



# The smartEn Map

European Balancing Markets Edition

2018

# About smartEn

smartEn is the European business association for digital and decentralised energy solutions. Our members include innovators in services and technology for energy and data management, finance and research. By taking an integrated perspective on the interaction of demand and supply, our mission is to promote system efficiency, encourage innovation and diversity, empower energy consumers and drive the decarbonisation of the energy sector.

For further information please visit [www.smarten.eu](http://www.smarten.eu)

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We also thank all smartEn Members for their invaluable contributions and feedback.



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# Foreword

Foreword by ENTSO-E

I am very honoured to have been invited to write the foreword of this edition of The smartEn Map on how Europe's balancing markets are open to smart, distributed and connected energy solutions.

By 2030, the amount of installed variable generation could exceed by 20% the peak demand, leading to high probability of wind and solar outputs curtailment. ENTSO-E and the European transmission system operators are fully aware of the need to unleash the potential of flexibility providers and to connect those with flexibility users. This is needed to keep the system secure but also to reduce costs and avoid spillage of clean electrons.

In a recent report - ENTSO-E Bidding Zone Technical Report - we have highlighted how congested the European grid is today. Since the 1990s, we went from zero to 30% of variable generation in the power generation mix. This "easy time" of renewables integration is reaching its limits. We need to act now to prepare for 60%, 80% or more of variable renewables.

As this report points out, the European Network Codes and Guidelines such as the Electricity Balancing Guideline, are key milestones in preparing our power system for the future. New rules and products will further enable participation of demand response and flexibility providers to electricity markets. ENTSO-E and its members are working hard in deploying the network codes and guidelines at national, regional and pan-European level. Only in 2020-2022, will we see the full benefits of these made-in Europe innovative pieces of legislation.

Beyond, the Clean Energy Package is setting the direction for putting the customer in the driver seat. Here again,

transmission system operators are investing for making this possible through developing the necessary software, and interfaces with their counterparts at distribution level. ENTSO-E and the European transmission system operators are committed to develop and implement a strategy to lay a digital layer on top of the physical grid allowing customers to access all markets and to best value their flexibility. Of course, this digital grid cannot resolve all congestions and reinforcing the infrastructure is unavoidable also to allow distributed resources to play their full part in the future.

Research, development and innovation are needed too and ENTSO-E and transmission system operators (TSOs) are actively involved in European and national projects to unlock Europe's flexibility potential. This means also bridging across sectors to seek synergies with other innovators. This is why we recently launched a Business Network for Innovation, bringing together TSOs and the world of start-ups to shorten the time from idea to market.

This smartEn report is another contribution for advancing new ways of apprehending our power system: more innovative, collaborative and connected without jeopardising security. Connecting the dots across the power system, across sectors, and across countries is paramount and will require efforts from all.

ENTSO-E is looking forward to more successful years of cooperation with smartEn and wishes every success to this edition of The smartEn Map and the ones to come.



Laurent Schmitt  
Secretary-General, ENTSO-E

# Introduction

Welcome to the new smartEn Map! This 2018 edition is the first of our new series of smartEn flagship publications, mapping the market environment for smart energy solutions in European countries. Building on the former SEDC Demand Response Maps, the new generation of smartEn Maps is designed to be more targeted and more frequent, with two editions annually. Each report zooms in on a specific part of the energy market, starting with Balancing Markets in this edition. The smartEn Maps are complemented with more detailed background material available exclusively for smartEn members.



Christiane Mann, Chairwoman, smartEn  
Frauke Thies, Executive Director, smartEn

The integration of the energy markets has come a long way. Europe has made important progress towards streamlining market conditions and improving access for innovative technologies and services that are essential to successfully complete the sustainable energy transition. When decarbonised, distributed and digitally-enabled energy demand, storage and supply can actively participate in the market, this empowers consumers and improves energy services, supports the integration of renewable energy sources and improves grid stability, enhances competition and lowers the price for society, while making the most of our existing energy resources.

The European Network Codes and the Clean Energy for all Europeans Package represent significant milestones on this journey. These European frameworks, with their detailed rules and regulations, now need to be implemented at a national level in order to secure the proper investment conditions for smart energy solutions. As of 2018, there are still important differences in the investment conditions for each of the European markets.

While Balancing Markets represent only a small fraction of the European energy markets, they often are the starting point for new flexibility offers and service providers. The smartEn Map reveals that there have been at least some improvements towards enabling smart solutions in almost all of the 16

countries analysed. However, while markets are opening up, progress is still slow in large parts of Europe. The most significant efforts can be witnessed in Italy, starting off at a relatively weak position, as well as Germany, where the trend towards more open balancing markets has steadily continued over the past few years. On the other hand, some of the countries that started off early on with frameworks conducive to innovative solutions, such as Great Britain or France, are now at risk of a stalemate if no further steps are taken.

One of the biggest drivers for improved product design on Balancing Markets has proven to be the Electricity Balancing Guideline (EB GL). This is especially true for countries that had not yet dealt with this topic previously. On the other hand, the rules for procurement still differ largely between countries, sometimes posing prohibitive barriers for the participation of distributed and innovative demand and supply resources.

With an effective implementation of the Clean Energy for all Europeans package, we are confident that we will see further improvements in the years to come. smartEn will continue to bundle the industry's efforts with the aim of ensuring an ever brighter picture of the markets in all subsequent editions of The smartEn Map.

Enjoy the reading,

## Top 10 Hot Tips for an Open Market

1

**Have an actual market**



The first step for an open market is to actually have the TSO procure the balancing products through an open tender process and not through opaque bilateral agreements or mandatory provision.

2

**Allow pooling of resources**



In union lies strength. Allowing grouping, also called pooling, of assets is key to empower many smaller consumers but also industrial customers, to allow BSPs to always have the right answer to the system needs.

3

**Technology neutrality**



All technologies should have the opportunity to provide services to the grid if they pass the prequalification process. No discriminating requirements should exist for storage or other new technologies.

4

**Neutral prequalification processes**



Technical requirements should be reassessed in order to identify the actual needs for the grid and product. Many requirements are still tailored to old generation units providing balancing services. Stating that all technologies can participate on equal footing is not the equivalent of actually having technical requirements that allow it.

5

**Value-reflecting prices**



In a market with a single buyer, the TSO, establishing the rules for procurement, the settlement rules will make or break a business case. Only a settlement based on marginal pricing will remunerate efficiently and, in a cost-reflective manner the efforts of independent market actors.

6

**Allow multiple simultaneous bids**



The technical capabilities already exist. An aggregator can provide several bids at the same time to different balancing products. This way it guarantees that if it is not activated in one product, it can still be activated in the next one. This way no flexibility is wasted, and aggregators can build a better business case based on diversification.

7

**Clear baselining methodologies**



A single baselining methodology is not necessary, as long as the different options are presented in a clear, and easily understandable way, reflecting the real value of a DR activation.

8

**Measurement and verification**



An accurate measurement process is needed to guarantee the burden is not on the individual consumer or connection point, but on the aggregator in case of pooling. Measurement should allow the aggregator to manage their portfolio as they see fit. Measurement and verification data should be exchanged using transparent, industry standards for interoperability.

9

**Boundaries that facilitate business**



A clear aggregator framework is the foundation on which to build fair and effective business relationships. These rules will guarantee that all parties' rights are respected and treated in a fair way, while also defining each party's responsibilities.

10

**Streamlining of products**



Nothing can destroy a market faster than a myriad of overly complicated products and requirements. TSOs should procure and design a limited number of effective products adjusted to their needs, that all interested market parties can provide.

# Measuring the European Balancing Markets

In the current edition of The smartEn Map the focus lies on the Ancillary Services and more specifically on the Balancing Markets. The chosen products for this map are the Primary Reserve (FCR), Secondary Reserve (afRR) and Tertiary Reserve (mFRR), as these represent the central frequency products across European markets. Other aspects, like Replacement Reserves, were excluded as they are used only in some countries and a comparison between products would have been misleading. The assessment of these markets is focussed on the general openness to different technologies, including Demand Response (DR), storage and other decentralized energy resources (DER). The different categories reflect the technical and legal requirements and how these are reflected on participation of DR and DER. The objective of this report is twofold. First to show the current situation in Europe. Secondly, using empiric examples, provide a clear picture on what the requirements are, to provide an open and inclusive market for all technologies and independent service providers, with the hope, to serve as example to less developed markets.

The selection of countries assessed in this edition's map is based on a series of criteria, chosen to represent the most relevant spectrum of important market design features. Firstly, a country's current development of Demand Response participation in the Balancing Markets was taken into account for the selection. Secondly, ongoing and expected regulatory adjustments and potentials of a country played an important role. In a fast-changing market, with new developments, technologies, and a new legislative framework being discussed, it is important to reflect changes that will open the markets to Demand Response in the near future. Thirdly, a regional spread and representation of different system designs was important for the selection. Finally, the availability of information for respective markets was relevant for a country to be included in the assessment. The result is a selection of 17 countries that paint a broad picture of the different market design models and provides insights into the state of Demand Response in different parts of Europe.

The assessment and evaluation of the respective national frameworks is based on a series of categories that give a consolidated picture of the Balancing Markets: Product design, technical requirements, details on payments and penalties, market size and segmentation, transparency and upcoming legislative changes. The categories are graded following a scale that allows comparisons, with a closer look into each category in the respective country chapters. Only the category of Payments and Penalties is described in the report but excluded from the grading. Prices can depend on the liquidity of a market, the number of participants, the

effects of regulatory conditions etc, and high or low prices can indicate either positive or negative market aspects. Similarly, penalties need to be non-discriminatory and appropriate to ensure reliability, so that no general ranking can be made based on level of penalties. This report and background data should therefore support market players in making their own judgement on whether the payment and penalty conditions constitute an attractive business case.

The findings of this report are based on a series of interviews based on questionnaires that were sent out to over 100 sources in more than 20 countries. The sources for the primary research ranged from national regulators and TSOs to retailers, aggregators, technology providers, consultancies and other associations. The information provided was completed with personal interviews with the sources, and finally through an extensive desk research of relevant literature to verify and complete the information. The report was subject to review by market participants, and thus also reflects the practical experience of companies active in the countries.

Finally, to expand the content of this report, a database is available exclusively to smartEn members. This database provides in a convenient and easy to read form, all the technical requirements and prices payed for each product in every country. We hope that after consulting both the current report and the database, our readers will understand better the nuances of the Balancing Markets, and hopefully, that it will help them guide their investment decisions.



# General Overview

The smartEn Map – Balancing Markets, 2018 Edition, revealed a clear interest across Europe to open markets to new technologies and innovative solutions offered by independent market parties. While changes in market design often tends to be slow, several countries have made significant efforts to improve their framework conditions in the last two years or are planning to do so in 2019.

The most advanced balancing markets for DR and DER with the highest overall scores are Belgium, France, Ireland and Switzerland, showing a deep investment in market solutions provided by different technologies. Great Britain is close behind, but overly complicated products and market structure exclude the GB from the most advanced markets group, even with mostly excellent conditions for FCR and mFRR and their ambitious SNAPS programmes. It is notable that no country has yet reached the best achievable overall grade. Even in front running countries, important aspects can still be improved. The biggest flaws in these markets tend to be in the area of transparency, either through incomplete provision of market relevant data, or opaque deals, conditions and payment structures.

Similar to the best placed countries', being at the bottom of the list does not mean that no improvements or efforts are being made to open the balancing markets. Italy is working towards an opening of its mFRR market, introducing a new market design for mFRR with welcoming technical requirements and an open participation of DR and DER, which will soon be followed up by a similar market design for aFRR. Spain is also looking to improve the access to its balancing market, pushed by the implementation of ENTSO-E's Electricity Balancing Guideline (EB GL) network code. These countries are not placed higher in our ranking, because these changes have not yet been implemented. Even though the aggregator framework models would warrant a report in themselves, they are inevitably an influence in the markets, and are considered in this report where relevant, if only in a cursory manner. Few countries, such as France and Belgium have a thorough aggregator framework. The Netherlands shows the effects of a weaker framework where welcoming technical requirements are not accompanied by the expected aggregator activity. Overall presence of DR and DER has improved, but there is still work to be done, and hopefully in the next edition of the "Balancing Markets" map we will show the results of this improvement.

## Payments and Penalties

Due to the nature of this category and its assessment, highly dependent on each company's business model, we excluded it from grading. An overview of the different possible payment options and the degree to which non-delivery is penalised is shown in each country chapter. Besides mandatory provision for large generators, where in some cases no payment is received, and bilateral contracts where payments are opaquely negotiated or set by the TSO, options for payments of market products include pay-as-bid, pay-as-cleared or marginal pricing. Of these, marginal pricing seems to be the preferred option for independent market actors, allowing them to best monetise flexibility, and take advantage of price variations. This mode of payment is progressively being implemented in more energy products where free bids are possible.

A major shift in the dynamics of the European Balancing Markets is taking place. Balance Service Providers (BSPs) are progressively reassessing business models' focus to replace the historical revenues obtained from capacity products, which have recently fallen due to increased competition with new revenues from energy products (free bids and passive balancing). These show an increasing financial potential due to the volatility from higher renewable penetration, or shift towards more incentivising design (use of single imbalance marginal pricing, instead of dual pay-as-bid settlements). This trend, pushing BSPs to seek dynamically for the best opportunities and stack value streams, is being facilitated through the opening of new markets and redesign of existing ones, creating new energy products.

Non-delivery or non-availability of a committed capacity is penalised in all markets in some way. Usually penalties are proportional to the non-delivered part and in the best cases linked to imbalance settlement prices or the bid price. In some cases, penalties are linked to the spot prices. In products where the benefit margin is small, and the business case heavily relies on many activations, these kind of penalties disincentivise participation in the market. Usually if penalties are repeated, it ends up in loss of the prequalification or the reduction of the prequalified capacity.

## Balancing Markets Overview





# Access to the Balancing Markets

This section explores the three main products of the balancing markets: FCR (primary reserve), aFRR (secondary reserve) and mFRR (tertiary reserve). Overall, there has been a continuous recent improvement in the different balancing products in most European countries. The trend is clearly towards opening the markets and creating products accessible for DR and DER. The development of the EB GL network code, and in particular also the initiatives for standardised European products have played an important role. Specifically, the so-called PICASSO, MARI and TERRE projects (for harmonised products for aFRR, mFRR and RR respectively), have played an important role. But also the general experience that new market actors can often provide balancing services as efficiently or even better than traditional resources, has led to progress at the national and European level. Countries that

have seen a significant improvement recently include Belgium, Germany and Estonia in mFRR. And the future seems brighter for historically closed countries, like Italy, that are introducing significant changes to their markets, opening them to DR and DER.

The general trend shows a lowering of the entry barriers, especially minimum bid sizes, the creation of market products where only bilateral agreements were previously available, and the creation of aggregator frameworks, giving legal certainty about the relationships and responsibilities between aggregators, Balance Responsible Parties (BRPs) and suppliers, and the consumer. Barriers still exist in many markets, even the ones with accessible technical requisites, due to outdated procurement methods or the lack of the proper frameworks.

