ENABLING RULES FOR DEMAND RESPONSE AGGREGATORS

Country/region	**EU**
Type of E1st approach	2 – Enabling E1st (Establishes level playing field between supply- and demand-side resources)
Energy carrier(s) targeted	Electricity
Sector(s) / energy system(s) or end-uses targeted	Grids and providers of flexibility, energy supply
Implementing bodies	National regulators
Decision makers involved	TSO/ DSO/ new market roles (aggregators)/ energy suppliers/ DR suppliers
Main objective(s)	The integration of renewable energy can be enabled by a flexible demand following the intermittent supply. The pooling of responsive demand requires appropriate market rules that enable – among others — the efficient operation of aggregators.
Implementation period	Ongoing

Many renewable electricity sources are intermittent. The integration of wind and solar power can be enabled by the activation of flexible demand. Germany is an example with a medium developed market for flexible energy where recent improvements as well as barriers can be pointed out; the development and further regulatory issues are described.

1. Background

Regulating demand is one way to tackle current and future challenges like volatile energy supply, decentralised generation and critical energy grid situations. This is usually referred to with the terms demand-side management (DSM) or demand response (DR). The terms imply that changes in demand happen as a reaction to the status of the grid or energy availability. The demand flexibility can be either market-driven (e.g., to use unforeseen renewable electricity generation) or grid-driven (e.g., congestion management). The goal of DR is not necessarily the reduction of energy consumption but the avoidance of high power costs, costs for grid expansion or backup power plants and conventional energies due to demand following generation (instead of vice versa). To make use of smaller loads and to integrate them into the balancing, wholesale or capacity market, an aggregation is necessary to meet the participation criteria. Aggregators are players who trade and supply energy without managing their own balancing groups. Their business model consists primarily of pooling and marketing generation facilities, flexible consumers and storage systems. They scale small plants or flexible loads to a tradable volume and represent these pooled resources as a single unit at the markets.

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2. How has the E1st principle (or similar concept) been implemented?

The Energy Efficiency First paradigm is referred to when dealing with the challenges of the energy transition and explicitly includes both energy efficiency and demand response as supporting the integration of renewable energies (ECF, 2016). The share of renewable energies is increasing, but future challenges will involve more than just adding more renewable energies quickly to the system. A secure and stable supply needs interlinkage of processes, i.e., interaction between power plants and renewable energies, flexible demand and storage and consumption. In the European Network Codes (European Commission, 2009), the Energy Efficiency Directive (European Commission, 2012) and the Commission's Energy Union Communication (European Commission, 2015), demand response is mentioned as an enabler of the integration of renewable energies and the security of supply. The aim is to use demand-side flexibility and integrate market players, including consumers. The integration of the DR potential of single market players needs to be structured and organised. Aggregators bundle the resources that can be traded at the flexibility markets. To do so, the rules for participation and interactions with other players like energy suppliers and TSOs need to be defined.

3. Effects / impacts

The Electricity Balancing Guideline (EB GL, Commission Regulation (EU) 2017/2195) sets out EU-wide rules governing the functioning of the load balancing mechanism. Europe has made important progress towards streamlining market conditions and improving access for innovative technologies and services that are essential for success in the sustainable energy transition. Although markets are opening up, the progress is still slow and varies by European country (SmartEn, 2018).

Italy and Germany have made strong efforts towards opening the balancing markets, although they started from a weak position with a market that was restrictive regarding participation with smaller loads or specific technologies/appliances. Other countries like Great Britain and France developed frameworks and innovative solutions earlier. Smart Energy Europe (2018) provides an overview of the status of different European countries and their development in the balancing markets and regulatory frameworks. Only a few countries (e.g., France and Belgium) have a well-developed aggregator framework. The Netherlands's framework is not accompanied by the expected aggregator activity, although includes welcoming technical requirements.

An opening of the balancing markets would let the DR providers enter the market. Companies have high loads and energy consumption to contribute to load balancing and the integration of volatile renewable energies. In Germany, for example, only a few energy-intensive industrial companies participate in the market so far, and no companies from the service sector participate. The potential of the industrial sector is estimated to about 1-12 TWh of flexible energy and about 3-5 GW of peak power; the potential of the service sector falls within a comparable absolute range but is distributed over more companies with a smaller potential each. The flexible technical potential of the service sector is estimated to be about 4 TWh, and 1 TWh is estimated to be the flexible practical potential (the potential of the companies willing to participate at the current state; Wohlfarth et al., 2020). Taking into account that the practical potential is always lower than the technically feasible potential, more favourable framework conditions that facilitate market access could significantly increase this practical potential. This is especially relevant as the service sector has not yet had the opportunity to enter the markets (i.e., due to regulatory barriers) which could be enabled by aggregators. Electricity consumption at the household level points to the potential here, too, with heat pumps and electric

vehicles as particularly promising technologies. However, the potential here is spread across households, and special electricity tariffs are typically offered for these applications.

