End-user flexibility and demand-side management. Review of current status and good practice in regulatory arrangement incentivizing and remunerating end-user flexibility

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Agenda

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1. What is flexibility and DSM?
2. Why de we need DSM?
3. Two categories of flexibility
4. Response to market signals: barriers and regulation
5. Active Participation: barriers and regulation

What is End-user flexibility or DSM?

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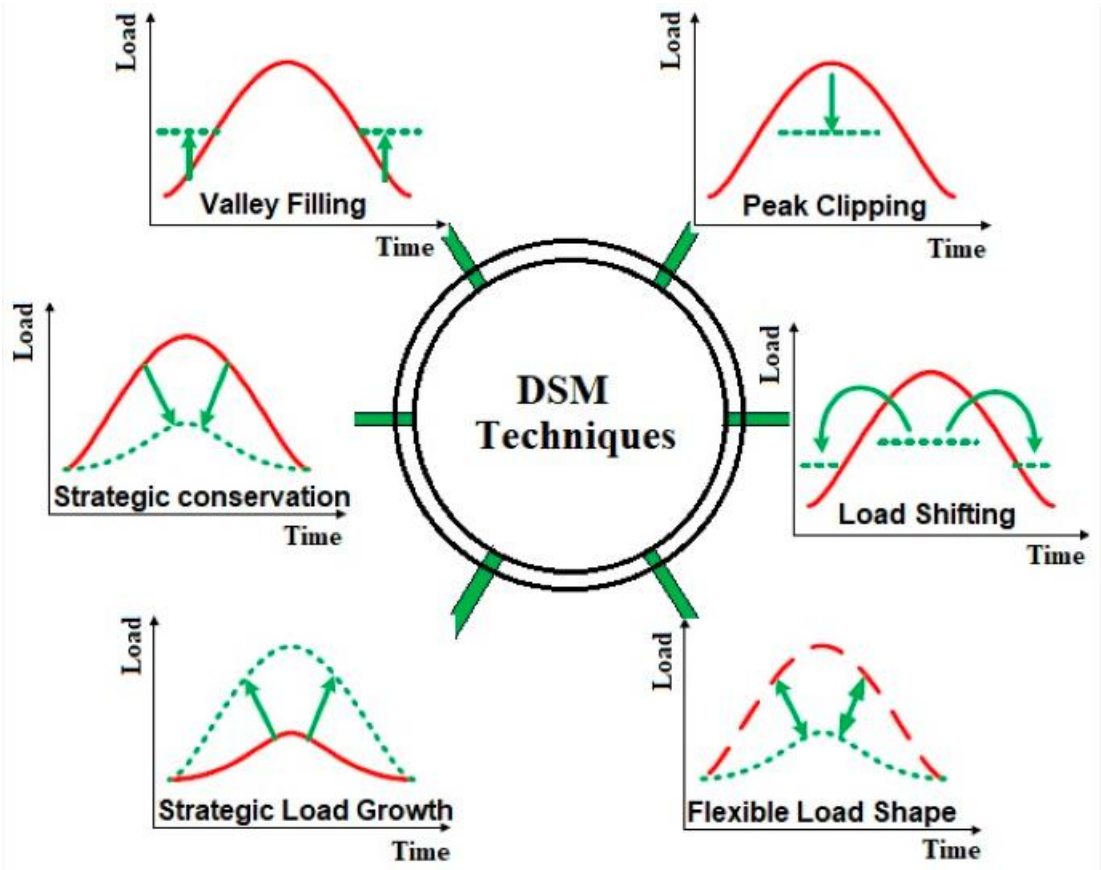

Source: https://www.mdpi.com/2076-3417/10/21/7551

DSM is the planning and implementation of active measures to influence customer use of electricity.

It is also called Demand-Side Flexibility (DSF).

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Why do we need DSM?

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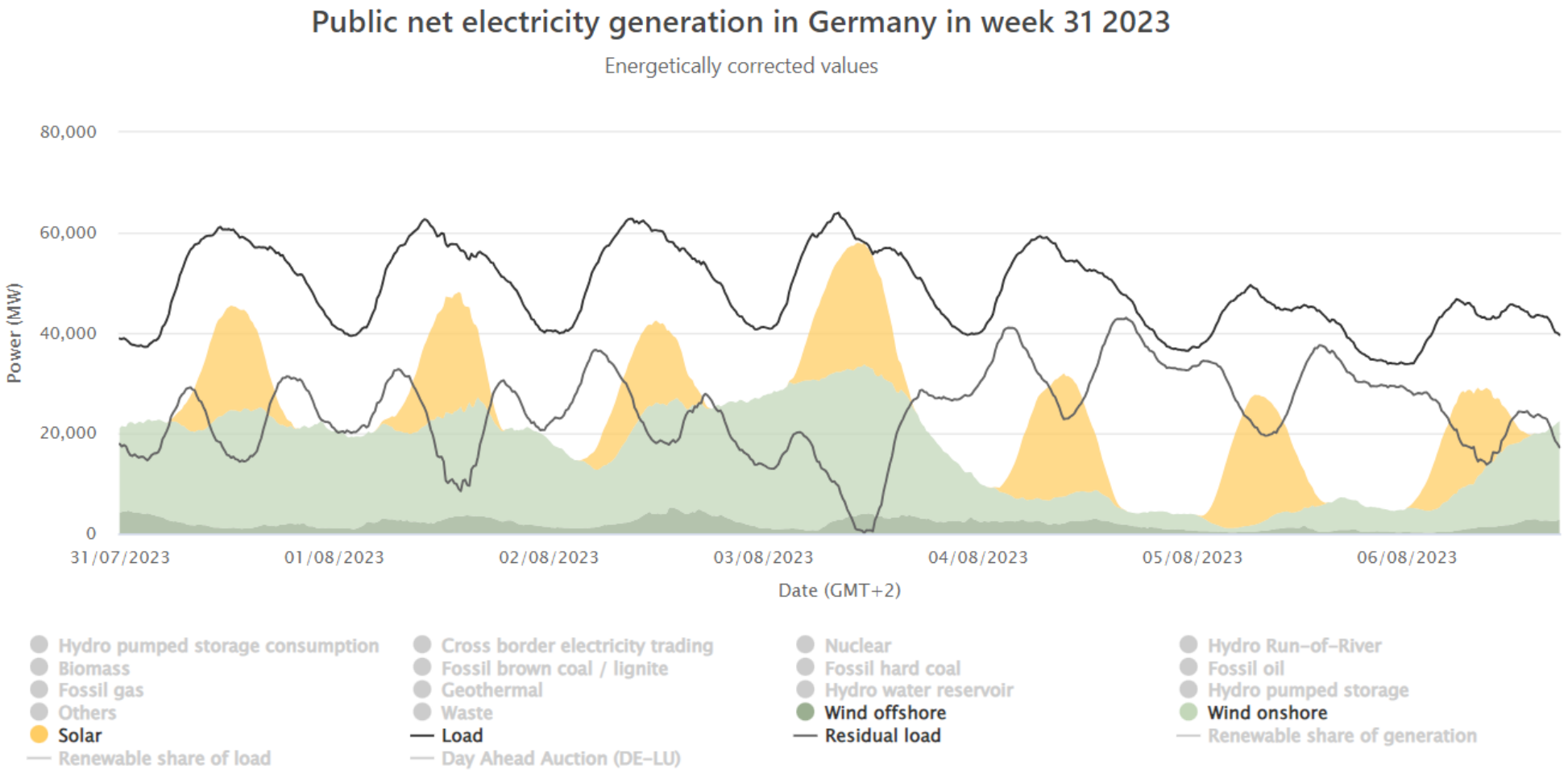