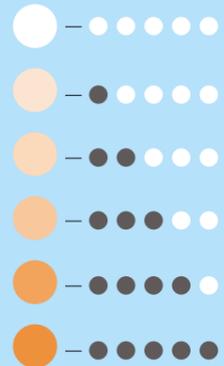
The following table includes the different criteria used to assess the access to each product:

<p>Non-existing product.</p>	<p>Procurement mandatory or through bilateral agreements. No DR and DER access.</p>	<p>Market procurement with limitations. High entry barriers. Small or no DR/DER participation. No aggregation allowed.</p>	<p>Open market or Pilot projects. Some barriers are present in requirements or procurement structure. Technology neutral. DR and DER participate, mostly through large assets. Aggregation is allowed.</p>	<p>Open market. Few minor barriers exist in requirements or procurement structure. Wide DR and DER participation. Small consumers active. Aggregation allowed.</p>	<p>Open market. Level playing field. Technology neutral requirements. Aggregation allowed. Wide DR participation. No barriers observed.</p>
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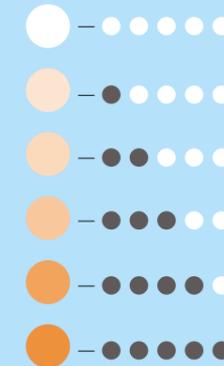
# aFRR

Secondary Reserve



# mFRR

Tertiary Reserve



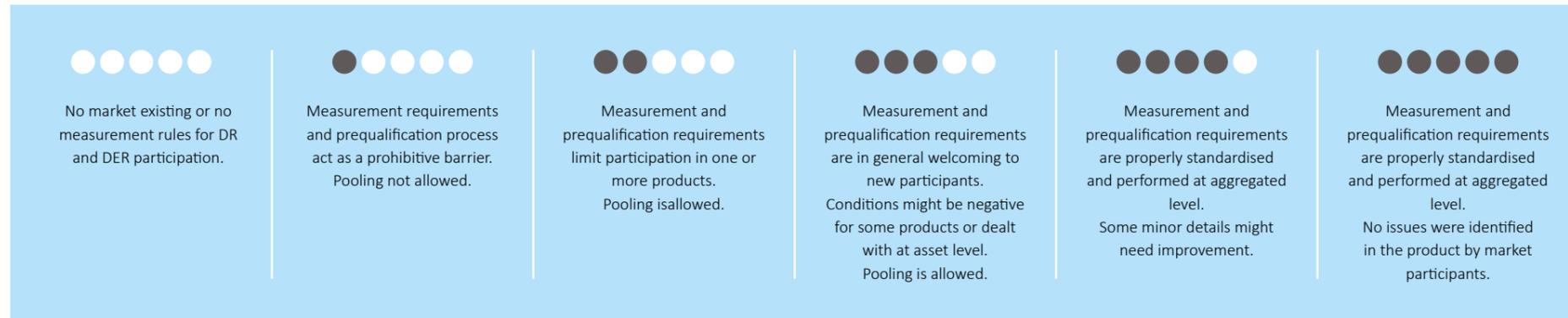


# Measurement and Prequalification

This category analyses the different technical requirements to participate in the balancing markets, the criteria used for measurement and verification and the impact they have on DR and DER and new market participants. In general, more and more countries moving to centralised measurement, allowing independent aggregators to manage their own pools and be responsible for them, without the need to individually measure each asset providing the balancing service. A clear baselining methodology has proven to be key for the most developed markets. If different baselining approaches are applicable, it is equally critical that they are well defined and openly available. One general finding is that, even though several TSOs claim their markets are technology neutral, in practice technical requirements are set in a way that de facto exclude many new technologies

and participants. There is also a lack of standardisation across Europe for technical requirements, which will in principle change in the next two or three years once the EB GL and the different standardised balancing products are implemented. Technical requirements are still not as homogeneous as would be desirable. Minimum bid sizes, although they are going down, as in Denmark and Great Britain, are still too high in many countries to be a truly technology neutral product. This also applies to ramping requirements in several products, still tailored to the capabilities of traditional generation plants.

The following table includes the different criteria used to assess the different measurement and prequalification requirements:



## Measurement and Prequalification



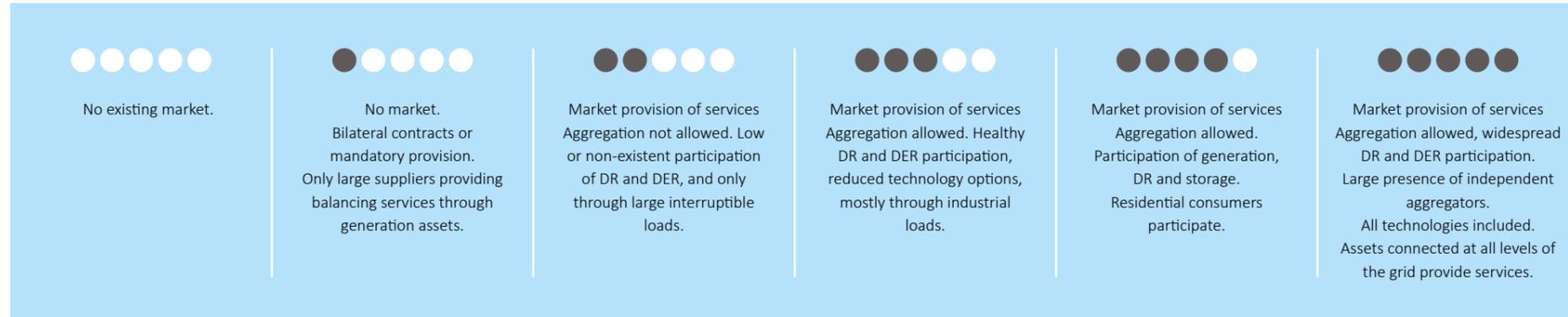


# Market Segmentation and Size

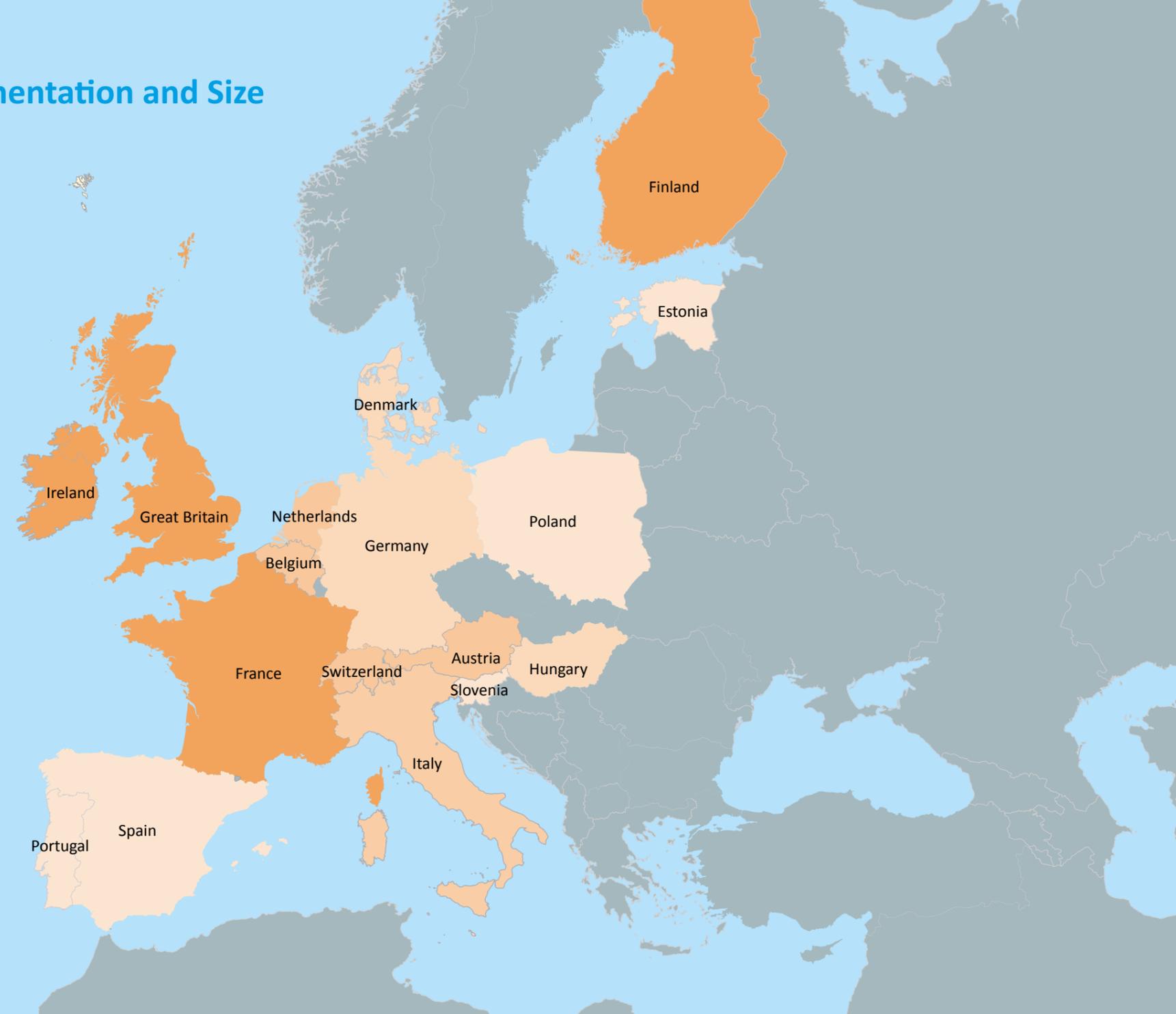
This section assesses the health of the country market based on the active market participants, capacities traded, types of assets and technologies participating, and the market penetration independent aggregators have. For this section, the assessment relies mainly on input from market participants, especially aggregators and technology providers. The lack of publicly available information, including centralised and reliable statistics on the market participation of different technologies in the respective products highlights one of the main deficiencies regarding the balancing markets and the general openness of a country for DR and DER. Given that TSOs typically require detailed information from market participants concerning the different assets providing a service, this information should be readily available and accessible. In general, the research points again to a clear positive correlation

between inclusive technical requirements, clear settlement rules and daily procurement, to the participation of DR and DER in the Balancing Markets. With the progressive opening of markets and adapting of technical requisites, a wide range of technologies have started to participate across Europe. Only a few countries restrict participation to generation, and in some countries, like Denmark with electric vehicles, innovative assets are entering the market.

The following table includes the different criteria used to assess the market penetration of DR and the variety of technologies providing balancing services:



## Market Segmentation and Size





# Transparency

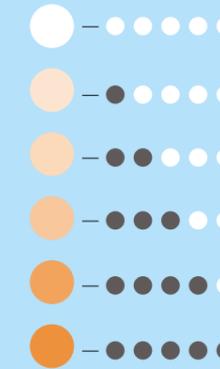
Transparency is a key element for a new energy company to consider providing services in a country. This section analyses the depth of information provided by the TSOs and ease of access. A clear and welcomed effort to increase communication is being performed by ENTSO-E through its Transparency Platform<sup>1</sup> which allows every user to access information, in many cases with only a 15-minute delay. While it intends to cover many data types, sometimes information is not available for certain countries. The reasons for this are not clear; whether it is for a lack of reporting, non-disclosure, or that the specific product does not exist. It is in the TSO's best interest to provide clear and close to real time information for market participants to properly assess a potential business case.

Other common transparency issues are related to the procurement methods for certain products, especially for those where TSOs contract them through bilateral contracts. In some countries the procurement is not even compliant with EB GL rules. Capacity payments in those cases are usually opaque and not publicly available, which creates a barrier of entry for new participants to assess the markets viability. Other TSOs are significantly improving their transparency, like Great Britain, with deep reforms of products, or the efforts by the Italian TSO, Terna, to publicise and make accessible their reformed products. In general transparency has improved across Europe, but almost all countries have issues that need to be dealt with.

The following table includes the different criteria used to assess the transparency in each country:



## Transparency





# Upcoming changes

Electricity legislation and market design are constantly changing, not only on a European level with the revision of the Electricity Market Design directive and regulation, but also through ENTSO-E's EB GL. National implementation of EB GL is the most urgent topic, with the most advanced countries like France and Belgium, implementing parts of it already by July 2019, for the slower countries these changes are delayed in some cases until 2021, which seems like an unreasonable amount of time for independent aggregators to start considering activities there.

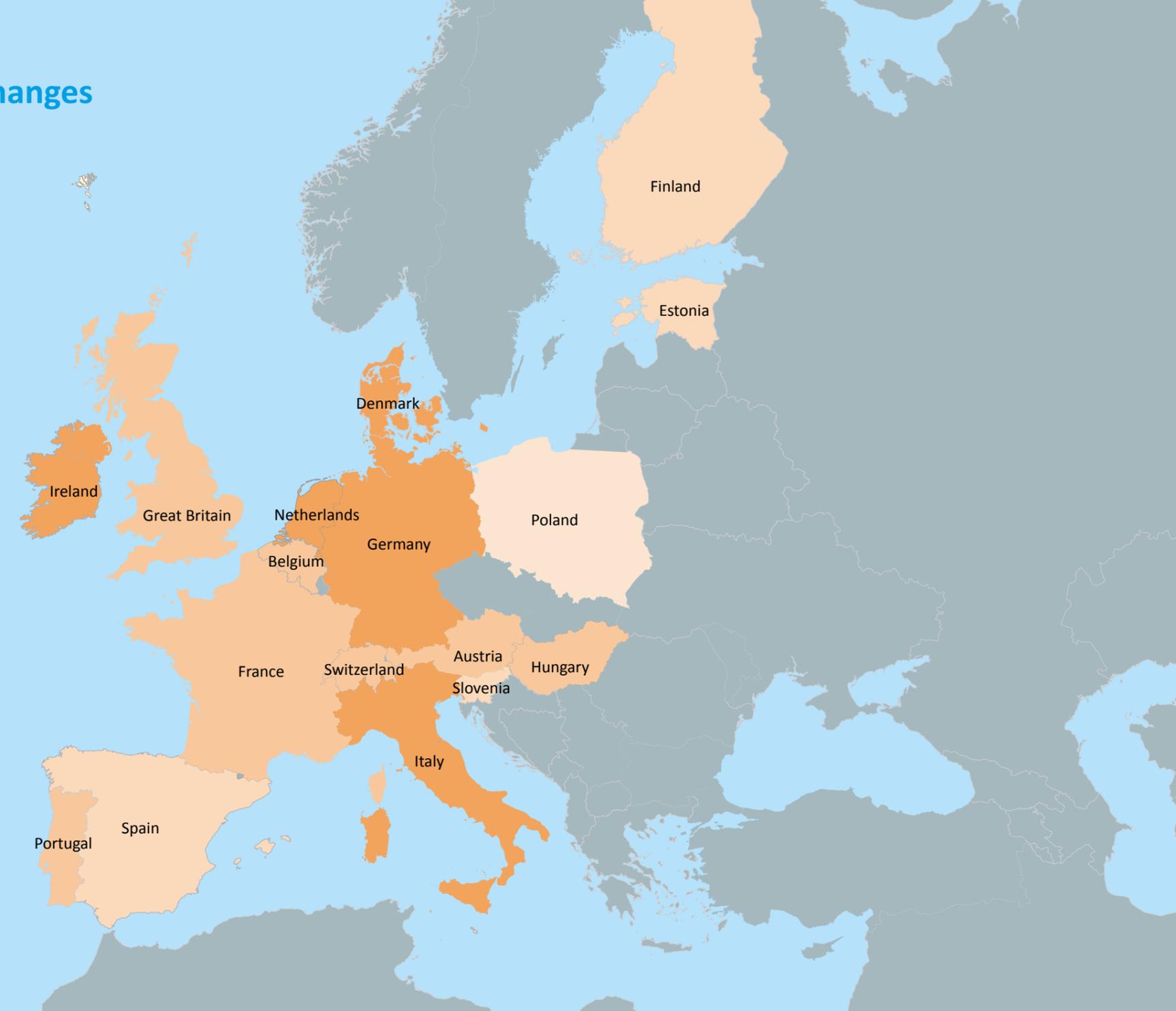
This map assesses the expected positive or negative impact of the planned changes in different markets and the timeline given for them. There is a clear interest for further market opening. Many countries are improving their conditions, implementing

pilot projects to test future market designs and including new technologies and services in their balancing markets. But these improvements are in many cases slow and focus on one topic at a time while a widespread and standardised change would be welcome, with an increase in European cooperation aiming for a harmonised European Internal Energy Market.

