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Scoping of flexible response

CEER discussion paper

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INFORMATION PAGE

Abstract

This document (C16-FTF-08-04) is a short paper focussing on flexibility. It is intended to serve as a working paper dealing with the current status for flexible response in the European electricity market. The report especially aims to highlight challenges for the integration of Demand Side Flexibility (DSF).

Target Audience

European Commission, NRAs; network operators, energy market participants, Member States and other interested parties.

Keywords

Electricity, flexibility; reliability; demand side response; demand side flexibility.

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Related Documents

CEER documents

- Final CEER 2016 Work Programme, 6 January 2016, Ref. C15-WPDC-27-06
- Final CEER 2015 Work Programme, 9 January 2015, Ref. C14-WPDC-26-05
- CEER Advice on Ensuring Market and Regulatory Arrangements help deliver Demand Side Flexibility, 26 June 2014, Ref: C14-SDE-40-03
- The Future Role of DSOs – A CEER Conclusions Paper, 13 July 2015, Ref: C15-DSO-16-03

Agency for the Cooperation of Energy Regulators documents

- ACER in cooperation with CEER, Energy regulation: A Bridge to 2025, September 2014
- Recommendation of the Agency for the Cooperation of Energy Regulators no. 03/2015 on the network code on electricity balancing and Annexes, 22 July 2015
- ACER Market Monitoring Report 2015, November 2015.
- Joint ACER-CEER response to the European Commission's Consultation on a new Energy Market Design, 7 October 2015.

External documents

- Demand Side Flexibility; The Potential Benefits and State of Play in the European Union (finale report for ACER), Cambridge Economic Policy Associates Ltd, TPA Solutions & Imperial College London, 29 September 2014
- Regulatory Recommendations for the Deployment of Flexibility – EG3 Report, Smart Grid Task Force, January 2015
- Refinement of Recommendations – Annex to EG3 Report, Smart Grid Task Force, September 2015
- Mapping Demand Response in Europe Today 2015, SEDC, 30 September 2015
- Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC
- Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management
- Draft Regulation establishing a network code on demand connection (DCC), 16 October 2015
- Draft Regulation establishing a Network Code on Requirements for Grid Connection of Generators (RfG), 26 June 2015
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1 Introduction

In recent years, power systems in Europe have increasingly shown short-term operational stress signs. This is triggered by historical causes of uncertainties and contingencies, together with an increasing penetration of intermittent electricity from RES, which have a massive impact on the volatility of the residual- or net load. In this perspective, flexibility from generation- and demand-side has the ability to improve the efficiency of the electricity system and contribute to security of supply.

In this paper CEER reviews different regulatory arrangements for flexibility and the valuation of flexibility in electricity markets across Member States, defining the concept of flexible response, exploring the ways in which flexibility is valued on the market and investigating the necessary arrangements to facilitate Demand Side Flexibility (DSF). The work also aims to support a common understanding of the topic as a basis for further discussions, especially since there are multiple parties discussing upcoming market changes each from their own perspective.

As the main focus of this report is on market arrangements, flexibility is described according to a simplified but quite common classification of the market organization with particular reference to:

- Wholesale energy markets including forward markets, day-ahead, intraday and balancing energy;
- Ancillary services markets including balancing capacity and support to Transmission System Operators (TSO) and Distribution System Operators (DSO) system operation and control during an emergency;
- Capacity markets; and
- Other network aspects (to a lesser extent)

The views presented in this paper are seen from the perspective of the electricity market, in particular aiming to identify what the flexibility needs are, the role of flexibility resources in the system today and how they can be efficiently procured and utilised. In other terms, in this paper it is not intended to investigate whether the current European power system presents a sufficient level of flexibility, as this challenging question would be part of much more complex studies also involving system planning.

With the Bridge Conclusions Paper and the CEER Work Programmes 2015 and 2016, CEER and National Regulatory Authorities (NRAs) committed themselves to ensure that barriers to the development of flexible response are removed and that flexibility can be provided by both the supply and the demand sides on a non-discriminatory basis, so that Demand Side Flexibility (DSF) can be established as a viable resource for the system.

2 Observations

This short paper on "scoping of flexible response" sets out the observations, grouped in the sections set out below.