Source: www.energy-charts.info

Why do we need DSM?

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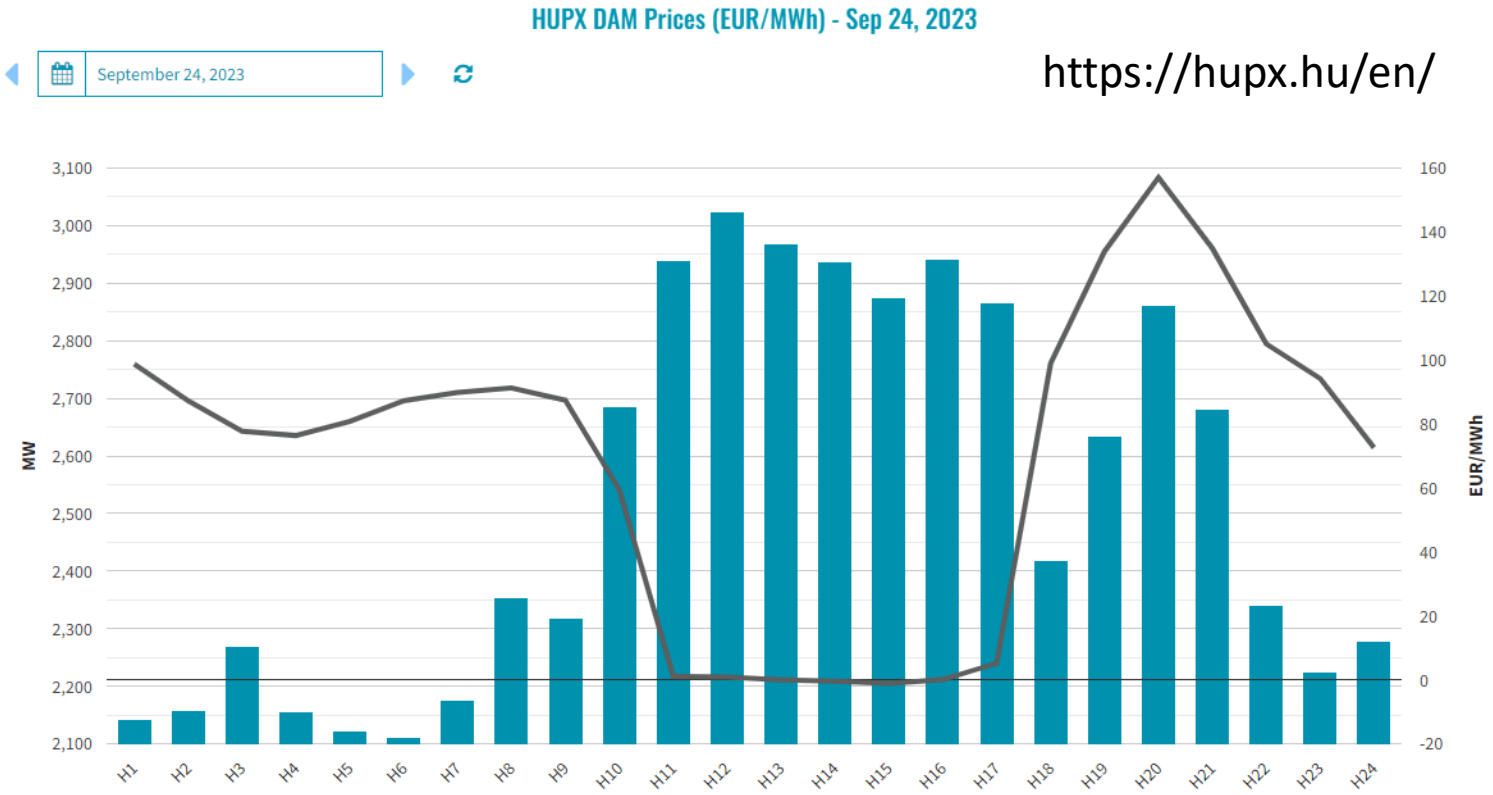

https://hupx.hu/en/

Need to incentivize consumption when renewables are abundant (= prices are low)

Why do we need DSM?

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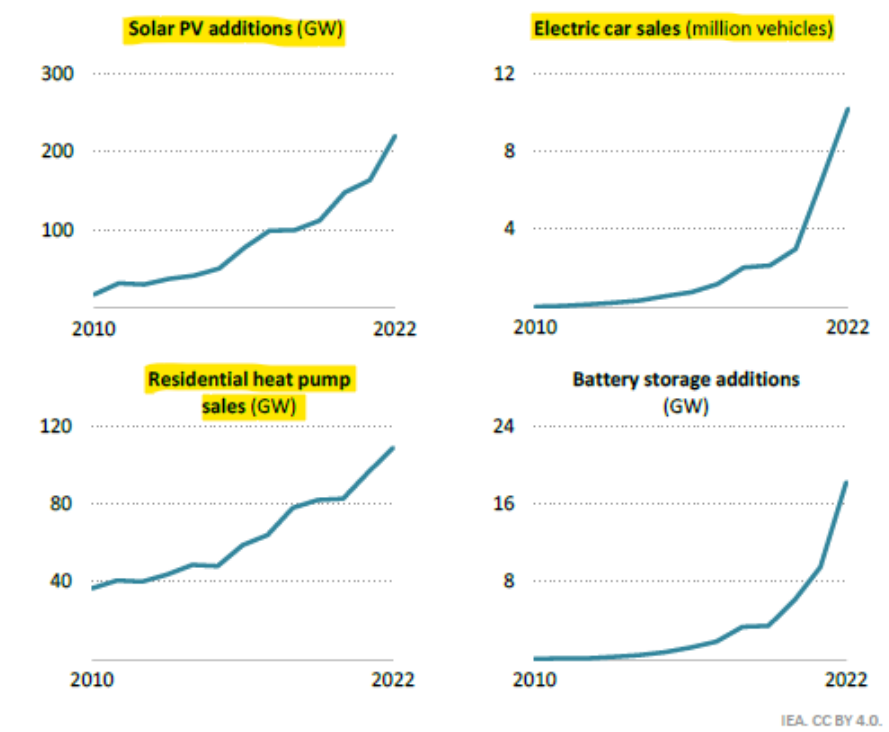
Figure 1.12 ▷ Global installations of selected clean energy technologies, 2010-2022