The following table includes the different criteria used to assess the quality and quantity of upcoming changes:

<p>No upcoming changes.</p>	<p>Upcoming changes only reacting to European directives or NC implementation. No future strategy, or unknown. Changes not happening in 2019.</p>	<p>Limited impact upcoming changes in 2019. Unclear future of developments or market design.</p>	<p>Full implementation of ENTSO-E products and platforms in 2019 Stakeholders consulted on parts of the changes. Changes happening in 2019.</p>	<p>Active role in the design of ENTSO-E platforms. Complete redesign of products. Opening of markets in 2019.</p>	<p>Complete redesign of products that will provide a welcoming market. Alternatively, no changes are needed to further open the Balancing Markets.</p>
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## Upcoming changes





# AUSTRIA

**Austrian balancing markets are in general open to all market participants** as long as they fulfil the prequalification process. But in practice there are technical requirements for certain technologies like storage, and DR that limit the participation of flexible resources. The minimum bid size in some platforms, the rules governing the pooling of resources, which must be of a certain size to be able to participate; and the lack of profitable revenue streams for smaller resources, make the integration of flexibility in the system more difficult. In addition, the requirement for aggregators to establish a contract with a BRP is still a significant barrier of entry for aggregators in Austria, not only due to the increased costs but also the required time investment.

Some steps in the right direction have been taken, such as the adoption of a new network tariff structure that reduces penalties for the bids activated in the Balancing Market, which only affects consumers. Further steps need to be taken to completely open all products to flexible resources and facilitate a business case for aggregators.



## Access to the Balancing Markets

### FCR (Primary control)



FCR is procured by the Austrian TSO, APG, through weekly tenders. The minimum bid size is 2 MW and the period of delivery is one week with symmetrical bids for upwards and downwards regulation. The measuring is performed on local level for each unit providing to the reserve, but APG is evaluating the option for a group of small units to share the same meter. FCR continues to be a market closed to DR and only generation can participate providing it.

### aFRR (Secondary control)



aFRR is procured through daily tenders with a gate opening time of D-7 and a gate closure time of D-1. The minimum bid size for the first bid is 1MW, and 5 MW for further bids. The full activation time is 300 seconds from reception of the setpoint signal from the TSO'S SCADA. The bids do not need to be symmetrical for upwards and downwards regulation. The committed bid cannot exceed the prequalified power. An obligation to supply exists, in case the necessary volume is not met, through a "Last Call" tender. Both generation and load management can participate in aFRR in addition to pumped storage.

### mFRR (Tertiary control)



There are both weekly and daily products tendered for mFRR. The daily tenders are organized in 4 hour blocks. The minimum bid size for mFRR is 1 MW and bids do not need to be symmetrical. The full activation time of mFRR is 15 minutes. An obligation to supply exists, in case the necessary volume is not met, through a "Last Call" tender. Both generation and load management can participate in mFRR in addition to pumped storage. The duration of activation is still 4 hours, which excludes aggregators that are pooling small residential customers from the market.



## Measurement, Prequalification, Payments and Penalties

### Measurement and Prequalification



Pooling is allowed in Austria, to reach the minimum prequalification requirements, but a local measurement has to be performed on each unit for prequalification. In cases of pooling the measurement of delivery can be performed on centralised level, but the BSP needs to measure and store the data for each unit. Measurement precision for power is 0.5% and in frequency 5 mHz.

The Austrian prequalification process is performed individually per product and a BSP is free to apply for prequalification for one single product without participating in the rest. The prequalification lasts 3 years before renewal, unless there have been major changes to the source of the supplier. The prequalification requirements are the same for all assets, without distinction between generation or demand. The ramping requirements for FCR are 50% in 15 seconds and 100% in 30 seconds after activation, for aFRR 100% in 5 minutes, and for mFRR 100% in 12,5 minutes.

Individual customers still need to provide a direct telephone connection with the TSO to be able to provide DR services. This requirement excludes residential consumers from participating in the market.

Storage is allowed to provide energy to the balancing markets, but a recharging strategy is required and approved by the TSO to ensure continuous delivery during 30 minutes full activation time and less than 50mHz frequency deviation.

### Payments and Penalties

There are availability payments for all three products. FCR is only paid a fix fee per product period but doesn't receive a payment on activation. There are activation payments for energy available for aFRR and mFRR, settled on a pay-as-bid basis.

There is no published rule regarding penalties, but in general penalties for non-delivery of a committed load usually depend on two criteria. The time when the unavailability is reported as well as the highest price offered for energy in that period. The underperforming party usually pays, at least, the costs of additionally called upon reserves to cover their unavailability. The penalty results in non-payment of the non-delivered quantity. Three infractions can lead to loss of prequalification.



## Market Size, Transparency and Upcoming Changes

### Market Segmentation and Size



Due to the below-mentioned transparency issues, the only source available to assess market participation are the prequalified parties. Currently there are 17 prequalified parties operating in any of the three reserves. Only seven of those participate in the primary reserve, while 12 participate in secondary reserve and 13 in tertiary. This confirms that the tertiary reserve (mFRR) is the easiest to participate in due to low technical requirements, while the secondary reserve is the most profitable with high prices and frequent activations.

There are no statistics available on how much storage or other small assets connected to the low voltage grid are participating in the balancing markets. This lack of information is due to consumer protection and information confidentiality.

Currently the APG control area requires 64 MW of FCR (symmetric product), 200 MW of upward and 200 MW of downward aFRR procured in weekly and daily tenders, 200 MW of upward mFRR procured in weekly tenders and 80 MW in daily tenders, and 125 MW of downward mFRR procured in weekly tenders and 25 MW in daily tenders.

### Transparency



Austria has a difficult to navigate market structure, which increases costs for independent market parties, although most information is publicly available and updated close to real time on APG's website<sup>2</sup>. The market segmentation is complicated to estimate for Austria due to confidentiality issues. There is no public information regarding how much of the capacity participating in the balancing markets is provided by DR or the sizes of the assets providing these services. There is also no information on how many resources connected to the low voltage grid are providing flexibility services, even though in principle they are allowed to participate in the balancing market.

The monetary penalties in case of non-delivery are at discretion of the TSO and are not publicly available.

### Upcoming Changes



Austria is playing an active role in the implementation of the PICASSO and MARI projects from ENTSO-E, which will update aFRR and mFRR products to bring them in line with other European countries. Their implementation is foreseen to happen in 2019.

<sup>2</sup><https://www.apg.at/en/markt/Markttransparenz/Netzregelung/Primaerregelreserve>



# BELGIUM

Belgium has a reasonably welcoming balancing market, with good access for different technologies and independent aggregators, although this does not yet apply to all products in the balancing market. In practice, some prerequisites, as with aFRR, exclude smaller aggregators, and flexibility in general, from the market. Enablers for DR and DER include specific products in mFRR, and national tenders in FCR that make it easier to provide for these types of resources.



## Access to the Balancing Markets

### FCR (Primary control)



FCR is procured on a weekly basis in two different tenders by the Belgian TSO, Elia. A move to D-2 auctions is planned for July 2019. The first tender follows the FCR cooperation auction, the second one is a national auction for a sub product with more lenient conditions for newcomers, like not having to provide a single symmetric bid, but the possibility to provide three bids that amount to one symmetrical one. The minimum bid size is 1 MW, with a granularity of 1 MW, and a maximum activation time of 25 minutes. This will probably change once ENTSO-E establishes a harmonised value. There are no technical limitations excluding different technologies. Although assets connected to the low voltage grid are allowed to participate in FCR, currently no flexibility is delivered with such assets.

### aFRR (Secondary control)



aFRR is procured through weekly tenders by the TSO. But access to aFRR is limited and only open to large generators above 25 MW, which excludes DR. Additionally, participation is limited to assets connected at the distribution grid level (medium voltage). However there is currently a project in the implementation phase to introduce a level playing field open to all technologies, including DR. The new market design is expected to also move to daily auctions and introduce a merit order list for activation. The full implementation of this market design is expected in 2020.

### mFRR (Tertiary control)



The TSO procures mFRR in monthly auctions for two different products, a standard mFRR and R3 flex, a derated mFRR that requires a limited number of activations, making it easier to be provided by DR and DER. Access to mFRR is open to all types of technology without limitations. The minimum bid size is 1 MW reachable through pooling. Independent aggregators can access the market independently from the BRP. Participation is limited to assets connected at the distribution grid level (medium voltage).



## Measurement, Prequalification, Payments and Penalties

### Measurement and Prequalification



The measurement and settlement are usually performed at the connection point of the asset delivering the balancing energy. In some cases, this requires a submeter to be installed behind the access point to isolate the asset delivering the service. Requirements for sub-metering are easily achievable in FCR, less so in mFRR, where requirements are stricter. Following the product definitions, the measurement is, as a standard, performed at asset level. But under certain conditions, especially for small assets with a small contribution to the pool, a central frequency measurement is allowed. The prequalification system allows for easy expansion of portfolios, not having to go through the entire process again, only with the new asset. Elia recommends a measurement precision of 0.5% but some deviation margin is allowed for small assets.

### Payments and Penalties

For FCR the only possible payment is for availability, no extra payment is given for activation because Belgium uses the uncorrected model for volume allocation, where the activated energy is not paid to the BSP. aFRR has payments for both activation and availability but due to the procurement being done together with FCR, price transparency is low. mFRR has availability payments and since the 1st of December 2018 also activation payments with the application of "Transfer of Energy" (ToE) for independent aggregators providing DSR. For all three products pay-as-bid is the modality used for settlement, although a move to pay-as-cleared is planned for FCR in July 2019.

Penalties are imposed based on two different criteria. First on the resource's availability, and then on the correct activation (time and form). The size of the penalty is based on the monthly remuneration. Recently penalties for declared unavailability have been raised for mFRR. Elia performs random availability tests, that if not passed are penalised, including reduction of prequalified capacity or complete loss of prequalification.



## Market Size, Transparency and Upcoming Changes

### Market Segmentation and Size



DR is a regular participant in FCR and mFRR, and currently excluded from aFRR. Up to 60% of the 70 MW procured for FCR can be covered by DR. Similarly, up to 60% of the demand can be covered by DR for FCR, mostly in the derated R3-Flex product, from a total of 830 MW traded in the market. For upwards regulating mFRR 830 MW are procured, although activations are rare and reduced in quantity, less than 100 MW.

There are five market parties delivering DR and DER prequalified to deliver FCR and mFRR products. The range of the technologies they use is quite varied, from CHP and biogas to batteries, hydropower or load management in industrial sites. Another indication of healthy participation of small-scale flexibility in the balancing market is that no DR providing party has any single asset in their portfolio with a capacity of over 50 MW.

Storage is allowed to participate in the markets under the same conditions as other technologies. However, for FCR, all assets need to have active energy management to guarantee the committed capacity during the whole delivery period (25 minutes of energy stored).

### Transparency



There are certain transparency issues regarding payments, especially for aFRR where its joint procurement with FCR and the nature of the market design make it difficult to assess the potential business case for independent aggregators. Prices and quantities tendered/activated are not openly available for all products at ENTSO-E's Transparency Platform but on Elia's website<sup>3</sup>.

### Upcoming Changes



A new market design for aFRR, including a new baselining methodology, is planned to be implemented in 2020. Changes for FCR are planned for July 2019, auctions will move from weekly to daily and the settlement will be based on pay-as-cleared instead of pay-as-bid. mFRR product design is being reviewed to adapt to the MARI platform, with a reduction in minimum bid size, and a change to daily procurement. Procurement of mFRR will move to daily tenders on D-1 in early 2020.

<sup>3</sup><http://www.elia.be/en/suppliers/purchasing-categories/energy-purchases/Ancillary-services/Ancillary-Services-Volumes-Prices>



# DENMARK

**The market access to balancing services in Denmark is still limited.** In theory products are all open to independent BSPs, but in practice they have to establish themselves as BRPs. Recent developments, like the lowering of bid sizes, are intended to reduce entry barriers. Most ancillary services in Denmark are currently provided by retailers, with only a small number of independent participants, since they are forced to register as both suppliers and BRPs, significantly increasing costs. The design of network tariffs does not account for time of use and location of the assets, which does not create an incentive structure to deal with congestion. Time-of-use tariffs are being implemented by DSOs and with the further possibility of geographical tariffs in the future. Finally, a significant limitation for DR and DER is the reduced potential for a business case due to low electrification of heating and transport, high investment costs required and in general low demand for flexibility.

On the other hand, some innovative technologies are participating, like V2G and other assets connected to the low voltage grid, enabled by the removal of the online measurement requirement for FCR delivery. Several pilot projects have demonstrated that flexible technologies like cooling systems and heat pumps could provide balancing services efficiently if the requirements were more inclusive.



## Access to the Balancing Markets

### FCR (Primary control)



FCR is procured on daily tenders by the TSO. Denmark participates in two synchronous areas, West Denmark and East Denmark with slightly different product definitions. In West Denmark primary control is known as FCR and in East Denmark two products, called FCR-D and FCR-N cover that role. The minimum bid size to participate in the programme is 0,3 MW. The maximum activation time is 15 minutes. Pooling of assets is allowed, however, they cannot mix in the same bid generation and consumption units, which must be pooled separately. This is a clear barrier for some technologies like storage, which can provide both.

### aFRR (Secondary control)



The secondary reserve is contracted from the Norwegian TSO Statnett in a bilateral contract with a duration of five years. The minimum bid size is 5 MW.

### mFRR (Tertiary control)



mFRR is procured through daily tenders. The minimum bid size is 5 MW, placed in asymmetrical bids. Maximum activation time for mFRR is 15 minutes. It is still necessary to have a control centre operating 24/7, which is an added cost for new market entrants.



## Measurement, Prequalification, Payments and Penalties

### Measurement and Prequalification



Prequalification is performed either at each unit providing reserves or at pooled level. There are currently active discussions in Denmark on what the measuring point should be.