2.1 Scoping the topic of flexibility

Flexibility is the ability of the power system to adapt to the growing fluctuations of supply and demand while, at the same time, maintaining system reliability. Any power system presents some degree of flexibility, mostly based on historic system structures.

Flexibility can be represented by a top-down approach, identifying the challenges at system level and the instruments (as market arrangements) to cope with those challenges. At the same time, flexibility can be described according to a bottom-up vision, at a more individual level (e.g. generator or consumer perspectives), to identify flexibility resources and their capabilities.

Whilst much of the terminology relating to flexibility has been defined and used in a range of ways in Europe and internationally, the examination in this paper can be seen in the context of the following use of terms:

- **Demand-side flexibility (DSF)**[1]: DSF can be defined as the capacity to change electricity usage by end-use customers (including residential) from their normal or current consumption patterns in response to market signals, such as time-variable electricity prices or incentive payments, or in response to acceptance of the consumer's bid, alone or through aggregation, to sell demand reduction/increase at a price in electricity markets or for internal portfolio optimisation;
- **Implicit and explicit valuation**[2]: The valuation of DSF can be done either explicitly or implicitly. The difference between those two notions is that explicit DSF is sold as a product on a market (it appears explicitly on the market), and therefore requires a specific control (ex-ante and/or ex-post check based on baseline etc.). Implicit DSF on the other hand does not need such a process since it is not sold to anyone and remains only for the benefit of the final consumer and the corresponding retailer or the Balance Responsible Party (BRP)[3] as an optimisation respectively of its sourcing costs or imbalances;
- **Aggregated resources**: a pool of consumers, generators or storage operated as a single unit by an aggregator in order to provide a flexibility service;
- **Aggregator**: A service provider that combines multiple consumer loads, generators or storage to provide an offer in the energy markets. An aggregator can be the retailer or the BRP of the aggregated units itself, an entity that provides services to a retailer, or an entity that acts independently from the retailer (independent flexibility provider) if national regulation allows for this; and

[1] Definition adapted from *CEER Advice on Ensuring Market and Regulatory Arrangements help deliver Demand-Side Flexibility*, C14-SDE-40-03, 26 June 2014

[2] Examples :
- Time-of-use retail prices have been historically developed to allow retailers to trigger DSF for their own portfolio optimization, without having to sell the flexibility provided to the market.
- With a single price for the imbalance settlement, a BRP can be incentivized as well to trigger implicit DSF to reduce the consumption of its clients and put himself in positive imbalance and help a system that is short
- The use of DSF on balancing capacity (i.e. reserves) can be done explicitly by the TSO that can trigger DSF in case of system needs.

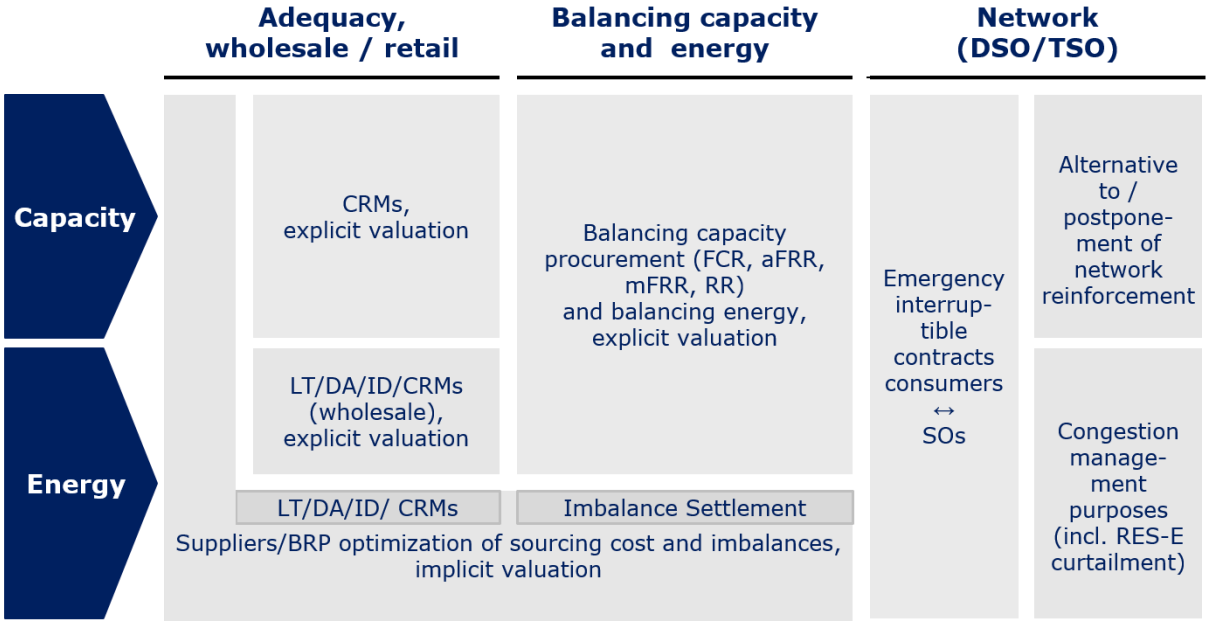
[3] The sharing of benefits between customer and supplier/BRP can be different depending on the arrangements between these parties.