4. Changes over time, if any

Within the last years, the market integration of DR and the definition of roles like the aggregator developed. When rating energy markets in terms of their degree of consumer participation, programme requirements, standardised verification and measurement as well as payment and risk structures, Germany is only ranked as "partially open," while other European countries (e.g., Belgium, France, Great Britain and Switzerland) already count as "commercially active" (SEDC, 2017).

On Germany's balancing market and under the Ordinance on Interruptible Load Agreements (AbLaV), flexible loads need to prequalify to fulfil minimum standards. The balancing market is split into three submarkets: the primary, secondary and minutes reserve market. Bid sizes and reaction times vary between 1 and 5 MW and from seconds to 15 minutes, respectively. The interruptible loads act (AbLaV) was issued in 2012 and revised in 2016. It allows transmission system operators to advertise their needs for sheddable loads for balancing or redispatch. In total they tender 750 MW of immediately sheddable loads (reaction time within seconds) as well as of quickly available loads (max. 15 minutes reaction time). To open the market to more customers, bid sizes and bidding cycles have recently been adapted (SEDC, 2015, SmartEn, 2018). Since the revisions, pooling of loads is also permitted, e.g., by third party actors like aggregators, as is the participation of medium voltage grids, thus facilitating participation for smaller customers and smaller loads. A standardised process (aggregator model) for contracting and financial compensation between the parties is currently in the works and has been thoroughly discussed by the German regulatory agency Bundesnetzagentur (BNetzA, 2016, 2017) and other relevant stakeholders. The challenges faced in untying the DR potential in the German case are used to provide recommendations for other countries as well, e.g., in Chile (Valdes et al., 2019).

5. Barriers and success factors

Regulatory barriers in particular often hinder market growth and there is a lack of clarity concerning market roles and responsibilities, especially for load aggregation. Currently, low prices for flexible demand inhibit participation even if aggregation is an option. In Germany, one example of current regulations that essentially counteract the participation in demand resources to balance the grid is the StromNEV (2005, §19, sec. 1 and 2). According to this, consumers that has their peak outside the pre-defined peak period of the network (and the given voltage level) and has a high load are eligible for a special demand/capacity network tariff. They get up to 80% reduction of the default rate if they keep their peak outside these network peak period. Thus, their availability for DR is limited to the hours outside the network peak period: the revenue they would get from DR that involved the peak period would most probably less than the extra cost of losing the privilege for the reduced demand tariff.

Clarity of regulation, incentives and information about the options involved are essential to promote DR participation. In Germany, for the aggregation of loads, contracts are necessary with the balancing responsible party and with the transmission system operator. Currently, the main barrier to balancing market participation of DR is that there are no standardised processes and contracts for the settlements between aggregators, balancing group managers and suppliers. Although the German regulatory agency Bundesnetzagentur (BNetzA) and other relevant stakeholders are discussing standardisation (the "aggregator-model"), in particular for quantifying balancing and financial compensation between aggregators and balancing group managers (cf. BNetzA, 2016).

A individual prequalification of each participant/flexible appliance is still required in Germany. In France and Switzerland, for example, pooling is permitted and prequalification conditions only need to be fulfilled by the pool as a whole; this facilitates the participation of smaller flexibility providers, so that flexible loads of any size and without restrictions in terms of technical requirements can participate in the rule market. The principle of aggregation in France works as follows: Suppliers receive a premium to compensate for lost deliveries. For reasons of confidentiality, all relevant processes, such as the transfer of data or payment of premiums, are coordinated by RTE (Réseau de Transport d'Electricité) as an independent body. Aggregators generate revenues by marketing flexibility on the spot market, while flexibility buyers receive a premium negotiated with the aggregator (Eßer et al., 2016).

6. Replicability and scalability potential

The system would profit from a harmonisation of market rules to facilitate the trade of flexible demand over the borders of European countries. Eßer et al. (2016) discusses the opportunities of cross-border trading of flexible loads. Besides the rules and regulations of aggregation, rules for a cross-border trade also need to be defined.

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ABOUT ENEFIRST

ENEFIRST is a 3-year project funded under the Horizon2020 programme, which gathers a consortium of partners from across sectors and regions: IEECP, BPIE, Fraunhofer ISI, CEU, RAP, IREES, TU Wien.

From definition to implementation, ENEFIRST aims at making the "Efficiency First" (E1st) principle more concrete and operational, better understand its relevance for decision processes related to energy demand and supply, its broader impacts across sectors and markets, focusing on the building sector and related energy systems in EU Member States.

> ***E1st gives priority to demand-side resources whenever they are more cost-effective from a societal perspective than investments in energy infrastructure in meeting policy objectives. It is a decision principle that is applied systematically at any level to energy-related investment planning and enabled by an "equal opportunity" policy design.***

ENEFIRST combines policy analysis and quantitative assessments of E1st impacts to develop policy guidelines and recommendations, following a process with continuous exchanges with stakeholders.

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