulatory recommendations for the target countries |
| Lead beneficiary | SUER |
| Contributing beneficiaries | SUER, NKW DE, NKW BE, oekostrom, Good Energy, EDP, FOSS |
| Due date of deliverable | 31st December 2018 |
| Actual date of submission | 25th February 2019 |

* PU = Public

PP = Restricted to other programme participants (including the Commission Services)

RE = Restricted to a group specified by the consortium (including the Commission Services)

CO = Confidential, only for members of the consortium (including the Commission Services)

| v | Date | Beneficiary | Authors |
|---|---|---|---|
| 1.0 | 21/02/2019 | SUER | Fabian Pause and Maximilian Wimmer |
| 2.0 | 25/02/2019 | WIP | Silvia Caneva |
| | | | |
| | | | |
| | | | |

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.