- **Independent flexibility provider**: A market player (e.g. an independent aggregator) that values the flexibility of a consumer (implicitly or explicitly) independently from the customer's retailer.

2.2 Valuation of flexibility in different segments – whole system view

There are a wide set of tools available to meet power system flexibility needs: system operation procedures, market design arrangements, generation performances, demand elasticity, system planning, and storage. Solutions and costs are system specific and time dependent. Electricity markets - especially short-term markets as day-ahead (DA), intraday (ID) and balancing (BAL) - are well-fit to meet certain flexibility needs.

For a fundamental analysis, the whole system and interdependencies need to be taken into account. The following diagram shows the range of current routes through which flexibility can be valued in electricity systems. Flexibility can be valued in adequacy and wholesale/retail markets, in balancing markets and for network purposes. The flexibility of the same generation/consumption unit can be of value in each of these different areas (although the requirements/obligations may differ). Horizontally, the chart differentiates between capacity and energy, because in most of the segments only one of the aspect counts (e.g. LT/DA/ID) or they are separately treated (e.g. aFRR).



These schemes are not applicable for each of the MSs (e.g. Capacity Remuneration Mechanisms (CRMs) exist only in some MSs).

In this paper, CEER explores current DSF valuation arrangements, not only in the DA and ID market, but also in balancing markets, CRMs and in relation to different services procured by TSOs and DSOs. The ambition has been to identify possibilities and challenges in relation to the further integration of flexibility options in general and DSF in particular into the EU electricity market.

2.3 Integration of demand-side for proper market function needed

Currently, system flexibility needs are generally met through generation flexibility – from our observation we conclude that cross-border exchange and conventional gas-fired generation are the most commonly widespread flexibility resources at national level. Several MSs can also count on hydro, including pumped-storage, even if this is location-dependent. Some contribution to flexibility is also expected by distributed generation (DG). In terms of DSF, the majority of the provision was reported to be from industrial consumers. Commercial, small business and residential consumers are less commonly used as flexibility providers and there are rarely references to other advanced solutions (e.g. electrochemical storage).

According to literature and practical experiences, electricity markets function more properly if consumers are not entirely disjoined from wholesale market prices. Improving opportunities to value DSF helps to overcome that (e.g. explicitly through the market or implicitly through retail prices).

2.4 Aggregation to be facilitated by market design

Power system flexibility can benefit from the aggregation of consumption and/or generation units. Aggregation can support the identification of possible sources of flexibility (for instance embedded flexibility at the consumer/prosumer location), pooling of resources according to market standards (e.g. wholesale in favour of competition, and the dispatch of these resources. Open issues concerning aggregation range from market design to legal and technical aspects.

As identified from the current debate and concrete experiences of NRAs in Europe, significant challenges exist. These challenges are namely:

- Feasibility of aggregation with escalating number of market participants;
- Visibility and controllability of small providers, usually non-dispatchable resources;
- Reliability of the service;
- Existence and costs of adequate metering and communication infrastructures;
- Definition of rights and responsibilities among different actors as balancing responsible parties, balancing service providers and system operators; and
- Contractual and/or settlement arrangements between the different entities.

Regulation should guarantee ex ante that aggregation is possible to the extent considered efficient.