Deployment of a number of key clean technologies has accelerated significantly since the Paris Agreement in 2015

The trend is likely to accelerate in the coming years, especially solar, EV, and heat pumps.

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Two categories

From Directive (EU) 2019/944:

The change of electricity load by final customers from their normal or current consumption patterns in response to market signals, including in response to time-variable electricity prices or incentive payments, or in response to the acceptance of the final customer's bid to sell demand reduction or increase at a price in an organised market as defined in point (4) of Article 2 of Commission Implementing Regulation (EU) No 1348/2014 (17), whether alone or through aggregation.

Response to market signals

Active participation in organized markets

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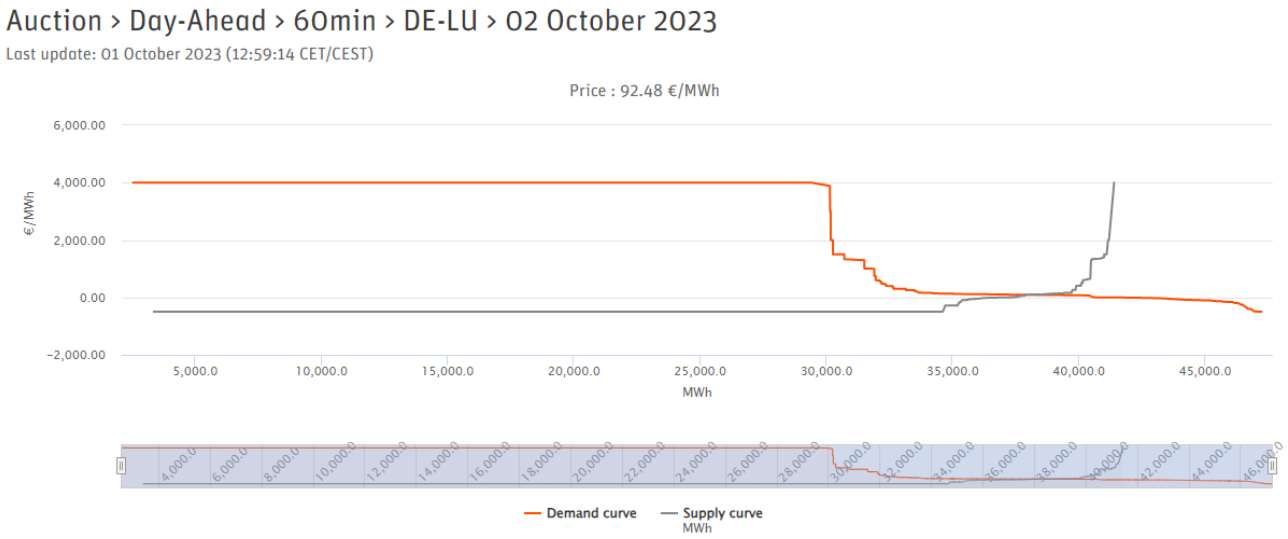
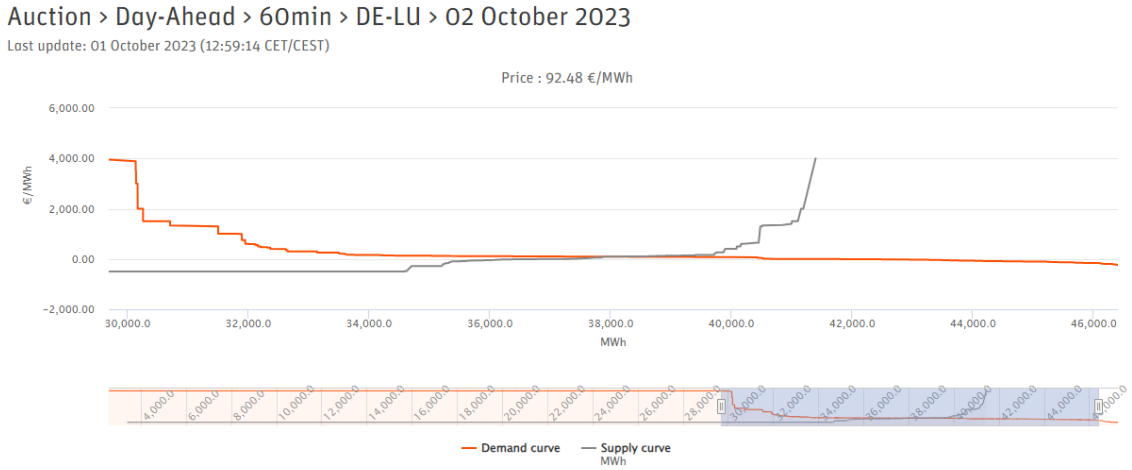
Category 1: Response to market signals

- Flexibility can be achieved by making consumers respond to electricity prices.
- Electricity prices at retail level are in general fixed (no incentive).
- Need to introduce:
  - time-varying prices.
  - Distribution charges based on power capacity.