The measurement requirements of the frequency metering must be better than 10 mHz, while the frequency sensitivity must be better than +/- 10 mHz. In 2017, the requirement for online measuring for FCR delivery But the requirement of a 24h control centre to participate in mFRR is still in place, which remains a costly barrier for smaller flexibility providers like the commercial sector. In case of activation, the first half of the committed load shall be delivered within 15 seconds, the second half shall be delivered within 30 seconds at a frequency deviation of +/- 200 mHz.

### Payments and Penalties

There are both availability and activation payments, but these are settled separately.

Both FCR and mFRR receive an activation price based on the price area's marginal pricing. aFRR's activation price is regulated and consists, for upward capacity, of the highest between the spot-price + 100DKK/MWh and the regulating price. For downward capacity the price is the lowest between spot-price - 100DKK/MWh and the regulating price. Availability payments for aFRR are confidential since they are delivered on a five-year contract through Norway.

In case of non-delivery, payment will be held back proportionally to the volume committed and not delivered. The responsible party might also be forced to cover the cost of purchase of the energy not delivered. The Danish TSO, Energinet, can also choose to impose a quarantine in cases of complete or partial non-delivery, that can vary between 2 to 30 days duration.



## Market Size, Transparency and Upcoming Changes

### Market Segmentation and Size



The Danish market welcomes different technologies, as long as consumers work with their supplier. There are currently 35 electrical boilers connected to the grid as well as 150 local CHP units, all of which participate in the ancillary markets. There are also 1.5 MW of stand-alone batteries and 0.5 MW of electric vehicles providing ancillary services.

On a yearly basis 4 or 5 different BRPs participate regularly in the balancing markets, which are all over 50MW in capacity.

There are different pilot projects active exploring the possibilities that new technologies can offer. While storage participates on an equal footing with other generation technologies, there is a current pilot project with more lenient conditions adapted to the technology. Several other pilot projects are exploring the opportunities of assets connected to the low voltage grid<sup>4</sup>, such as electric vehicles and small storage assets.

### Transparency



Transparency in some products is opaque due to the nature of the bilateral contracts used in their procurement. The lack of a clear aggregator framework and baselining methodology is an issue for independent aggregators assessing the market. A clear framework is also needed for storage participating in the market to avoid issues with classification. Access to data from independent aggregators is incomplete, which makes it difficult to create a business case.

### Upcoming Changes



In 2017 the minimum bid size for the mFRR reserve was lowered from 10 MW to 5 MW. If this change proves successful a further decrease in the minimum bid size is foreseen.

There is currently an ambitious initiative working to define the aggregator framework. The initiative proposes three different market models for aggregators especially focusing on removing the prior consent with suppliers, and the costly BRP requirements<sup>5</sup>. The new framework will be finalised once a final agreement has been reached on the Electricity Market Design Directive, especially on the points regarding the definition of an aggregator and their relationship with BRPs

<sup>4</sup><https://energinet.dk/El/Nyheder-som-systemydelse/Nye-teknologier-i-markedet-for-systemydelse>

<sup>5</sup><https://en.energinet.dk/-/media/Energinet/Publikationer-TLU/Markedsmodel/Market-models-for-aggregators.pdf?la=en>



# ESTONIA

**The Baltic States have a very specific electricity balancing market not replicated elsewhere in Europe** due to their interconnection with the IPS/UPS synchronous area. One characteristic is that they do not have either FCR or aFRR products. The disconnection from the IPS/UPS area is planned for 2025 and it is expected that FCR and aFRR products will be created and incorporated into the balancing services. Estonia allows aggregators to participate in the market, having established a standard regulation agreement for aggregator operation. Currently only one aggregator has signed this sort of aggregator framework. The main barrier to enter the Estonian Balancing Market is not so much legislative but economic. Prices in mFRR are too low to develop a profitable business case.



## Access to the Balancing Markets

### FCR (Primary control)



Not available.

### aFRR (Secondary control)



Not available.

### mFRR (Tertiary control)



mFRR is procured through daily auctions in 1-hour blocks with an activation time of 15min for a maximum duration of 1 hour. This product is open to generation and demand-side resources and all technologies can participate in this product. While the opening of the market to DR is quite recent, its uptake and participation remain small. One of the reasons for this limited participation of DR is the low prices in this product. Additionally, even with a standard regulation contract for aggregators, single agreements have to be reached with the retailer bilaterally. Aggregation of resources is nonetheless allowed, and in theory it is allowed for assets connected to the low voltage grid to be pooled, as long as they reach the minimum bid size. On the other hand, technical requirements are reasonable for DR. The fact that only two independent parties are prequalified to provide DR services, and one of them is currently not actively providing them, underlines the need for a proper legislative effort by Estonian authorities.



## Measurement, Prequalification, Payments and Penalties

### Measurement and Prequalification



Measurement is performed at pool level, individual units do not have to pass any specific test. There is no proper prequalification test required, since the regulation agreement signed covers all the requirements to participate. The TSO requires the location and type of asset providing the reserve for verification and balance settlement reasons. There is currently no standard baselining methodology in Estonia.

### Payments and Penalties

Payments are settled on a marginal price basis once activated. The marginal price of activation also establishes the position of the bid in the merit order. Even though marginal pricing is an enabler for DR and DER, prices in Estonia for balancing energy are quite low, making the investment opportunity less interesting.

No specific penalties are contemplated for non-delivery since each BSP must have a contract with a BRP. Any penalty of the BRP is then handled through the imbalance price.



## Market Size, Transparency and Upcoming Changes

### Market Segmentation and Size



Only two parties are currently participating in the balancing market (mFRR) with DR. Only one of them is regularly active in the market providing 7 MW of DR, which they source by altering the consumption of mine pumps. The other party that signed a regulation agreement, but is currently not active, provides capacity from oil-shale power stations. This shows the small penetration of demand-side flexibility in the market since mFRR amounts to 1.5 GW in total.

### Transparency



Information provided by ENTSO-Es Transparency Platform on prices and activated loads is incomplete or non-existent.

### Upcoming Changes



In the medium term, Estonia's market will disconnect from the IPS/UPS synchronous area in 2025, prompting it to create new balancing products in line with the Continental Europe synchronous area. This change will create new opportunities for DR and DER in the balancing markets.

Additionally, the regional flexibility platform (enabling the cross-border exchange) is under development in the Baltic-Finnish region which will enable DR and DER resources to enter different markets more easily, providing the same pool of resources simultaneously to TSOs and DSOs. TSO-DSO cooperation regarding the use of flexibility for congestion management purposes is also under development. Grid users are already allowed to join the grid with their flexibility assets, enabling their resources to be used for congestion management when needed.

There is interest for DR to provide services, as the welcoming technical requirements for mFRR show, but these have to be accompanied by defined roles and responsibilities for independent actors to show interest in the market.



# FINLAND

**Finland's balancing markets are reasonably accessible for independent actors and different technologies.** Although this is not the case for all products, since there are requisites and aspects of the market design that are limiting it reaching its full potential, like the procurement of aFRR from other countries. Still, there are no specific technology barriers in place and aggregation of distributed resources is accepted for all balancing products with a healthy participation generation and load management in all products.



## Access to the Balancing Markets

### FCR (Primary control)



There are two different FCR products available in Finland. FCR-D, which is the frequency containment reserve for disturbances (activates when frequency falls below 49,9 Hz), and FCR-N, the frequency containment reserve for normal operation (activates when the frequency moves between 49,9-50,1 Hz). Both FCR types are procured by the TSO in openly accessible reserve markets.

Minimum bid size in FCR-N is 100 kW and it is a symmetric product. Small aggregated loads, household water boilers, storage and DR are active in FCR-N. The minimum bid size for FCR-D is 1 MW. Consumption and independent aggregators are very active in FCR-D.

The minimum required full activation capability is presently 30 minutes in both FCR-N and FCR-D. The procurement of FCR-D is performed on a yearly basis to ensure available capacity and also on an hourly basis (as well as FCR-N).

### aFRR (Secondary control)



The TSO procures the aFRR reserves from an hourly market and from other countries in the Nordic area. The minimum bid size for aFRR is 5 MW, can be asymmetrical, with a full activation time of 2 minutes. aFRR is open to all technologies, including DR, but only generation, like hydropower plants, provides this service at the moment. Low procurement volumes and rather large minimum bid size might affect DR participation, but the procurement volumes will increase in future.

### mFRR (Tertiary control)



The mFRR energy market is an hourly market. mFRR capacity is procured on weekly tenders by the TSO for hourly blocks to ensure adequate resources for the mFRR energy market. The minimum bid size for mFRR is 5 MW, both up and down regulation, with ramp-up time of 15 minutes and activation time between 1 to 60 minutes. All technologies can participate, and DR represents about one third of the mFRR bids.



## Measurement, Prequalification, Payments and Penalties

### Measurement and Prequalification



The prequalification process for an asset or pool consists of a physical test and a written application with the technical specifications of the asset. If the aggregator has a specific operations model, whether it is on aggregated level or resource specific, it can present it to Fingrid, the Finnish TSO, for approval. For pools where a new asset is incorporated, if it affects the capacity that the aggregator wants to provide, the prequalification process must be performed again. In that case, the physical test might be performed on the whole pool or on the specific asset.

The measurement is performed on a local level or aggregated level, both are allowed, but mostly local measurement is used. For aggregated assets a single meter reading is required for the measurement, to be able to verify the correct delivery of the reserve. This means that prequalification has to be passed also on aggregated level, which facilitates the access for small consumers to the market through an aggregator that deals with the prequalification. This is a clear enabler for DR, added to the lack of minimum technical requirements for the single unit.

For FCR-N full activation has to be reached within 3 minutes of the frequency change. For FCR-D the full activation has to be reached after 30 seconds and 50% has to be reached after 5 seconds. The ramping requirements for FCR-N are linear and piecewise linear. For FCR-D they are linear, piecewise linear and one-step.

### Payments and Penalties

In Finland there are both availability and activation prices accessible for the different balancing products. Marginal pricing is used in FCR markets. In the yearly market the price is fixed for a calendar year, and in the hourly market it is defined for each hour.

The penalties in case of non-delivery for aFRR and mFRR products are settled through the imbalance settlement process based on the imbalance price.

In the case of FCR-D and FCR-N the BSP will be sanctioned for the non-delivered capacity based on 100% the price for which the reserve was sold.



## Market Size, Transparency and Upcoming Changes

### Market Segmentation and Size



The prequalified capacity active as of January 2018 was of 430 MW prequalified capacity for FCR-D and 4 MW for FCR-N. There is currently no participation of DSR in aFRR, due to the minimum bid size and low procurement volumes. For mFRR the situation is more positive with around 100-300 MW in bids, representing about one third of the bids on average. As a reference, peak load in Finland is about 15,000 MW.

Approximately 10-20 actors regularly participate in the TSO reserve markets, with a varied range of technologies that include hydro generation, CHP, industrial load management, household water boilers, datacentres and batteries.

In general, market participants are rather small, most of them with assets with capacity below 50 MW, only a few have large assets providing flexibility.

### Transparency



Reserve market data is available to all stakeholders in Fingrid's open data service<sup>6</sup>. Market participants would like to have the real-time price of the activated mFRR energy. Currently Fingrid publishes this information when the system is tight, i.e. when the cross-border transmission lines are congested and there is less than 150 MW in balancing bids remaining.

### Upcoming Changes



The upcoming implementation of the EB GL will have an effect on the product design (standard European aFRR and mFRR products), adoption of European market places (interface to the Finnish market participants will still be Fingrid) and metering requirements. The change in Nordic system balancing model will increase volumes of aFRR.

There is currently a pilot project for the implementation of the independent aggregator model in the mFRR market, similar to the framework already in place in the FCR-N markets.

The changing power system characteristics have an impact to frequency controlled reserves. There might be a need for FCR-D for over frequency situations and a need for a fast frequency reserve, kind of a faster-reacting FCR-D, in low inertia situations.



# FRANCE

**Currently an almost fully open balancing market allows for an effective participation of DR and DER in almost all products.** Technical prerequisites are reasonable enough for independent parties to be able to bid into the market through pooling. There are still some barriers in place limiting the direct access to some products, for example in aFRR, enabling BSPs to provide their flexibility through a secondary market.

Some barriers are still limiting the full access to the balancing markets. Aggregation of DR and generation in the same pool is not allowed. A pilot project has been launched for FCR mixing on-site generation with DSR. RTE has initiated a discussion with the industry to remove this barrier and widen possibilities to constitute aggregated pools. Also, the use of sub-metering is still very limited (only on FCR and under experimental status).

On the positive side, the independent aggregator framework is quite developed in France, allowing aggregators and consumers to provide flexibility without having to sign a contract in parallel with the supplier of the BRP of the site. This key regulatory evolution has been introduced in 2014 with the implementation of a framework for the valuation of DR on the wholesale energy market (“NEBEF” mechanism).



## Access to the Balancing Markets

### FCR (Primary control)



FCR is procured on weekly auctions open to DR. Currently industrial consumers participate in the market as well as aggregators pooling resources from the residential level up to the industry level.

The minimum bid size is 1MW. FCR is tendered through the FCR cooperation on a weekly basis with a maximum activation time of 30 seconds. Starting in July 2019 the procurement will be done on a daily basis with auctions held on D-2 instead of weekly basis. DR and generation cannot be mixed in the same pool, aside from on-site generation under an experimental status.

### aFRR (Secondary control)



The minimum bid size is 1MW which would be favourable for DR. In practice however, this reserve is not open to market players directly. Large generators, which are legally obliged to provide aFRR, can procure it through a secondary market to cover the amount assigned to them by the TSO. This can provide an indirect access for other market participants. However, activation is done on a pro-rata basis, which severely hampers possibility for DR to enter this market, since activations would be too often and lengthy. In practice no DR aggregator participates in this product. Merit order list activation will be implemented once ENTSO-E’s PICASSO project is adopted, with a free activation price, which will allow for effective participation of DR.

### mFRR (Tertiary control)



The contracting of mFRR is performed through a yearly tender that guarantees a fixed annual amount of mFRR. The minimum bid size is 10MW with an activation time of 15 minutes. Although this limit has already been lowered, it still is a barrier for smaller independent providers. No combination of DR and generation is allowed.



## Measurement, Prequalification, Payments and Penalties

### Measurement and Prequalification



The prequalification process for FCR and aFRR is fair and well known. Accuracy of measure is 0.5% both for head and sub-meter, which still constitutes a barrier, since the sub-meters are often less accurate. Measurement is performed by RTE on a continuous basis, using a linear regression on the available 10s telemetry measured points, to control if the performance delivered is in line with the contractual obligations.

For mFRR prequalification is a barrier for new technologies and competition between BSPs. RTE requires five activations to be performed with a four out of five-success rate. These tests are not paid at full costs, but at the marginal balancing price, and in some cases not payed at all. Measurement requires a telemeasure with points every 10s for prequalification, but then relies on the 10min points from the official meters.

There are currently three different main methods used for baselining in mFRR:

1. Based on the 10-min average consumption values before the activation of DR.
2. Historical values, either declared by the aggregator or calculated based on statistical approach.
3. Forecast values, declared by the aggregator.