2.5 Implicit/explicit participation in markets – different challenges in MSs

With reference to **terms and conditions for explicit DSF**, it can be concluded that the provision and valuation of DSF is closely linked to the retail activity in most MSs since the provision of DSR can only be implemented by, or through, the retailer/BRP of the consumer. Even when possible, the provision of DSR by independent flexibility service providers often has to rely on the prior bilateral agreement with the retailer/BRP. In those MSs where the participation of independent flexibility service providers does not rely on such an agreement, the impacts on the retailer/BRP activity are taken into account only in one MS, where, due to market arrangements, no direct interaction between the two parties is required. Provision of explicit DSR by small consumers (such as those connected to the distribution network and/or those without a meter able to settle their consumption e.g. on hourly basis) only occurs in some MSs. Finally, a number of methodologies used to certify (ex-ante or ex-post) the accuracy of explicit DSR exist. This allows different methodologies to be compared in real life, but it might also create some difficulties for DSR operators to adapt their development to the specificities of each MS.

Regarding **implicit DSF valuation**, it can be concluded that most countries have long-standing experience of static time-of-use prices, such as on peak/off peak or day/night tariffs. However, without smart meters (and optionally in addition other facilitators such as smart appliances) these contracts provide limited possibilities for retailers to value DSF in their portfolio optimisation. The main barriers for retailers in offering dynamic pricing contracts relate to how settlement rules work (e.g. based on profiling vs. measured values) and access to smart meter information. As the roll-out of smart meters is only complete in a very few MSs it is difficult to draw any general conclusions about retailers' and customers' interest in time-of-use pricing reflecting the settlement period on the wholesale market. Economic and efficient use of DSF by retailers in their portfolio optimisation is also important in order to improve the functioning of the wholesale market and to better reflect the price-elasticity of demand. The use of profiles for different customer groups in the settlement function has an important influence on retailers' interests in this respect.

Regarding **explicit DSF valuation in the day-ahead market**, in some MSs consumers may explicitly resell energy, which they have bought at a fixed price contract from their retailer, back to the day-ahead market. There is a need for metering and settlement on at least hourly resolution to enable such a solution.

Aggregated load can, in at least some MS, explicitly participate in the day-ahead market. In at least some MS this will also require the need to have balance responsibility for the involved consumers or have an agreement with the consumers' BRPs. Such conditions can be agreed in bilateral contracts between the market parties.

In some MSs, consumers also have the possibility to provide their **flexibility on the intraday market**. Consumers managing their own portfolio can act as BRPs on their own and therefore resell energy in the intraday market, in line with existing European market regulations. In principle, it also is up to the consumers to agree with the retailer whether or not they would provide flexibility to the intraday market through the retailer.

Except for the case of strategic reserve, participation of **DSF into CRMs** is rather new or under study. While DSF in CRMs can contribute to system adequacy, it is not possible to conclude if DSF in CRMs helps in terms of reliability requirements as well. This is because capabilities in terms of reliability requirements are usually more demanding in terms of dynamic performances (e.g. short notice activation time, ramp capabilities) than capabilities in CRMs. Ingredients of specific attention in designing technology-neutral CRMs are related to eligibility and pre-qualification criteria, credit requirements, de-rating factors, testing metering and baselining DSF.

2.6 Balancing services partly open to demand – variation still evident among MS

Markets for balancing services (load frequency control) are open to demand in certain MSs. A few MSs allow pooling of resources without restrictions, while in the majority of cases this is possible with limitations as separation of demand and generation portfolios. Minimum-bid sizes vary across MSs, some have already reduced their magnitude (as much as down to 1 MW) while others plan to do so. Some MSs allow for DSO connected demand to be fully integrated into balancing services, others do not foresee this option. While balancing for frequency management remains a TSO responsibility, interactions with DSO networks ought to be taken into account and DSO should have an adequate role in the process. The involvement of DSO is documented at least for the prequalification stage but it might become increasingly necessary in the operation time frame as well. Even where DSF can provide balancing services, limitations exist, for example participation in different processes at the same time as well as participation of demand units with estimated load curves might not be allowed.

As practical observation in at least one MS it can be reported, that the liquidity of the balancing market increased and prices got more competitive after the participation of demand-side resources.

2.7 Different network related topics in MSs

Interruptible emergency contracts have been in operation for some time, even if documented usage is actually very limited. Evolution towards remuneration schemes reflecting the value of the service they provide would increase the efficiency of the instrument which should be better integrated into existing markets, in particular balancing services.