Response to market signals: already existing



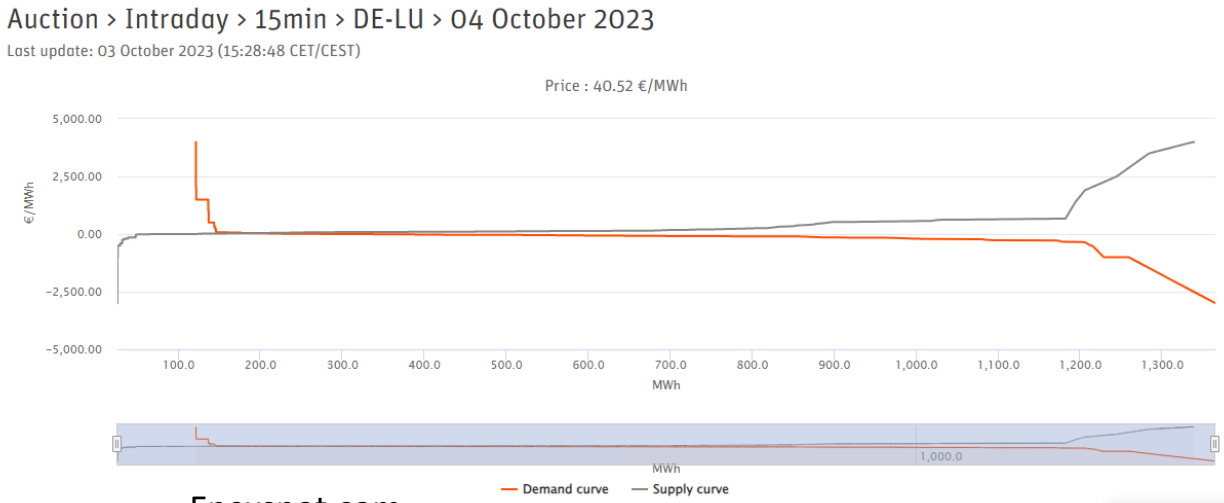


Response to market signals exist already

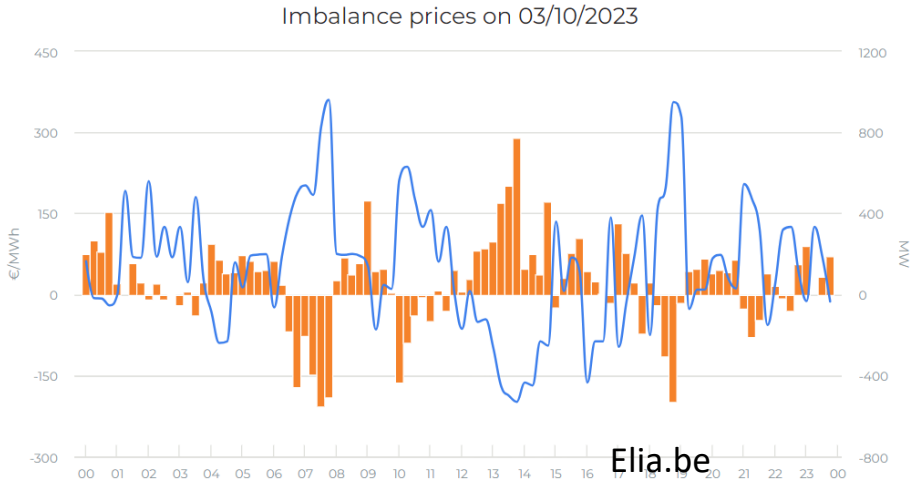
Some large customers are able to have a response to lower electricity prices

But in general, this is rather limited to specific consumers and most load is still inflexible.

Response to market signals: already existing



Epexspot.com



Elia.be

Different markets:

- Day-ahead markets.
- Intraday markets.
- Balancing markets.

Response to market signals: retail tariffs

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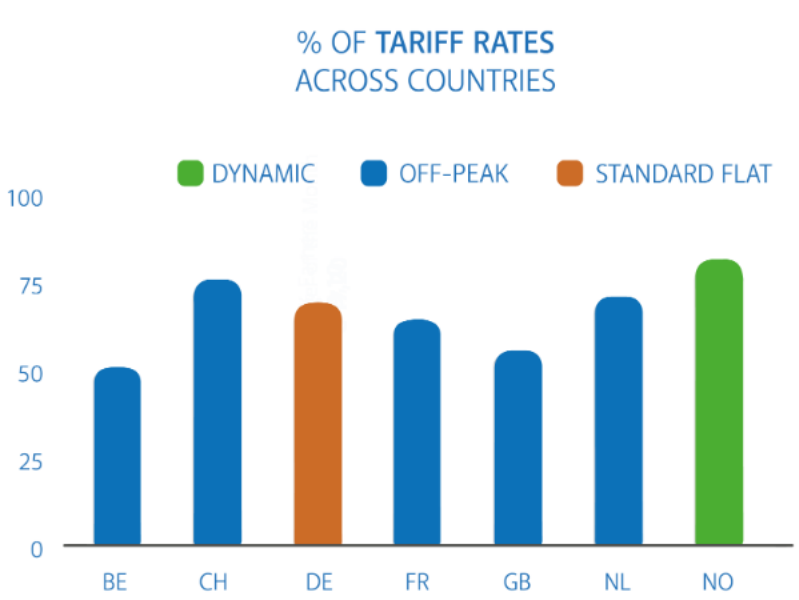

Retail tariffs are in general fixed, constant (€/kWh)

Need to introduce dynamic tariffs.