### Payments and Penalties

There are activation and availability payments for all three products. mFRR and RR can also be submitted through free bids, based on marginal pricing, which supposes one of the big revenue streams for DR and DER. Availability payments for FCR are on a pay-as-bid basis. aFRR is paid based on a regulated price. mFRR follows a pay-as-clear settlement. Regarding the activation payments, a spot price is payed for FCR and aFRR, mFRR payment is based on pay-as-bid principle, with a free bid price set by the BSP. An annual, DR exclusive tender (“AOE”, Appel d’Offres Effacement) gives the awarded DR capacities the opportunity to get an additional remuneration for mFRR. Both capacity and availability payments are possible for this tender, but amounts have been decreasing in the last years. For the mFRR/RR capacity tendered through AOE, a capacity payment is payed out for participants available for at least 20 days. An extra remuneration of 2000 €/MW is available for participants available for 60 days. This programme still is the main source of revenue for DR in France.

For FCR and aFRR the penalties for unavailability equal the availability fee plus the spot price. This exposes the BSPs to important risk in case of spikes in the market due to the limited possibilities to find a backup. For mFRR the penalty is based on the spot price for declared unavailability. This results in high risk for BSPs, due to the low mFRR prices. The low probability of activation for the bottom of the merit order disincentivise the declaration of unavailability.



## Market Size, Transparency and Upcoming Changes

### Market Segmentation and Size



Around 10 independent DR aggregators are currently participating in the French balancing market. While the exact amount of DR and other flexibility sources participating in the balancing markets is not known, one indication of the significant participation is the 2.5 GW of DR activated during the 2017-2018 winter in France in all markets.

Currently between 500 MW and 700 MW of DR are procured in all balancing markets. In FCR 70 MW (out of 570 MW in total) and 500 MW in mFRR (out of 1 GW). There is no DR participating in aFRR or RR. In the AOE yearly tender, a product designed as a support to enhance participation of DR in mFRR/RR, 730 MW of DR participates. About a third of it, 226 MW, is destined to mFRR. Resources participating in the balancing markets can be connected to the grid at any level, with participation from residential to industrial sector.

### Transparency



Transparency is lacking in several areas. Especially in aFRR where participation is mandatory for large generators and prices are regulated, not reflecting correct investment signals. The procurement method for mFRR in yearly auctions, besides not being compliant with the EB GL, raises transparency issues for independent market players. RTE will most likely ask for a derogation in the MARI platform to continue with the yearly procurement. Additionally, there is no disclosure of what technologies have been awarded a tender.

### Upcoming Changes



The T&C of the EB GL have to be decided before the end of 2018. FCR will move in July 2019 to a pay-as-cleared settlement. The PICASSO platform will have the biggest impact in the French market, although the procurement through generators will remain the same. In November 2018 the “energy mix planification” programme (PPE: Programmation Pluriannuelle de l’Energie) will come into force, establishing the amount of DR present in the markets. To achieve this amount and to develop DR participation in the existing products, additional exclusive tenders for DR are organized. The quantities tendered are decided beforehand by the French government. For 2018 2200 MW were originally tendered. The main reason to not reach that target are the possible penalties disincentivising participation and the decreasing payments in this product.



# GERMANY

Germany has seen some recent improvements regarding the access for DR to the market. It is still too early to assess the impact of those changes in the market since most of them were only implemented in mid-2018, like the new FRR market design, or will be approved by the end of 2018, like the new market design for FCR. The current statistics regarding prequalified capacity, show a very small share of DSM and storage<sup>7</sup>, with most of the balancing capacity coming from hydropower and mostly traditional generation.

All balancing services are open to all market parties and all technologies, as long as they fulfil the technical requirements. Since the beginning of 2018, with the introduction of an aggregator framework, independent participants no longer need the previous consent from the consumers' retailer and the contracts needed have been streamlined.

It is very difficult to estimate how much of the traded energy in the balancing markets comes from the demand side, since only the prequalified capacity per technology is publicly available.



## Access to the Balancing Markets

### FCR (Primary control)



FCR is procured on a weekly basis by the German TSOs, with a planned move to weekday tenders in June 2019 and daily procurement of four-hour blocks at the end of 2019. The minimum bid size to participate in the market is 1MW and pooling is allowed.

### aFRR (Secondary control)



Since July 2018 aFRR is procured in auctions on a daily basis in six four-hour blocks. The minimum bid size is 5MW for the Germany and Luxemburg LFC block and 1MW for the LFC area. Pooling is allowed and all technologies that can prequalify can participate, except for RES.

### mFRR (Tertiary control)



mFRR is procured in auctions on a daily basis in six four-hour blocks. The minimum bid size is 5 MW for the Germany and Luxemburg LFC block and 1MW for the LFC area. Prequalification is possible for wind turbines that want to provide negative mFRR. The required activation period for this market is 4 hours.



## Measurement, Prequalification, Payments and Penalties

### Measurement and Prequalification



A new set of rules for the prequalification process has been introduced in October 2018, with some key aspects still missing. Reserve units and reserve groups are introduced with immediate effect. Assets must undergo an additional postqualification every five years. In addition, the marketable capacity can be determined at pool level by the provider, but the criteria still need to be determined. No pooling or backup is possible across TSO areas and the new conditions for limited energy resources are damaging for many storage solutions. Backup across TSO areas will be available for aFRR and mFRR from July 2019.

There is no limitation on the connection point of the resource, assets connected at the low voltage grid can participate in equal conditions. However, assets in the distribution grid need to get approval by the DSO before participating in the balancing markets.

### Payments and Penalties

Currently FCR only has capacity payments available based on the pay-as-bid principle, with a move to pay-as-cleared planned from July 2019. Energy used on activation is not remunerated for FCR. Both aFRR and mFRR have capacity payments (pay-as-bid) and an energy price for the activation. The payments for FRR products have seen the introduction of the concept of total bid cost in October 2018, this is calculated based on the capacity price plus the product of the factor<sup>8</sup> and the energy price. Since the 15<sup>th</sup> of October 2018 a new combined procurement method is in place, that takes both capacity and energy prices into account.

The penalties for the different platforms are a combination of imbalance charges based on the non-delivered loads. There are currently discussions on a new penalty structure where 100% availability and delivery is mandatory, with the risk of incurring very high penalties, including the reduction of the capacity remuneration, a contractual penalty, a claim for indemnity and even possible market suspension.

For FCR the current penalty consists of the average non-delivered volume over the ISP multiplied by the maximum price. For 15-minute products, this can be the maximum price reached in DA auctions, ID auctions or continuous ID prices. For 1-hour products the continuous ID price will be taken as reference. For aFRR and mFRR the penalty consists of non-delivered capacity volume multiplied by the average volume weighted energy price of activated aFRR bids, with a minimum price of 100€/MWh and a maximum of 1000€/MWh.



## Market Size, Transparency and Upcoming Changes

### Market Segmentation and Size



As of July 2018, 59 different companies have been prequalified to provide their services in one or more of the different balancing platforms. In all products the resource mostly prequalified is hydropower, followed by gas, coal, brown coal (lignite) and nuclear power. But the actual activated sources are known only to the TSOs. Storage is mainly active in FCR, while DR is active across all balancing products. TSOs do not publish data on how much of each technology is actually used per product.

### Transparency



Data on balancing markets is available on regelleistung.net for all four TSO zones. This data does not contain technology information, but gives detailed insights into auction results, activations. There is no public knowledge as to how much DR and DER are actually participating in the market. Prequalified capacities are not a good reflection of participation, since many prequalified assets are not used.

### Upcoming Changes



For FRR a new framework was put in place on July 12<sup>th</sup> 2018 with the inclusion of daily auctions and a new product duration of 4 hours. Additionally, a new market design for FCR is currently under approval process, with expected implementation in 2019. The main changes will be daily auctions only happening on weekdays and a move towards pay-as-cleared.



## GREAT BRITAIN

Great Britain was one of the first European countries to allow DSF to participate in their electricity markets. But this process has not been completely developed for all balancing products, since some of them do not have a proper market, and in others DR is not allowed to participate. There is no true balancing services market in Great Britain, since reserves are procured by National Grid through pay-as-bid tenders and bilateral deals. Even though many balancing products are in principle technology neutral, National Grid has tended to introduce products whose requirements are tailored to different technologies. This has created a highly fragmented market with different technologies encapsulated in very specific products, instead of lowering entry requirements for one balancing product and creating a technology neutral level playing field. National Grid is trying to improve this situation and has launched a substantial reform effort, with the SNAPS programme launched in 2017, aiming at streamlined, standardised balancing products procured on a market. So far, the implementation of the project is slower than desired, but moving forward. Future developments are not very clear, and in the last years products with high profitability for DSR have become less interesting due to a decrease in payments.



### Access to the Balancing Markets

#### FCR (Primary control)



Firm Frequency Response (FFR) is partly procured on monthly tenders and partly through technology oriented contracts. Part FFR incorporates several different products with different activation times: dynamic FFR which is active on a continuous basis and static FFR which is activated when frequency drops below 49.7 Hz. Participation in FFR is open to all technologies and aggregation is partially allowed. The minimum bid size to participate is 1 MW and is delivered in six daily 4-hour blocks. The activation requirements for primary dynamic FFR are a 2 second response time once called upon, with a full response by 10 seconds that must be sustained for 20 seconds. For static FFR the response must occur within 10 seconds for a maximum of 30 minutes.

#### Enhanced Frequency Response (EFR)

Similar to FFR but provides a faster response over a shorter time. This product was introduced to fit the capabilities of storage. 4-year contracts were awarded in a tender, and in bilateral deals. It has a 1 second response time and the committed load has to be provided for 15 minutes. Around 200 MW are contracted in this product.

#### aFRR (Secondary control)



The Fast Reserve (FR) is not very friendly to independent aggregators providing DSF, especially smaller ones, since the minimum bid size to participate is 50 MW. The minimum bid size is expected to be lowered to 25 MW in the near future. Participants come mainly from pump storage and reciprocating engines. The procurement is similar to FFR on a monthly basis.

#### mFRR (Tertiary control)



mFRR is procured through extremely complex pay-as-bid tenders several times a year. The minimum bid size is 3 MW. Offers into the tender have many variable parameters, making them hard to compare. The minimum performance requirements are that the response time must be less than 4 hours, and the response must be sustained for at least 2 hours. Resources which are in the Balancing Mechanism and those which are outside it can both participate in STOR but are treated differently.



### Measurement, Prequalification, Payments and Penalties

#### Measurement and Prequalification



The prequalification process includes the signing of a framework agreement with National Grid, the submission of a tender and a frequency injection testing prior to delivery. The requirements for the testing procedure in FFR are the use of the correct frequency injection profile, with a tolerance of  $\pm 0.01$  Hz, sustained through 30 minutes and with a deviation that does not exceed the 2.5% of the contracted load<sup>9</sup>. Prequalification for FFR is considered to be too strict for the technical capabilities that have to be tested. There is no margin for noise or baseline errors and the established sampling rate every 100ms is too costly and not justified for the provision of the services required.

Pooling is allowed to reach the 1 MW minimum bid size. Measurement is performed at pooled level, the aggregator can submit aggregated data once the individual asset has been tested. Aggregation of small and large units in FFR is only allowed under limited circumstances. National Grid is currently working on an improved baseline methodology for FFR.

#### Payments and Penalties

Payments for balancing services are too complicated to assess since the allocation is through bilateral pay-as-bid tenders and vary significantly between products. Price signals are difficult to understand due to a complex mechanism with many different auctions at the same time period. National Grid is trying to increase transparency by reporting on average prices in their DSF annual report.

Non-delivery below 95% of the committed load will forfeit the availability payment. In cases of repetition of non-delivery this can lead to termination and rescission of qualification.



### Market Size, Transparency and Upcoming Changes

#### Market Segmentation and Size



Currently 22 different independent aggregators are offering their balancing services. National Grid reported that in 2017 135 MW of Demand Response provided reserve services, and around 70 MW provided frequency response.

In principle mFRR (STOR) is one of the more technology inclusive products in Europe, allowing generation, load management, pump storage and batteries to provide balancing services, allowing aggregation, and only requiring one-way response. In practice, however, it is dominated by generation, with the most recent public figures showing only 0.01% of the volume coming from load response.

#### Transparency



Transparency is lacking in several aspects, especially with regards to the procurement through bilateral agreements. Payment structures are not openly available for FFR and in general the procurement scheme for FFR and FR are not easy to assess for independent aggregators trying to enter the market. National Grid is committed to getting rid of this complicated structure, but the process is slow. The exact amount of DR participating in each product is unknown and no clear reporting is available. An effort to improve transparency is underway with yearly DSF Reports.

#### Upcoming Changes



The first changes happening are related to the Balancing and Settlement Code (BSC) being updated to comply with ENTSO-E's TERRE platform (Replacement Reserves) which will have a great impact. One of the most important changes is that independent aggregators will have access to the Balancing Mechanism for the first time. This is planned to be implemented by the end of 2019.<sup>10</sup>

Most balancing products are undergoing changes to increase transparency and market access for different technologies. A big effort is being made to communicate the needs of National Grid and provide more information to the market so that it can provide the products that are required.<sup>11</sup>

National Grid is currently investigating the possibility of central measurement for aggregated assets. There is no timeline for its implementation so far.

<sup>9</sup>[https://www.nationalgrideso.com/sites/eso/files/documents/Firm%20Frequency%20Response%20%28FFR%29%20Interactive%20Guidance%20v1%200\\_0.pdf](https://www.nationalgrideso.com/sites/eso/files/documents/Firm%20Frequency%20Response%20%28FFR%29%20Interactive%20Guidance%20v1%200_0.pdf)

<sup>10</sup><https://www.elexon.co.uk/mod-proposal/p344/>

<sup>11</sup><https://www.nationalgrideso.com/insights/future-balancing-services>



# HUNGARY

In principle all types of assets can participate in the balancing markets and all of them are open to market participants, with only restrictions related to the technical requirements in the prequalification process. In practice this is not the case since most products are only provided by generating units. Furthermore, most of these products are only provided by traditional generation plants, especially gas plants.



## Access to the Balancing Markets

### FCR (Primary control)



FCR is tendered in four times a year. Participation in FCR is mandatory for generators. The minimum bid size for FCR is 1 MW procured in hourly blocks, but with bid selection every 15 minutes. The product shape for upwards and downwards FCR has to be symmetrical. The bids are selected based on the availability fee they registered, and the bids are settled on a pay-as-bid basis. In theory the market is open to every technology, but in practice it is dominated by generator, with small battery participation.

### aFRR (Secondary control)



aFRR is procured in quarterly, monthly and weekly tenders, which are mandatory for generators with remaining capacity. In addition, a daily market exists where the bids accepted in the two annual tenders are reconfirmed. The daily market is performed in one-hour blocks on a day ahead basis and the bids have a minimum size of 1MW, with the possibility to offer asymmetrical bids for upwards and downwards aFRR. The participants receive an availability fee in addition to the energy price of the committed load, once delivered. The maximum committed load has to be delivered in 15 minutes time.