There is evidence that a number of countries across Europe are considering using DSF as an **alternative, or as a means of deferring network reinforcement**. This is predominantly the case at distribution level although in several MSs there are indications that it may also take place at the transmission level. It is mostly an option deployed through research and innovation projects incentivised by NRAs.

It will be valuable both to network operators and NRAs across Europe to learn from the outcomes of ongoing trials and innovation projects in this area. Of particular interest will be the extent to which the learning is adopted as business as usual. More work needs to be done in this area to clarify whether DSF can offer a viable alternative to reinforcing the network and to ensure the associated benefits are realised.

3 Summary and outlook

Despite substantial efforts to define different DSF concepts in the frame of the analytical work, it is challenging to come to a coherent understanding of the concept of flexibility. The same applies to a common approach to the practice of integrating DSF, which is equally challenging. For this reason, conclusions from the information provided in this paper must be drawn with caution, especially when it comes to the overall presence of different market solutions for DSF. However, this paper provides a valuable input to come to a better understanding of the available solutions to value DSF in relation to specific national needs and circumstances. It contributes clearly to creating a common platform for mutual understanding and further evaluations of possibilities and barriers to create a level playing field for all sources of flexibility. Interesting results and proposals for further studies have been identified.

Further work on the topic of demand side flexibility will be necessary and a policy paper with more detailed views on market arrangements, including the roles of involved actors, will be published this year.

CEER further continues to work on the topic of flexibility through its work on a paper "Future of DSO-TSO relationship". Increasing amounts of distribution generation and new network technologies may require DSOs to play a more active role in network operation. This document will help NRAs to better understand the changing relationship between DSOs and TSOs and how NRAs can help shape this process. The relationship between DSOs and TSOs will need to evolve in order to ensure the deployment of efficient system solutions to accommodate the needs of a sustainable energy system.

CEER will also work on Guidelines of Good Practice on Incentives Schemes for DSOs, including Innovation, in which CEER will review economic signals of regulation, including the form of regulation, incentives on DSOs, and the treatment of expenditure on flexible and smart solutions.

Next year Guidelines for Flexibility Use at Distribution Level will be published aiming to review the conditions under which DSOs could use flexibility and to provide guidelines on how they can use flexibility with minimal distortion to markets and competition.

Annex 1 – List of abbreviations

Term	Definition
aFRR	Automatic Frequency Restoration Reserve
Agency	Agency for the Cooperation of Energy Regulators
BRP	Balance Responsible Party
CEER	Council of European Energy Regulators
CRM	Capacity Remuneration Mechanism
DA	Day-ahead
DG	Distributed Generation
DSF	Demand Side Flexibility
DSO	Distribution System Operator
DSR	Demand Side Response
FCR	Frequency Containment Reserve
ID	Intraday
mFRR	Manual Frequency Restoration Reserve
NRA	National Regulatory Authority
RES	Renewable Energy System
RR	Replacement Reserve
SO	System Operator
TSO	Transmission System Operator

About CEER

The Council of European Energy Regulators (CEER) is the voice of Europe's national regulators of electricity and gas at EU and international level. CEER's members and observers (from 33 European countries) are the statutory bodies responsible for energy regulation at national level.

One of CEER's key objectives is to facilitate the creation of a single, competitive, efficient and sustainable EU internal energy market that works in the public interest. CEER actively promotes an investment-friendly and harmonised regulatory environment, and consistent application of existing EU legislation. Moreover, CEER champions consumer issues in our belief that a competitive and secure EU single energy market is not a goal in itself, but should deliver benefits for energy consumers.

CEER, based in Brussels, deals with a broad range of energy issues including retail markets and consumers; distribution networks; smart grids; flexibility; sustainability; and international cooperation. European energy regulators are committed to a holistic approach to energy regulation in Europe. Through CEER, NRAs cooperate and develop common position papers, advice and forward-thinking recommendations to improve the electricity and gas markets for the benefit of consumers and businesses.

The work of CEER is structured according to a number of working groups and task forces, composed of staff members of the national energy regulatory authorities, and supported by the CEER Secretariat. This report was prepared by the Agency's and CEER's joint Flexibility Task Force of the Electricity Working Group.

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