https://www.vrijopnaam.nl/en/partner/dynamisch-tarief

Physical barrier: smart meters

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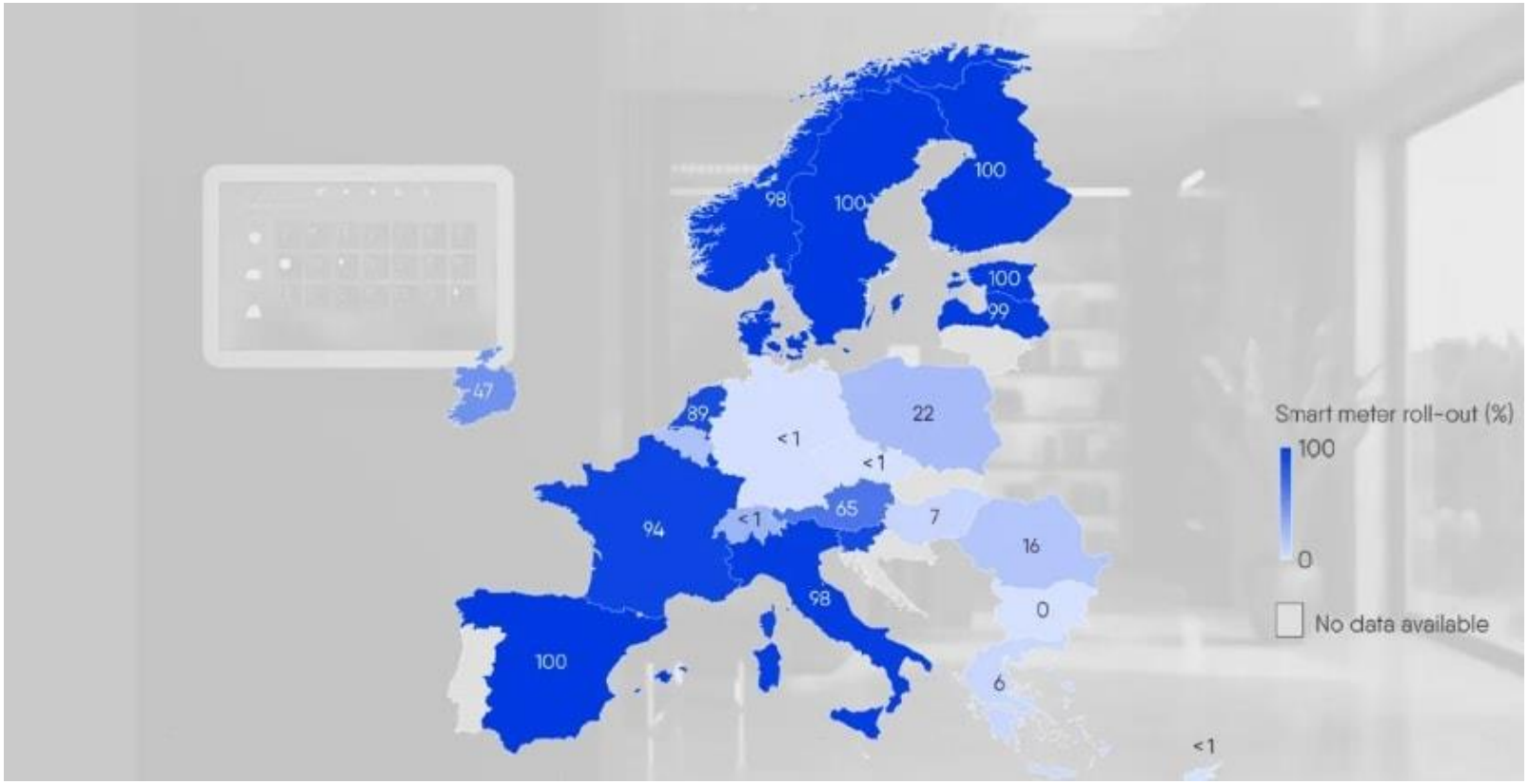

https://balkangreenenergynews.com/central-eastern-europe-severely-lagging-in-smart-meters-rollout/

Physical barrier: absence of smart meters

Regulatory barrier

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1. Tariffs must be adapted to allow supplier to offer dynamic tariffs.

2. Discussion on network tariffs and taxes/fees
   - If fixed (€/kWh), risk of decreasing incentives.
   - Network tariffs could be (partly) capacity-based (€/kW).
   - Taxes/fees could also interfere on incentives.

3. Net metering must be replaced by net billing (for prosumers).

Challenges of setting the right tariffs

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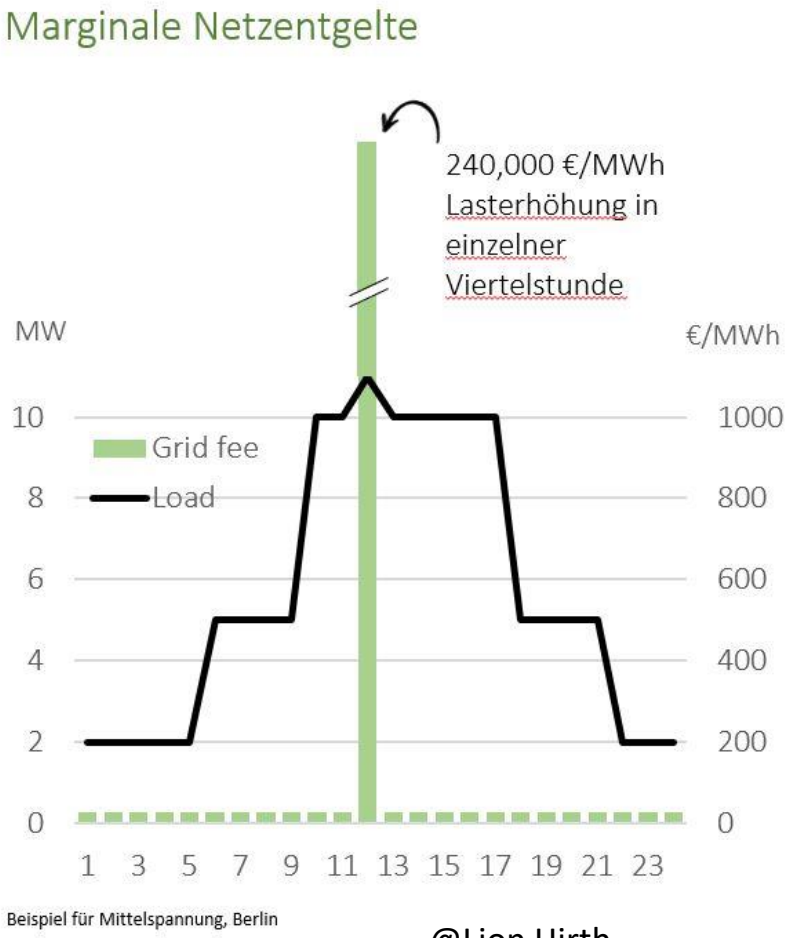
Network tariffs:

- **Energy-based:** remove incentives for flexibility.