### mFRR (Tertiary control)



mFRR is procured on quarterly and weekly tenders. The minimum bid size for this product is 1 MW, with a delivery time of 15 minutes. mFRR is open to all technologies.



## Measurement, Prequalification, Payments and Penalties

### Measurement and Prequalification



Aggregation is allowed in Hungary with a specific prequalification test required to measure minimum and maximum delivery times, the ramping times and other special characteristics requirements. The precision for measurement requirements is 0.5%. Regarding the ramping requirements for FCR, half of the activation has to be achieved after 15 seconds and full activation after 30 seconds.

Measurement has to be performed on each single unit even when dealing with pooled assets. But the frequency measurement is performed on a central level (for the entire pool).

### Payments and Penalties

Payments for balancing services come in form of an energy fee and an availability payment depending on each product. Primary reserves have only availability payments and no energy prices payed out. Quantities for prices can be found in the Hungarian TSO's website<sup>12</sup>.

Penalties for non-delivery or under delivery exist and their quantity are proportionally linked to the amount not delivered up to losing all payments in case of complete non-delivery. Additionally, in case of insufficient quality in the balancing service delivered the BSP can be penalized by paying the imbalance price. Repeated offenses might lead to the revocation of the prequalification.



## Market Size, Transparency and Upcoming Changes

### Market Segmentation and Size



Assets connected to the low voltage grid are allowed to participate in all balancing services but currently not many participants are active. It is estimated that under 10 independent market actors are providing services through low voltage grid connected assets. Between 15 and 20 participants bid into the balancing markets on a regular basis, with only one of them providing DR services. The resources used are mostly gas, with some participation from coal and nuclear plants. The Hungarian market is dominated by traditional resources, highlighted by the fact that less than 5 of the market participants have assets with less than 50 MW capacity. DR's share in the capacity provided to the balancing markets amounts to around 180 MW.

### Transparency



The transparency issues encountered for independent aggregators are severe, and to be expected for a mandatory "market" where only generators bid into. Identifying the potential business case in Hungary is difficult due to the contracting model used by the TSO and the lack of information regarding these contracts. ENTSO-E's platform does not reflect the full prices and activations for all products in Hungary.

### Upcoming Changes



As with other European countries the EB GL will come into force and changes in legislation are foreseen in Hungary in 2019 to adapt to the network code. No other specific changes are under discussion.

<sup>12</sup><https://www.mavir.hu/hu/web/mavir-en/average-and-marginal-prices-of-bids-offers>



## IRELAND

Ireland allows demand-side flexibility to be offered to the grid, but a market is absent, since these services are contracted through a reconfigured ancillary services arrangement called System Services through the TSO run programme called “Delivering a Secure, Sustainable Electricity System” (DS3). This programme is intended to enable Ireland to reach its 2020 renewable electricity target of 40%. The scheduling of generation and consumption as well as the dispatching of services is performed by the TSO. Demand Side Unit (DSU) is the form through which DR can participate providing their capacity into the Single Electricity Market (SEM). This is in only available to industrial size loads due to the technical requirements. Currently, aggregation of residential demand-side flexibility is not allowed to participate in the DS3 programme, only industrial size units can be aggregated.



### Access to the Balancing Markets

#### FCR (Primary control)



Aggregation is allowed to participate either as Demand Side Unit (DSU) or Aggregated Generation Unit (AGU), but with a minimum unit size of 4 MW. Individual assets 10 MW and over are not allowed to aggregate, and must participate as stand-alone units. The procurement process takes two forms – a regulated tariff process that is open to all technologies, but has a budgetary risk, and an auction process that is predominantly designed for storage. Contracts have a duration of 5-6 years. Primary control is provided across two system services – Fast Frequency Response (FFR), activated from 2-10 seconds, and Primary Operating Reserve, activated from 5-15 seconds. The precision of the power measurement monitoring for frequency is 0.1 Hz, for individual phase voltage reading 0.2% and for individual phase current readings 0.5%.

#### aFRR (Secondary control)



The closest product to aFRR in Ireland is known as Secondary Operating Reserve (SOR) which is active 15-90s after the frequency drop and needs to be maintained for 75s. Aggregation of residential demand side management is not allowed for this product, only industrial units. Minimum unit size is 4 MW as for FCR, since it is the minimum bid size for participation in DS3 which includes all system services products.

#### mFRR (Tertiary control)



Tertiary Operating Reserve is formed by two different products depending on the response time. The first one is activated between 90s and 5min after the frequency drop, the second one between 5 and 20min. TOR1 has to be sustained for 210s and TOR2 for 900s. Aggregation of residential demand side management is not allowed for this product, only industrial units. Minimum unit size is 4 MW as for FCR, since it is the minimum unit size for participation in DS3 which includes all balancing products.



### Measurement, Prequalification, Payments and Penalties

#### Measurement and Prequalification



Measurement is performed on each single asset providing the service, alternatively at the connection point in the case of several assets in the same site. In case of aggregation the measurement will be done for the whole portfolio.

For assets to participate in any balancing product they must be approved for a particular product on the DS3 System Services Proven Technology List<sup>13</sup>. There is also a trial process in place to include new technologies in the DS3 approved list<sup>14</sup>. This trial tests new technologies' capacity to deliver any given product as well as the requirements for a proper measurement of the technology.

There are no special requirements for storage assets if they are batteries behind the meter. In case of before the meter batteries they will be required to provide five products together, from FFR to TOR2, that is, be able to deliver frequency services throughout 20 minutes of time. Additional requirements for batteries exist:

- Minimum speed of response between 150-300ms
- Trajectory of 0.3Hz
- The required reserve trigger capability at 49.8Hz
- A recharge limitation that only allows trickle recharge post-event and once the frequency has returned to within ±0.05Hz and maintained during the last 5 minutes

#### Payments and Penalties

In an effort to ensure price certainty the availability payments are fixed for all the products at the beginning of the contract with the TSO and only altered under certain conditions. The current prices for all the services are as follows:

- FFR: 2,16€/MWh (standard 2s response), triple rate for enhanced 150ms response)
- Primary Operating Reserve (POR): 3,24€/MWh
- Secondary Operating Reserve (SOR): 1,86€/MWh
- Tertiary Operating Reserve 1 (TOR1): 1,55€/MWh
- Tertiary Operating Reserve 2 (TOR2): 1,24€/MWh

Also, worth highlighting is that aggregators do not have access to energy payments once activated, which does not reflect the true value of DR and creates a barrier for aggregators.

Contracts include performance scalers foreseen that can be applied to payments. In case of non-delivery these change the received payment in a proportional manner to the non-delivered energy. This can go up to the point where the full payment can be cancelled. The scalers take into account different factors, including monthly and dynamic time factors.



### Market Size, Transparency and Upcoming Changes

#### Market Segmentation and Size



As of 15<sup>th</sup> August 2018 479,77 MW of DR participated in the Irish market. This includes capacity mechanism and wholesale market and not only balancing services. There are no specific statistics for the quantity provided for balancing services, however the TSO is expected to publish a report by the end of 2018. This amount adds up to only 3.48% of the total registered capacity in Ireland. 266 market participants in total are active in balancing services, 200 of which have assets with a capacity under 50 MW, which shows a healthy participation of new energy actors. DS3 is due to become an auction-based mechanism in the second quarter of 2019.

#### Transparency



Prices and quantities contracted are not available at ENTSO-E's Transparency Platform for any product.

#### Upcoming Changes



As of the 1<sup>st</sup> of October 2018 Eirgrid, will adopt a new model for wholesale market that introduces for the first-time balancing markets in Ireland. All providers that enrol in the wholesale market will be mandated to participate in the balancing mechanism. This is part of the Integrated Single Electricity Market (I-SEM) effort to bring Ireland on the same level as Continental Europe.

<sup>13</sup><http://www.eirgridgroup.com/site-files/library/EirGrid/DS3-System-Services-Proven-Technology-Types.pdf>

<sup>14</sup><http://www.eirgridgroup.com/site-files/library/EirGrid/DS3-System-Services-Decision-Paper-on-Qualification-Trial-Process-FINAL.pdf>



## ITALY

Italy is one of the historically closed countries regarding balancing markets. Arera, the Italian Regulator, is trying to improve this situation with new pilot projects that allow independent market parties to provide flexibility services to the grid. Currently these pilot projects are only working for RR but there are draft projects for FCR and voltage regulation. Future projects may involve FRR. Based on the results achieved through the pilot project experimentation, an overall reform of the ancillary services market will be issued. A complete opening of the ancillary services to the market is long overdue, will contribute to system and price stability. Despite being called “pilot projects” they are completely integrated since 2017 in the Italian ASM with a participation of more than 600 MW today. Since November 2018, UVAM project has substituted, UVAC and UVAP, details on these projects are still included in this report, as they serve as a blueprint for UVAM. Italy is undertaking important efforts to improve the access to balancing markets, aligning with other European markets and with the requirements of ENTSO-E’s EB GL.



## Access to the Balancing Markets

### FCR (Primary control)



FCR products are currently not open to the market. It is mandatory for generators and conventional power plants with an installed capacity of 10MW to provide it. If the asset is installed in mainland Italy, it must provide ±1.5% of its effective power to FCR. Plants in Sicily and Sardinia must provide ±10% of their effective power. These units can also participate in a voluntary mechanism for primary reserve remuneration, in which energy is paid a regulated price and the operator must install advanced equipment for the measurement and control of the primary reserve actually provided to the system.

### aFRR (Secondary control)



aFRR is currently closed to DR and DER. There are plans to expand the UVAC project to aFRR in 2019, but concrete details on the requirements and details of the project are not known yet.

### mFRR (Tertiary control)



The tertiary reserve, or “Altri servizi”, is the only product open to market participants, through a project called UVAM, that includes aggregation of consumption and generation. UVAM went live in November 2018, absorbing the two previous projects for generation and consumption units, UVAP and UVAC.

To participate in the pilot projects, facilities must have at least hourly metering. By 25<sup>th</sup> November 2018, UVAC and UVAP will be converted to UVAM. UVA products will participate to spot ancillary services market for the provision of replacement reserve and balancing. The full activation time (FAT) is 15 minutes for balancing (except for slow replacement reserve “riserva terziaria di sostituzione”, which has a FAT of 120 minutes). The balancing services are offered in the ancillary services market both ex-ante and real time (D-1 and D). The minimum bid size is 1 MW for 1 hour of delivery. For 2019, 1 GW of total capacity will be tendered in UVAM.

The TSO, with approval of the Regulator, purchases balancing services from UVA on a forward basis. Auctions are based on a competition for the fixed premium perceived as a remuneration for the availability to offer upward tertiary reserve in the ancillary services at a price below a strike reference (400 €/MWh). Forward contracts have been in place for UVAC till 30<sup>th</sup> September 2018.

New forward contracts will be auctioned for the provision of balancing service by UVAM for the delivery period 2019-2020.



## Measurement, Prequalification, Payments and Penalties

### Measurement and Prequalification



The prequalification is performed through a registration of the assets and then through a field test to check the ability of the UVA to perform and deliver at the expected level.

Measurement is performed at each delivery point and in case of aggregation through a concentration device. This measurement is performed and sent to the TSO every 4 seconds.

### Payments and Penalties

In case of participation in the spot ancillary services market, remuneration is pay-as-bid. Forward contracts have been assigned to UVAC until 30<sup>th</sup> September 2018. These contracts are based on a fixed premium perceived as a remuneration for the availability to offer upward tertiary reserve in the ancillary services at a price below a strike reference (400 €/MWh). The fixed premium abovementioned is a result of an auction with downward competition with a reference price of 30 k€/MW/year and the premium assigned to each UVAC is pay-as-bid.

The reference price for the new forward UVAM procedure is 30 k€/MW/yr. This would reward assets that can be available for at least 4 consecutive hours between 14:00-20:00, Monday to Friday, and can do so at strike price (400 €/MWh) or below. In case of offers below 4 hours, the fixed price is proportionally reduced until 15k€/MW/yr (corresponding to 2 hours of offers, which is the minimum offer obligation).

Penalties for under-delivery for UVAM in the spot market, are the marginal price in the ASM. A 5% franchise is applied, calculated as the ratio between the imbalance and the quantity accepted in the ASM. In the forward contract regulation, if the requirement to offer capacity is not positively verified for at least 70% of the days of the month, Terna does not recognize the fixed price related to that month to the BSP.

The penalty scheme for the UVAC forward contract is similar to the UVAM one. For the spot market, if the dispatch order is not respected, the BSP must pay a penalty equal to the product between the amount of energy not supplied and the 150 % of the price offered on the ASM.

Finally, for the UVAP, a penalty is provided both if the dispatch order and if the baseline is not respected. In the latter case, the BSP must pay to Terna a penalty equal to the 2% of its monthly income.



## Market Size, Transparency and Upcoming Changes

### Market Segmentation and Size



In September 2018 there were 516 MW of enabled UVAC and 110 MW of aggregated generation units (UVAP). The capacity is provided by 20 prequalified BSPs, of which most aggregating pools consist of medium to large industrial customers. Only two of these BSPs provide more than 50 MW and only five other market actors provide more than 10 MW, the remaining BSPs provide all less than 10 MW capacity to the balancing markets.

For low voltage connected clients, the requirement to participate is the availability of hourly metering. In Italy, customers with demand above 55 kW already have this kind of metering, and smaller customers have recently started to install the new smart meter with this functionality. V2G is enabled from a regulatory point of view in the new UVAM framework, its practical implementation is not yet foreseen.

### Transparency



The Italian TSO, Terna, is publicising their new pilot projects in a clear effort to open the market. More information is required on how the future market design will look like and whether the pilot project will be integrated into it, and especially when this will happen.

### Upcoming Changes



In the next months “Integrated generation units” (UPI) and “Relevant generation units not mandatorily enabled to the ASM” (UPR) regulation will be approved. With the first project, UPI, it will be possible to provide FCR through systems made up of an aggregation of relevant generation units and storage.

UPR will allow relevant generation units not mandatorily enabled to ASM (for example not programmable generation units powered by renewables sources) or units who don’t respect minimal technical requirements for ASM enabling, to participate to the provision of congestion management, tertiary reserve and balancing.

For 2019, 1 GW of total capacity will be tendered in UVAM with a starting price of 30k€/MW per year. Bids need to commit to delivery the contracted capacity for at least 4 consecutive hours and are entitled to a strike price of 400 €/MWh. Finally, there are explorations into expanding market access for the procurement of additional speed frequency regulation resources.



# THE NETHERLANDS

The Netherlands has a reasonable amount of DR active in its grid, especially represented in the balancing markets. This has been encouraged by a flexible set of requirements and an open, technology-neutral market for DR. There are still some significant barriers that The Netherlands should improve, especially related to the direct access for independent aggregators to the consumers, which severely limits their access to the market. Currently, independent aggregators wanting to provide their services still need to do so through a BRP. But the potential is clearly there with a market already adapted to the use of demand-side flexibility services.



## Access to the Balancing Markets

### FCR (Primary control)



FCR is procured by the TSO in two weekly auctions. The first one only involving Dutch suppliers and another one with other European TSOs called the "common auction". Generation, load management and batteries are allowed to provide their services to the market. The minimum bid size is 1 MW with symmetrical bids required. The maximum activation time for "limited energy resources" (LERs) is 15 minutes, for the rest maximum activation time is limitless. Pooling of assets is allowed as long as there is one single BSP responsible for the whole pool.