- **Capacity-based:** marginal costs at peak hours can be extremely expensive



@Lion Hirth

Net metering: the opposite of flexibility

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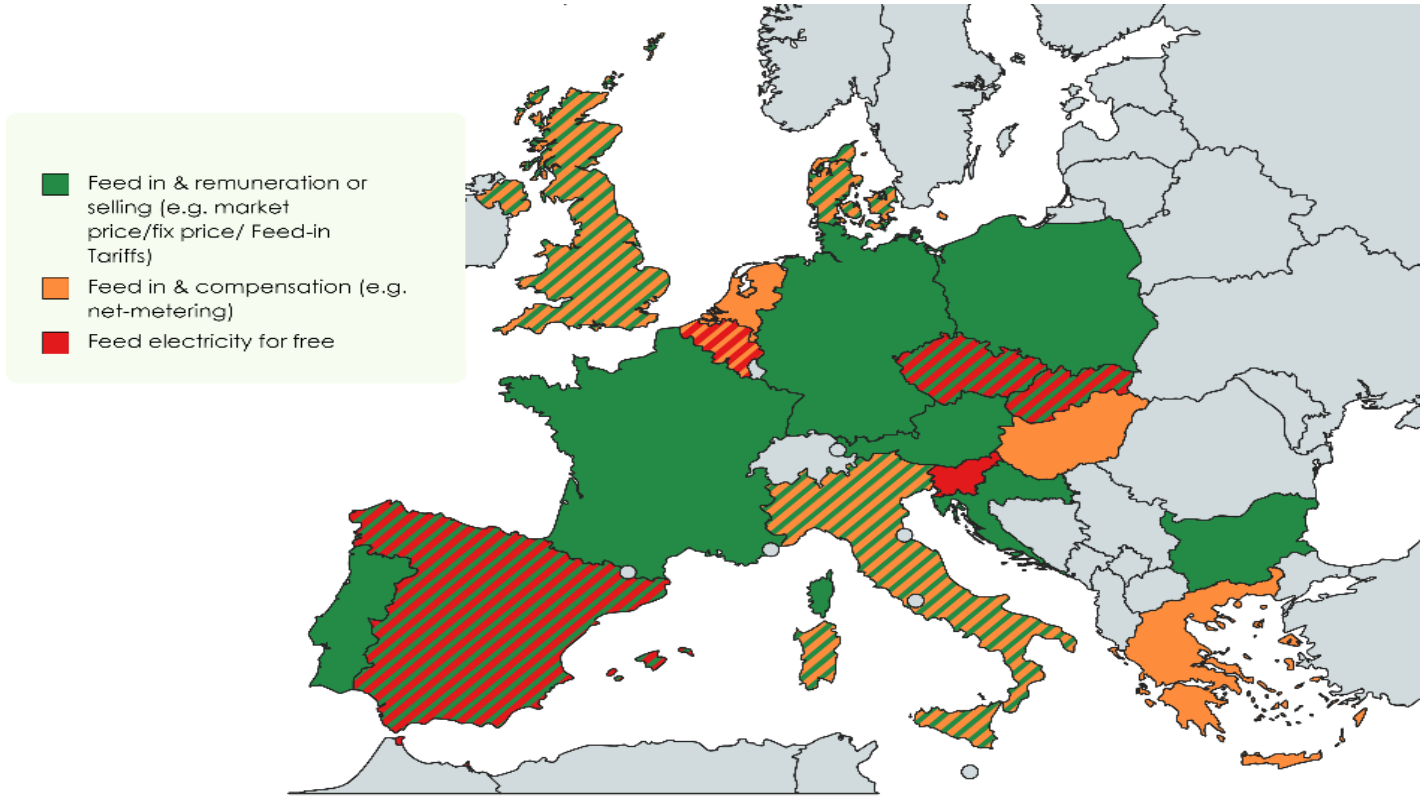
Net metering should be abolished and replaced by net-billing with flexible tariffs as they do not incentivize flexibility.



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Category 2: Active participation
What is it?

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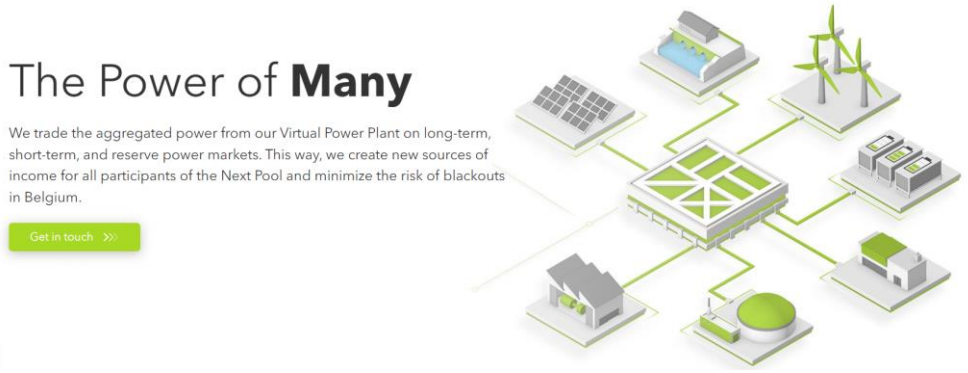
Active participation means that the demand is selling a "energy product" into organized markets.

For large loads, such participation can be direct. For smaller loads, it requires aggregation.

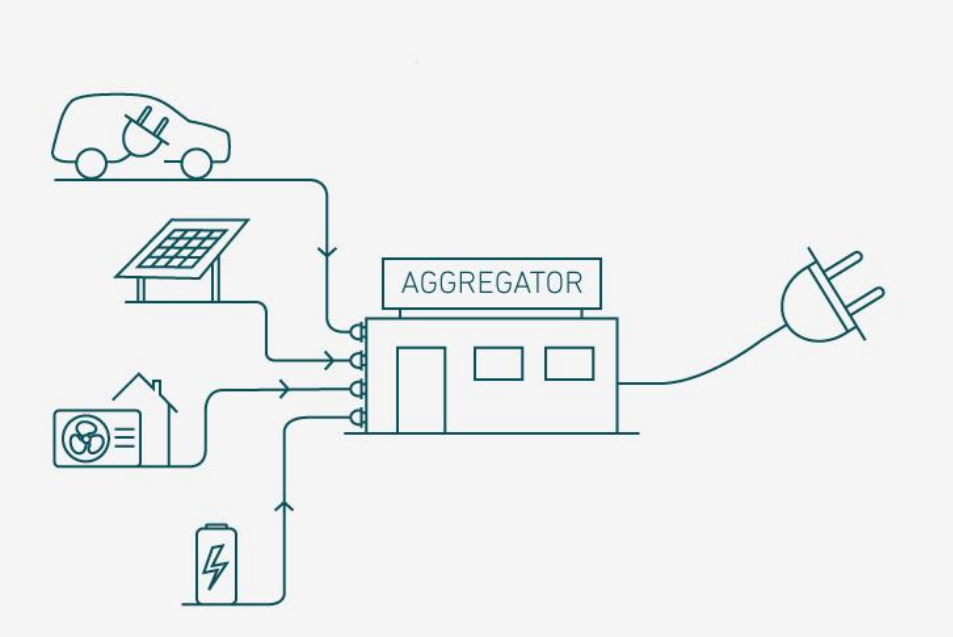
In general, local generation and storage can be mixed up with active loads (concept of aggregation).



Active participation: concept of aggregator

Load/consumers can be mixed together with local generation and storage.

The aggregator can then offer products / services.



Aggregator can be aggregation of a few large loads to thousands of small consumers.

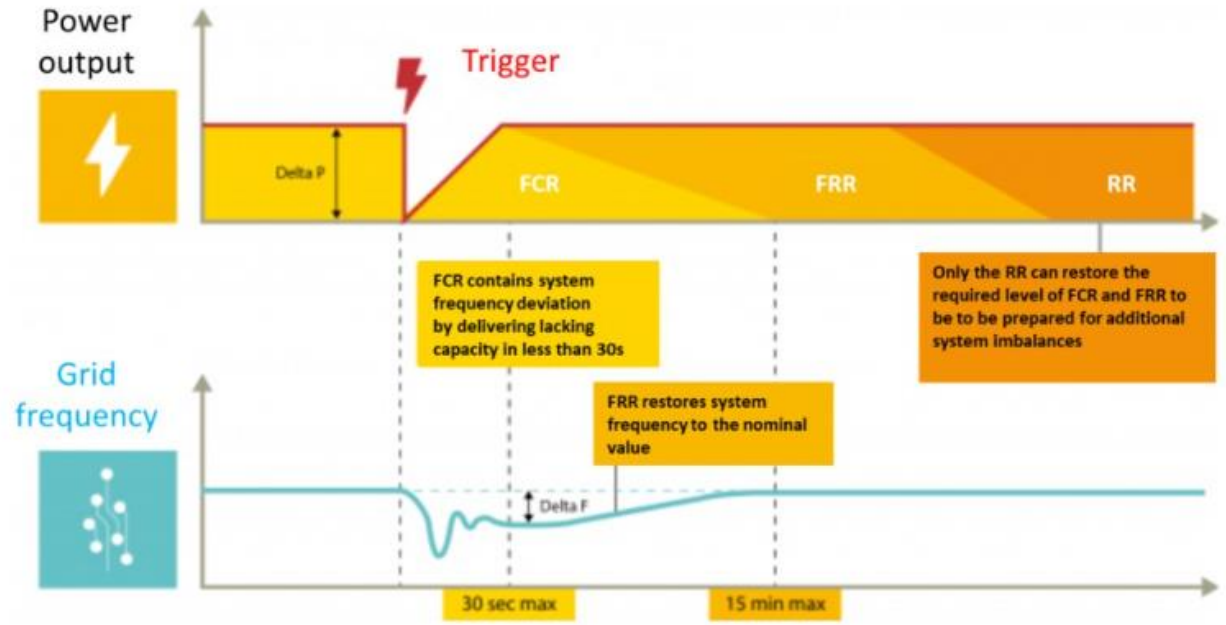
https://en.energinet.dk/Electricity/Green-electricity/Demand-side-response/What-is-an-aggregator/

Different products for active participation

1. Power reserves

Attention, each market is different. I present here the cases for the European continental grid.

Power reserves such as Frequency Containment Reserves, Frequency Restoration Reserves (manual and automatic), and replacement reserves.



Overview of FCR, FRR and RR utilization (Source : CRE)

Different products for active participation
1. Power reserves

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Provision of Frequency Containment Reserve Through Large Industrial End-Users Pooling

Edouard Perroy, Damien Lucas, Vincent Debusschere

Load Shifting Versus Manual Frequency Reserve: Which One is More Appealing to Flexible Loads?

Peter A. V. Gade, Trygve Skjøtskift, Charalampos Ziras, Henrik W. Bindner, and Jalal Kazempour

Abstract—This paper investigates how a thermostatically controlled load can deliver flexibility either in form of manual frequency restoration reserves (mFRR) or load shifting, and which one is financially more appealing to such a load. A (*ii*) the provision of manual Frequency Restoration Reserve (mFRR) services. We develop a stochastic optimization tool capturing the temperature dynamics and therefore consump-

Small Flexibility-based Frequency Containment Reserves – Opportunities Analysis and Modeling

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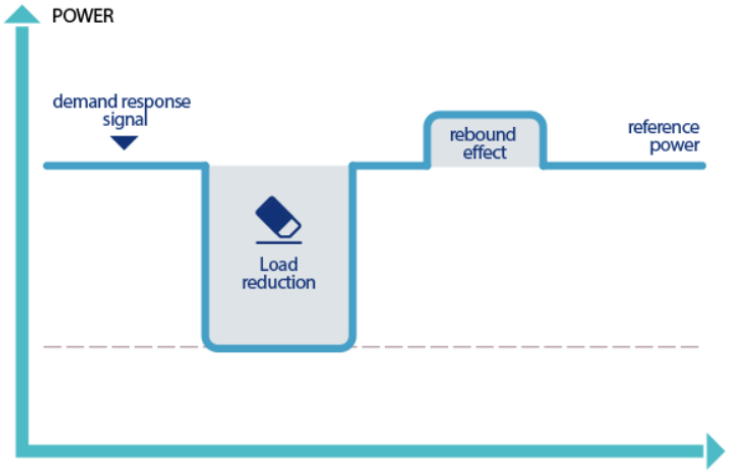
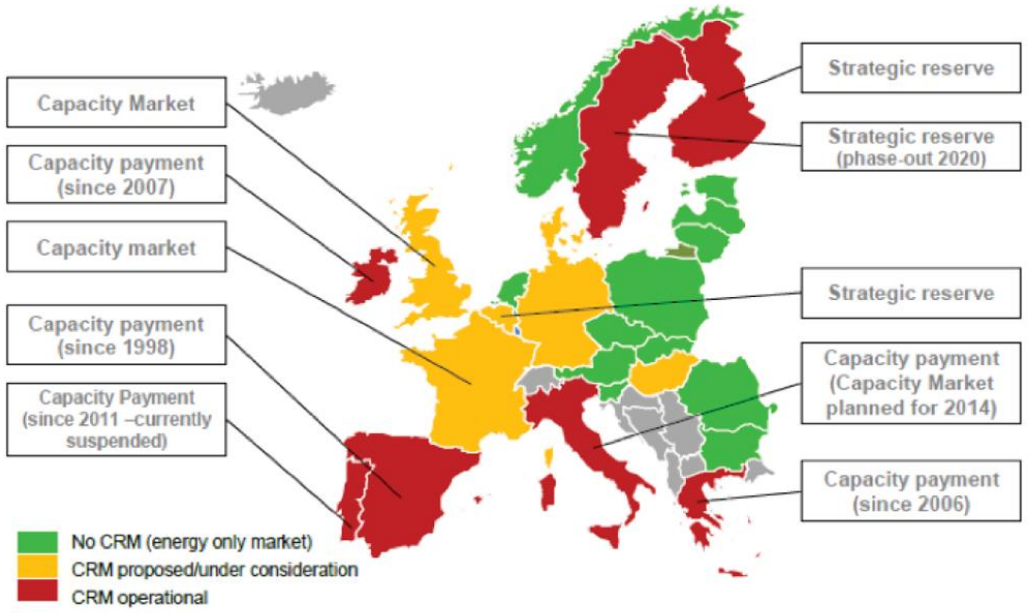
December 2020



https://www.services-rte.com/en/learn-more-about-our-services/flexibilities.html

Different products for active participation
2. Capacity Markets

Figure 1. **Capacity Mechanisms are Increasingly Prevalent (or Under Consideration) Across Europe**