### aFRR (Secondary control)



Procurement of a minimum amount of aFRR is organized through monthly and weekly tenders by the TSO. The participating parties in these tenders have first signed a capacity contract with the TSO committing them to provide a certain amount of bids per Imbalance Settlement Period (ISP) of 15 minutes. All BSPs, even without a capacity contract, are allowed to provide "free bids". Since 2018 the minimum bid size is 1 MW. Aggregation is allowed to reach the minimum bid size, but aggregators still require previous agreement from the consumers' BRP to settle possible imbalances incurred by the activation.

### mFRR (Tertiary control)



mFRR is procured through quarterly and monthly tenders by the TSO. The minimum bid size is 20 MW, with the option of incremental bid-pricing for each 5 MW. The current structure is not favourable for DR, but there are plans in the near future to reduce the minimum bid size.



## Measurement, Prequalification, Payments and Penalties

### Measurement and Prequalification



In general measurement is performed on a central basis for the entire pool. If the assets are spread out in different regions, then a measurement is necessary for each of them. The Netherlands is split into seven regions to ensure system stability in case of disturbances. In principle, only the delivery of FCR should be measured, independent of the level where the measurement is performed. The BSP is free to choose as long as a clear verification of activation can be delivered. The precision of the measurement is 1% on an aggregated level.

There are some special technical requirements for storage, geared towards preventing the load management of the battery to interfere with the product activation. That is, no charging or discharging during the frequency disturbance.

### Payments and Penalties

For FCR the remuneration is based on availability payments for the committed load in the tender. aFRR has availability payments based on the amount of contracted capacity, and activation payments for the energy delivered, based on the marginal imbalance price of each ISP.

mFRR is remunerated similarly to aFRR with an availability and activation payment. The activation payment is the same for all activated bids and is selected from the highest of the following options: the minimum established price in the contract, the price of the most expensive activated aFRR bid.

The penalty for non-delivery of FCR is the product of the bid price and the period of non-delivery. For aFRR the penalty for non-delivery is the imbalance price of the period affected and at least as high as the bidding price of the BSP. The penalty for non-availability is related to the ISP where the non-availability happens and the capacity fee payed. For mFRR the penalty for non-delivery of availability is the product of the price and non-available period (in hours). The penalty for non-delivery of activation is the product of the non-delivered volume and the imbalance price for the ISPs affected.



## Market Size, Transparency and Upcoming Changes

### Market Segmentation and Size



Activation of bids in aFRR is done on a portfolio base and not for each individual asset. For this reason, the TSO cannot know what kind of units the BSP is using to provide the service. There are currently no statistics on how much DR is participating in this product.

For mFRR there is more registered information and DR has been a constant and significant provider to the market. Currently about 150 MW of DR participates in the market on a regular basis and all of it is provided from decentralised assets with less than 50 MW size.

Low voltage connected assets are allowed to participate in all products as long as they comply with the prerequisites. But there are no exact figures on how many assets connected to the low voltage grid are participating, since only the location of the qualified assets is known and the ones participating through free bids offered by the BSPs are unknown.

### Transparency



TenneT is trying to increase the transparency on what kind of assets and technologies are providing balancing services and have initiated a project to collect data from market participants and the flexibility technologies they are using. In general, Most information regarding prices, functioning of markets, different products and restrictions can already be found easily on TenneT's website (some documents only available in Dutch). Activated bids and prices payed are not recorded at ENTSO-E's Transparency platform, except for aFRR.

### Upcoming Changes



Requirement for BSPs providing aFRR to have a dedicated communication line with the TSO will be removed in 2019. A measure that was clearly identified as a barrier for small and independent aggregators.

By the end of 2018 FCR will be exclusively procured in the "common auction" with an added requirement for at least 30% of the capacity to be contracted within The Netherlands. A year from now TenneT will procure FCR on a daily basis, and as of July 1st 2020 it will be procured in 4-hour blocks. EB GL and the new product design will be implemented by the end of 2021. The activation times for FCR will be harmonised in 2019.



**Poland's ancillary services markets are not open to independent participants.** DR is not allowed to provide services and aggregation is not permitted. It is one of the few EU countries left working with a central dispatch model. The balancing products are provided by centrally dispatched generation plants with capacities larger than 100 MW. Provision of ancillary services is mandatory for most large generators. But there is potential for flexibility services, and according to ENTSO-E's Transparency Platform, aFRR is activated often and for large amounts.



## Access to the Balancing Markets

### FCR (Primary control)



All large generators in thermal power plants are obliged to maintain the ability to provide primary and secondary regulation services. The price is about 5% of the variable costs of generation in a given unit. The selection of units that will receive remuneration for having an active regulation system is made by the TSO, aiming for minimisation of costs. Pump storage and large hydropower plants negotiate individual contracts for the provision of system services. The minimum bid size for each hourly block is 1 MW provided in symmetrical bids. FCR is provided only by large generation, no DR or aggregators have access to it.

### aFRR (Secondary control)



aFRR is acquired by the TSO through bilateral contracts. The minimum bid size for each hourly block is 1 MW in symmetrical bids.

### mFRR (Tertiary control)



mFRR does not exist in Poland. A similar service exists but is outside a market. System generators are obliged to submit offers on the balancing market whenever there is a possibility of deliveries to the network. In case the operator does not accept balancing offers, these producers receive remuneration for the so-called Operational Power Reserve. It is about 10 EUR / MWh, but if the reserves available to the operator are higher than 9%, price decreases in proportion to the increase in reserves. The TSO negotiates separate bilateral contracts for reserve capacity with pumped storage power plants, large hydro power plants and large local CHP.



## Measurement, Prequalification, Payments and Penalties

### Measurement and Prequalification



Measurement is performed on each unit providing the service. PSE defines in the network code requirements for technical specifications for measurements as well as control and regulation systems (dedicated mainly for large thermal power plants). Such systems have to be carefully tested by PSE.

### Payments and Penalties

As described above for participation in the aFRR and mFRR remuneration is 5% of energy generation of the unit plus up to 10 EUR/MWh Operational Capacity Reserve (OCR) payments for being in the reserve. This OCR payment is also for large generators that unsuccessfully offer their flexibility on the balancing market.



## Market Size, Transparency and Upcoming Changes

### Market Segmentation and Size



For upwards regulating FCR, around 170 MW are bid into each block in symmetrical bids and for aFRR around 560 MW. Activations for aFRR are quite common, with more than 100 MW activated in most blocks.

### Transparency



Transparency regarding the contracts, payments and prequalification to provide balancing services is low. There is no clear communication on upcoming changes and next steps for the market which creates uncertainty for potential investors.

### Upcoming Changes



Poland is working towards the implementation of the EB GL, which will require a complete restructuring of the balancing markets to open them up and provide products in line with the new network codes. The implementation of the new model is not expected before 2020-2021.



# PORTUGAL

**Balancing markets in Portugal continue to be very rudimentary.** No big changes have occurred in recently to remedy this, and the only positive outlook is the future implementation of the EB GL by ENTSO-E. Especially given the ambitious goals for renewable energy implementation in Portugal, a way of ensuring grid stability will become extremely important.

In this respect, in May 2018, the Portuguese TSO launched a public consultation on its proposal for the Terms and Conditions for BSPs and BRPs, which includes DR and DER as potential providers of balancing services. Furthermore, with the aim of learning lessons on this issue, in October 2018, the Portuguese regulator launched a public consultation on a pilot project for the participation of consumers in the mFRR market. But currently, DR does not participate in the balancing market and only aFRR and mFRR are provided by the market in Portugal. FCR continues to be a mandatory, non-remunerated service.



## Access to the Balancing Markets

### FCR (Primary control)



There is no market for FCR since it is a mandatory and non-remunerated product to be provided by every generator connected to the transmission network.

### aFRR (Secondary control)



aFRR is provided on a market basis, by mostly thermal and hydro units. Procurement is done as a single product that needs to include both upwards and downwards capacity ("regulation band"). The proportion between these must be the same as the relation between up and down capacity required by the TSO for the whole system. This requirement imposes a barrier on the participation of DR since the provision of downward capacity by DR implies that whenever aFRR is activated downwards, consumers have to increase consumption- something which is challenging for many loads, and can be expensive, depending on the network tariff that applies during the delivery period.

### mFRR (Tertiary control)



mFRR is provided by balancing areas which include conventional generators and pumped storage consumption units under the same BRP. These balancing areas are required to present price offers for the whole available upwards and downwards capacity. Although providers offer capacity, only activated mFRR is remunerated.

As previously mentioned, the Portuguese regulator recently launched a consultation on a pilot project for the participation of demand in the mFRR market. According to the project rules, only individual consumers who can offer more than 1 MW of mFRR and pass prequalification procedures are allowed to participate in this market. The obligation of presenting offers to the market is not applied to demand.

As for service remuneration, consumers will be entitled to the same payments as generators (i.e. the marginal price of mFRR activation).



## Measurement, Prequalification, Payments and Penalties

### Measurement and Prequalification



Currently, there are no rules in place regarding measurement and prequalification of DR in Portugal, although these will have to be established within the framework of the above-mentioned pilot project.

### Payments and Penalties

For aFRR, there are both availability and activation payments. During the first 10 months of 2018 the average availability price for aFRR was 13€/MWh. The price of aFRR activation is determined by the mFRR activation prices.

As previously mentioned, for mFRR only activation payments exist. During the first 10 months of 2018 the average upward and downward mFRR activation prices were 69€/MWh and 40€/MWh, respectively. In the same period, the day-ahead market price was 56€/MWh.

In case of non-compliance with the committed bids, the penalty for aFRR is 1,5 times the marginal price of the aFRR market multiplied by the non-delivered capacity. Any non-compliance with aFRR/ mFRR activation is settled at the imbalance price, which in Portugal implies a symmetrical penalty for both long and short positions, regardless of the system imbalance.



## Market Size, Transparency and Upcoming Changes

### Market Segmentation and Size



Due to the numerous constraints, participation of DR in Portugal is almost non-existent, and even though participation for low voltage grid connected assets is allowed, so far none are providing services to aFRR or mFRR.

For upward aFRR capacity, between 250 MW and 400 MW are accepted to each hourly block, with around 20 MW – 70 MW activated each time. For downward capacity, accepted bids amount to around 150 MW, with rare activations that do not go over 40 MW.

For upwards and downwards regulating mFRR between 4000 MW and 7000 MW are made available to the TSO in each hourly block. Activations are less common in mFRR than aFRR and range between 20 MW to 200 MW.

What is currently a possibility in Portugal, similar to the situation in Spain, is an interruptibility regime, where certain consumption units, limited to large industrial consumers connected to the High Voltage grid, can be run down or turned off in response to network constraints. This service is remunerated and currently around 667 MW of capacity is available under this regime.

### Transparency



Basic data is available online in Portuguese and English. Communication by the TSO has been limited in line with a market with slow changes and low participation of DSF. While rudimentary data on electricity consumption can easily be found online, more specific data on the composition of bids would be welcome. For aFRR and mFRR quantities activated and the prices payed are made available by the Portuguese TSO and at ENTSO-E's Transparency Platform.

### Upcoming Changes



The Portuguese TSO is actively working to implement the EB GL, which should open all the balancing markets and remove undue barriers that might remain.



# SLOVENIA

**Slovenia is a small market with a reduced use of balancing energy resulting in limited business opportunities.** In addition to this several barriers remain for independent market parties to deliver their services. FCR is currently a mandatory service and while aFRR and mFRR are open to DR, some requirements like the 24/7 availability to participate makes it difficult for some technologies and puts an additional constraint in the design of the aggregators' portfolio. Upcoming changes and adoption of the EB GL will provide an open and standardised market in line with its European neighbours, but the question remains if this will be enough to provide the business opportunity in Slovenia, given that other markets important for DR like the wholesale market, are still closed to its participation.



## Access to the Balancing Markets

### FCR (Primary control)



No market is available for the provision of FCR since it is a mandatory product to be delivered by all generating units connected to the high voltage grid with capacity above 10 MW.

### aFRR (Secondary control)



aFRR is procured through bilateral contracts from the TSO with big industrial consumers. The amount contracted so far is quite small, 60 MW upwards regulation and 60 MW downwards regulation.

### mFRR (Tertiary control)



mFRR is procured on a market base through yearly tenders. The minimum bid size is 1 MW divided into 24 daily one-hour blocks. Activation time is 15 minutes before the delivery of the committed load.



## Measurement, Prequalification, Payments and Penalties

### Measurement and Prequalification



Measurement is performed on each individual unit that intends to provide a balancing service on the grid connection point. The precision required in measurement is 0.5% and the ramping requirements are standard in line with the SO GL network code.

Besides providing the relevant documents, prequalification consists on a performance test carried out by the TSO for seven days in a row with a maximum activation of ten hours in total. Aggregators need to be able to provide bi-directional communication with the TSO in real time.

Additionally, aggregators need to submit a guarantee of 15.000 € per MW committed.

There is currently only one official baselining methodology based on the actual reduction in consumption from the scheduled regular consumption.

### Payments and Penalties

aFRR products are payed on activation. The prices range from 45€/MWh to 72€/MWh in the winter for upwards regulation and from 15€/MWh to 42€/MWh downwards regulation. In the summer months it ranges from 62€/MWh to 92€/MWh for upwards regulation and from 32€/MWh to 43€/MWh for downwards regulation. The last recorded data before publishing of this report, showed prices in October 2018 that ranged from 50€/MWh to 125€/MWh for upwards regulation and from 15€/MWh to 44€/MWh for downwards regulation.

mFRR products are payed on activation (pay-as-bid) and availability.

Currently the penalties for non-delivery are quite onerous, but this is a transition period until the implementation of the Terms and Conditions. Until now, the penalties are 4.000€/MWh with a tolerance of 20% for under- and over-delivery. Once these enter into force, the penalties, in line with other European countries, will be handed out for non-delivery of committed load or underperformance as well as a penalty for unstable operation or delivery.



## Market Size, Transparency and Upcoming Changes

### Market Segmentation and Size



The participation of DR in the Slovenian balancing market is quite limited for diverse reasons, from barriers of access to low prices and a small market that does not make an attractive business opportunity for investors. For example low voltage grid connected assets can currently not participate in the balancing markets. Most aggregators and BSPs currently use diesel generators, industrial loads, commercial buildings and CHP to provide balancing services. Only two market participants have a registered portfolio of less than 50 MW capacity. Currently DR is participating in mFRR with 33 MW in upwards regulation and 10 MW for downwards regulation, compared to 315 MW up and 175 MW down of generation. These bids are rarely activated.

### Transparency



Due to the nature of the balancing market, and the bilateral deals used to provide services, knowledge is limited for independent parties to assess a possible business case in Slovenia. The lack of aggregator framework and standardised baselining methodology adds to this difficulty. Prices for the capacity payments from bilateral contracts are difficult to estimate.

### Upcoming Changes



As in many European countries the biggest effort underway in Slovenia comes from the implementation of the EB GL. Its full implementation is foreseen for the end of 2021, and by then standard balancing products, open to market provision, need to be implemented. The closest changes to be implemented are the Terms and Conditions for participating BSPs in the balancing markets, which should be fully in force in 2019.



## SPAIN

Spain is historically a closed country to explicit DR with a stronger focus on implicit DR. Although this remains the case, recent changes in renewables legislation, which is expected to increase small decentralised installations, and a new government with an ambitious programme and a tight schedule, herald changes in the electricity market design.

But for now, electricity balancing markets are closed to DR and aggregation is only allowed for generation and limited to pools of assets from the same technology. And even if this were not the case, the current design of products is not friendly for DR to participate. Besides the upcoming implementation of the EB GL, market design in Spain must be adapted to foster demand-side participation.

Currently the only active programme is the interruptible loads contract in which large customers can curtail their consumption as a form of rudimentary DR. According to the last interruptibility auction held in May 2018, a total of 2.6 GW of capacity is available for consumption reduction. Aggregation is not allowed to participate in this programme; since only individual customers with more than 5 MW of contracted power can participate.



## Access to the Balancing Markets

### FCR (Primary control)



FCR is provided on a mandatory basis by every generator connected to the transmission network. It is not remunerated. If a generator is not able to provide it for technical reasons in a specific unit, the unit has to contract the service to be provided by another generator.

### aFRR (Secondary control)



aFRR is purchased through auctions held on D-1. It is provided by regulation zones, consisting of aggregated generation units belonging to the same BRP. The minimum size of the regulation zones is 300 MW. The minimum bid size for each unit (or aggregation of units) within a regulation zone is 10 MW. The prequalification process to participate in the aFRR market involves the qualification of each unit (or aggregation of units) and that of the regulation zone as a whole. Another barrier for Demand Response is the requirement that each regulation zone must offer both upward and downward aFRR capacity to the market. aFRR is provided by mostly large generation companies.

### mFRR (Tertiary control)



mFRR is purchased on a market basis, but until the T&C are approved, DR has no access to it. Under certain circumstances, the TSO can activate interruptible capacity which acts as a sort of DR. There are 500 MW of interruptible capacity available today. Since recently renewable resources can participate in this product, in an effort to integrate Spain's large renewable pool.

Similar to aFRR, the physical units have to be enabled, through a prequalification process, by the TSO. All participating units have to present offers for their full available capacity at any given time for 15 minutes and each bid has to include upward and downward regulation, even if only one direction is activated. The minimum bid size to participate is 10 MW, and even though aggregation of demand will be allowed, this requirement represents a barrier to the participation of small consumers (even when aggregated).



## Measurement, Prequalification, Payments and Penalties

### Measurement and Prequalification



The design of the prequalification process to provide balancing services excludes DR. To participate in a market, each unit, or aggregation of units, has to qualify, as well as the whole 300 MW regulation zone. Since recently, production units, especially renewables, are allowed to undergo prequalification in an aggregated way. It is expected that once the EB GL Terms and Conditions are approved, DR will also be able to participate in a similar way. Each regulation zone must offer both upward and downward capacity to the market, even if each unit only provides services in one direction. For the prequalification process the TSO has a proportionality criterion that establishes, that the proportion between upward and downward capacity allocated to each regulation zone must be equal to the proportion between the upward and downward capacity required by the TSO for the whole system. This implies that, for large portfolios storage units could provide downward regulation, but it would still be a significant barrier for small actors.

### Payments and Penalties

For aFRR there are availability and activation payments. The availability prices are set through the marginal price of each hour block in the D-1 auction. The activation prices are set based on the mFRR bid ladder, considering the amount of mFRR that would be necessary to restore the consumed aFRR energy. mFRR has only activation payments, based on the marginal prices of each hourly block.

The penalties are quite onerous and may restrict the participation of smaller providers. Non-availability penalty for the regulation area consists of 150% of the capacity marginal price. Other variables are also taken into account, like the number of units not available in the same regulation zone, the weight of that regulation zone on the system reserves and the reserves that were required at the moment of non-delivery.

For upward regulating mFRR the non-delivery penalty consists of the cost of the energy not delivered in addition to 20% of the non-delivered energy value, based on an average balancing price. For down regulating mFRR the penalty consists of the cost of the deviation plus the value, based on the spot market price, of the non-delivered energy. Apart from that, any deviation from market schedules (which includes the balancing energy allocated by the TSO) constitutes an imbalance and is settled accordingly.



## Market Size, Transparency and Upcoming Changes

### Market Segmentation and Size



So far, no DR is participating in the Spanish Balancing Markets. Most bidders are traditional generation and pumped storage units. Small cogeneration, wind and other renewables participate in the Balancing Markets with a total capacity of 13 GW. Around 1400 MW of upward and downward capacity, is accepted in each hourly block for the aFRR tenders. The amount activated moves between 0 and 500 MW in each block the median amount activated being around 30-40 MW for upwards regulation. For downwards regulation in aFRR the amounts are significantly bigger with activations of 200 MW – 400 MW in each hourly block. Amounts for activated mFRR are also higher, with around 300 MW – 700 MW activated each block for upwards regulation and similar amounts for downwards regulation.

### Transparency



Transparency issues in Spain are related to the bilateral contracts for mandatory participation, where the prices do not reflect the real potential. Prices and quantities for some of their products can now be found close to real time in ENTSO-E's Transparency Platform, but datasets are in some cases incomplete. Until EB GL is completely in force, a better source for market data is REE's Transparency Platform<sup>15</sup>. Details on technical requirements and current market design are not easily accessible and most documents are only available in Spanish.

### Upcoming Changes



The EB GL is forcing a major overhaul of the Spanish balancing system that is already in motion. In June 2018 the national Terms and Conditions proposal for the balancing markets was sent to the Spanish regulatory authority. It's expected that its approval by the regulator will allow the participation of DR and storage in the balancing markets on an equal footing to generation. Changes in the Spanish market design are still necessary to steer away from a generation-optimised focus.



# SWITZERLAND

Switzerland is one of Europe's leading countries regarding their access to the balancing markets. All active power reserve products are procured on open markets, aggregation is allowed, and the technical requirements are technology agnostic.

Nevertheless, there are several barriers that limit the participation of DR and DER providers with small assets. For example, the minimum bid size for aFRR and mFRR is 5 MW, a move to 1 MW would be welcome. The metering business is not liberalised yet for small installations, which makes additional meters expensive, which are necessary for aggregators to avoid green-washing where subsidies for combined PV and battery installations are applied. Finally, FCR and aFRR require the BSP to be available 24/7 as it is a weekly product, which is impossible for some aggregators focusing on residential and commercial size customers, having to combine them with large industrial consumers or hydro plants. Improvements are also happening, and the requirement of symmetric bids in aFRR was removed in 2018.



## Access to the Balancing Markets

### FCR (Primary control)



FCR is procured on a weekly basis from the market. All parties can participate in the tenders after passing the prequalification process. The minimum bid size to participate is 1 MW, which can be reached through aggregation. The maximum activation time is 15 minutes. The ramping requirement expects a full activation latest after 30 seconds and a start of delivery latest after 3 seconds after activation.

### aFRR (Secondary control)



aFRR is procured on a weekly basis from the market (a change to daily tenders is foreseen in 2019). The minimum bid size to participate is 5 MW, which can be reached through aggregation. The maximum delivery time for aFRR is theoretically unlimited, however in practice only some minutes., aFRR activation is done following pro-rata and not a merit order, which means all parties that bid into the tender are activated every time that aFRR is needed, in proportion to their size compared to the whole capacity tendered. Asymmetrical bids are allowed, making this product more flexible for different types of technologies and consumer sizes.

### mFRR (Tertiary control)



mFRR is procured on a weekly and daily basis through market tenders. The minimum bid size to participate is 5 MW, which can be reached through aggregation. The delivery time for mFRR is 15 minutes after notification and 20 minutes for the weekly tender of negative mFRR. There are two separate products tendered on a weekly and daily basis and asymmetrical bids are allowed, making this product more flexible for different types of technologies and consumer sizes.



## Measurement, Prequalification, Payments and Penalties

### Measurement and Prequalification



Measurement is performed on a central basis for the entire pool, but each unit is measured individually. There is no minimum size for individual assets or minimum technical requirement that they must comply with, since this is only required for the pool. Pooling of assets is allowed and there are no restrictions as to what voltage level the resources are connected to. The baselining methodology used in Switzerland considers the measured value of the load before the DR activation.

### Payments and Penalties

Capacity payments are available for all three active power reserve types. Additionally, aFRR and mFRR also receive an energy payment on activation. The payments follow the "pay-as-bid" principle and the merit order list is based on the capacity price they indicated when placing the bid. The most attractive markets for aggregators in Switzerland are FCR and aFRR, due to low prices from mFRR.

There is a financial penalty in case of non-availability, if it drops below 99.9%. The provision penalty is the capacity price the BSP received times a penalty factor. The latter depends on the reason for non-availability. A non-delivery of activated energy counts as an imbalance and the imbalance price is applied.



## Market Size, Transparency and Upcoming Changes

### Market Segmentation and Size



Around 10 MW of DR is currently active in aFRR which amounts to up to 2% of the total reserves. For mFRR the amount is somewhat higher at around 50 MW due to a participation of industrial loads. FCR on the other hand has a very restricted participation of DR at around 3 MW, which highlights the low profitability of that product for aggregators. In general, the participation of DR is not as high. This is due to abundance of cheap hydropower, used by the roughly 20 market parties normally bidding in the balancing markets. Only five of these companies have assets that amount to less than 50 MW capacity.

In the FCR markets roughly between 70 MW and 160 MW. are contracted daily depending on the season. For FRR between 350 MW and 400 MW in bids are accepted for each block.

### Transparency



Information on payments and quantities activated in ENTSO-E's Transparency platform are incomplete.

### Upcoming Changes



Several changes will take place in 2019. A move from weekly bids into daily bids is planned for the next year. Additionally, as with other countries, the implementation of the Transmission System Operation and EB GL in the upcoming years will change the requirements of some products, although Switzerland is already fairly aligned.

On 18 October, the Federal Council opened the consultation on its proposal for a revision of the Law on the supply of Electricity. This foresees the opening of the market for the household customer, the liberalisation of the measurement market for industrial customers and clear stipulations on the ownership of the flexibility. There is also a proposal for a strategic reserve, but DR is not explicitly taken into account.

## List of Acronyms

<b>ACER</b>	Agency for the Cooperation of Energy Regulators	<b>FRR</b>	Frequency Restoration Reserve	<b>PQ</b>	Pre-qualification
<b>ARegV</b>	Anreizregulierungsverordnung	<b>FRR-A/aFRR</b>	Frequency Restoration Reserve – Automatic	<b>RES</b>	Renewable Energy Sources
<b>BRP</b>	Balance Responsible Party	<b>FRR-M/mFRR</b>	Frequency Restoration Reserve- Manual	<b>RK</b>	Regulating Power
<b>BSP</b>	Balancing Service Provider	<b>FSP</b>	Flexibility Service Provider	<b>RKOM</b>	Regulating Power Options Market
<b>CAPEX</b>	Capital Expenditure	<b>GW</b>	Gigawatt	<b>RPM</b>	Regulating Power Market
<b>CER</b>	Commission for Energy Regulation	<b>GWh</b>	Gigawatt hour	<b>RR</b>	Replacement Reserve
<b>CHP</b>	Combined Heat and Power	<b>HV</b>	High Voltage	<b>SBR</b>	Supplemental Balancing Reserve
<b>CRM</b>	Capacity Remuneration Mechanism	<b>HVDC</b>	High Voltage Direct Current	<b>SCR</b>	Secondary Control Reserve
<b>DA</b>	Day-Ahead	<b>HV Grid</b>	High Voltage Grid	<b>SCADA</b>	Supervisory control and data acquisition
<b>DER</b>	Distributed Energy Resources	<b>I-SEM</b>	Integrated Single Electricity Market	<b>SDR</b>	Strategic Demand Reserve
<b>DK1</b>	Electricity Grid Price Area for West Denmark	<b>ICH</b>	Interruptible Contract Programme	<b>SE1</b>	Bidding area Luleå
<b>DK2</b>	Electricity Grid Price Area for East Denmark	<b>ICT</b>	Information and Communication Technologies	<b>SE2</b>	Bidding area Sundsvall
<b>DSR</b>	Demand-side Resources	<b>ID</b>	Intra-Day	<b>SEM</b>	Single Electricity Market
<b>DR</b>	Demand Response	<b>IGCC</b>	International Control Cooperation	<b>SGEM</b>	Smart Grids and Energy Markets
<b>DNO</b>	Distribution Network Operators	<b>INC</b>	Imbalance Netting Cooperation	<b>SGR</b>	Strategic Generation Reserve
<b>DSBR</b>	Demand-Side Balancing Reserve	<b>IPS</b>	Integrated Power System	<b>SNL</b>	Quickly Interruptible Loads
<b>DS3</b>	Delivering a Secure, Sustainable Electricity System (Ireland)	<b>kV</b>	Kilovolt	<b>SOL</b>	Interruptible Loads
<b>DSM</b>	Demand Side Management	<b>kVA</b>	Kilo (Volt X Amps)	<b>SR</b>	Strategic Reserve
<b>DSO</b>	Distribution System Operator	<b>kW</b>	Kilowatt	<b>STOR</b>	Short Term Operating Reserve
<b>DSU</b>	Demand Side Unit	<b>kWh</b>	Kilowatt hour	<b>STOR TR</b>	STOR Tender Round
<b>EC</b>	European Commission	<b>M&amp;V</b>	Measurement and Verification	<b>T&amp;C</b>	Terms & Conditions
<b>EDRP</b>	Emergency Demand Response Programme	<b>mHz</b>	MiliHertz	<b>TNUoS</b>	Transmission Network Use of System
<b>ENTSO-E</b>	European Network of Transmission System Operators for Electricity	<b>MR</b>	Minute Reserve	<b>TOR</b>	Technical and Organisational Rules
<b>ESCO</b>	Energy Service Company	<b>MS</b>	Member State	<b>ToU</b>	Time-of-Use
<b>FCDM</b>	Frequency Control by Demand Management	<b>MW</b>	Megawatt	<b>TSO</b>	Transmission System Operator
<b>FCR</b>	Frequency Containment Reserve	<b>MWh</b>	Megawatt hour	<b>TW</b>	Terawatt
<b>FCR-D</b>	Frequency Controlled Disturbance Reserve	<b>NRA</b>	National Regulatory Authority	<b>TWh</b>	Terawatt hour
<b>FCR-N</b>	Frequency Containment Reserve- Normal	<b>OPEX</b>	Operating Expense	<b>UMIG</b>	Utility Market Implementation Guide
<b>FIT</b>	Feed-in-Tariff	<b>OTC</b>	Over the Counter	<b>USEF</b>	Universal Smart Energy Framework
<b>FRFS</b>	Fast Reserve Firm Service	<b>PCR</b>	Primary Control Reserve	<b>VOLL</b>	Value of Lost Load
		<b>PDBF</b>	Daily Base Operating Schedule	<b>VPP</b>	Virtual Power Plant
		<b>PJM</b>	Pennsylvania, Jersey, Maryland Market		