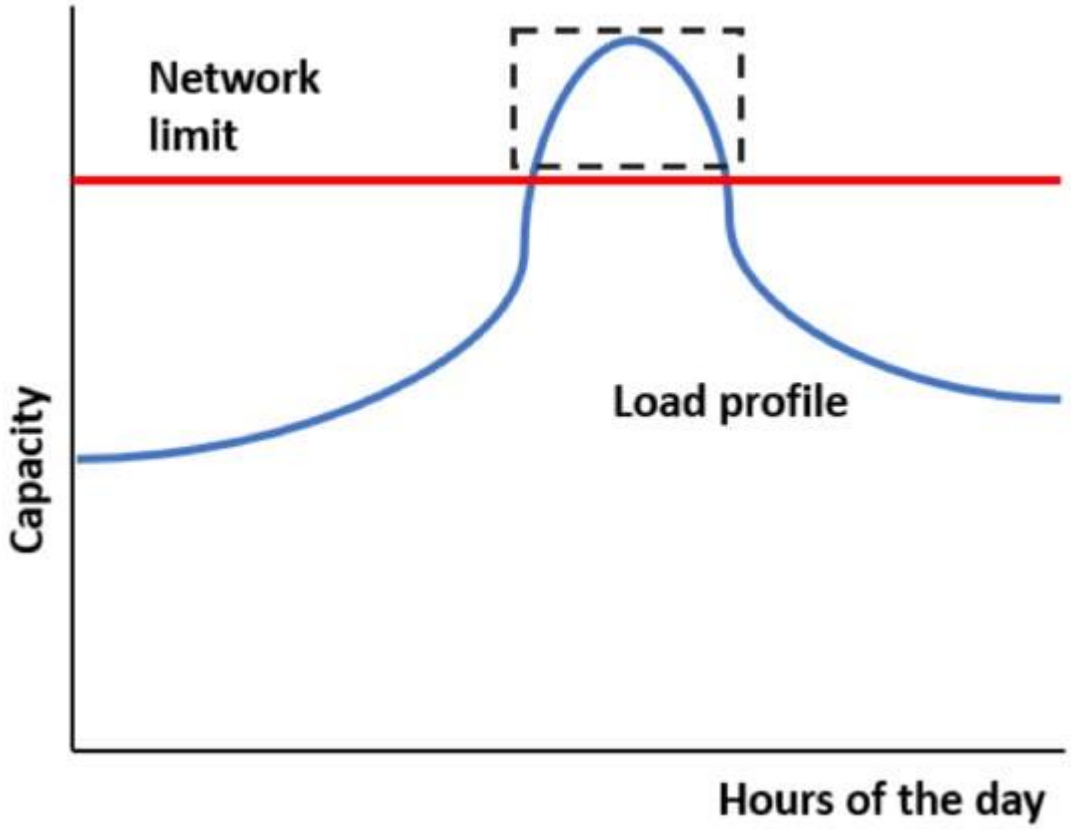
Source: ACER (2013), Capacity Remuneration Mechanisms and the Internal Market for Electricity, 30 July 2013, page 8

Capacity market, or Capacity Remuneration markets (CRM) are markets to ensure sufficient electricity capacity.

In some countries, load/consumption can participate to such markets.

Each country has its own design in general.

Different products for active participation
3. Congestion management – local flexibility market



https://www.mdpi.com/1996-1073/14/14/4113

Congestion markets are markets establish to reduce congestion (transmission or distribution)

Such markets are not yet widespread but they are increasingly discussed.

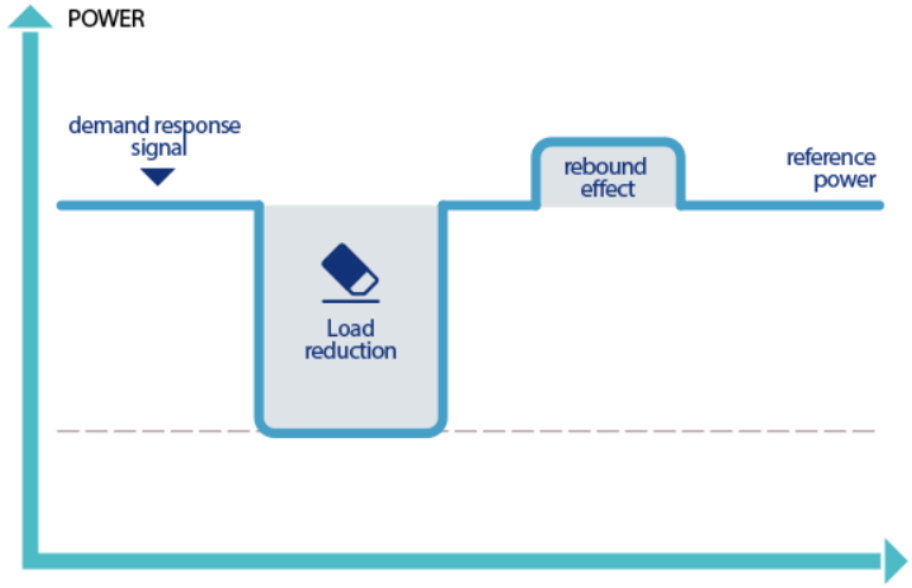
Regulatory barriers: product specifications

- Products specification must allow loads to participate to the specific markets.

- Aggregation must be allowed and streamlined (how to regroup different loads).

- Example: not allowing a limit on energy delivered (=duration of the activated reserves) could limit thermal loads to participate.

The importance of a baseline



https://www.services-rte.com/en/learn-more-about-our-services/flexibilities.html

It is important to have a correct baseline (what was expected to happen) of the load and to have established proper rules.

Regulatory barriers: communication DSO/TSO

DSO have in general less control and visibility on what is happening on their network.

Need to enhance coordination and to ensure more standardization at DSO level to enable flexibility from distribution.

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