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EU4ENERGY PHASE II

Roles and forms of flexibility and demand response in RES integration

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Regional Workshop on Accelerating Market Integration of Renewables: Focus on Flexibility and Active Consumers
13-14 November 2025
Paris



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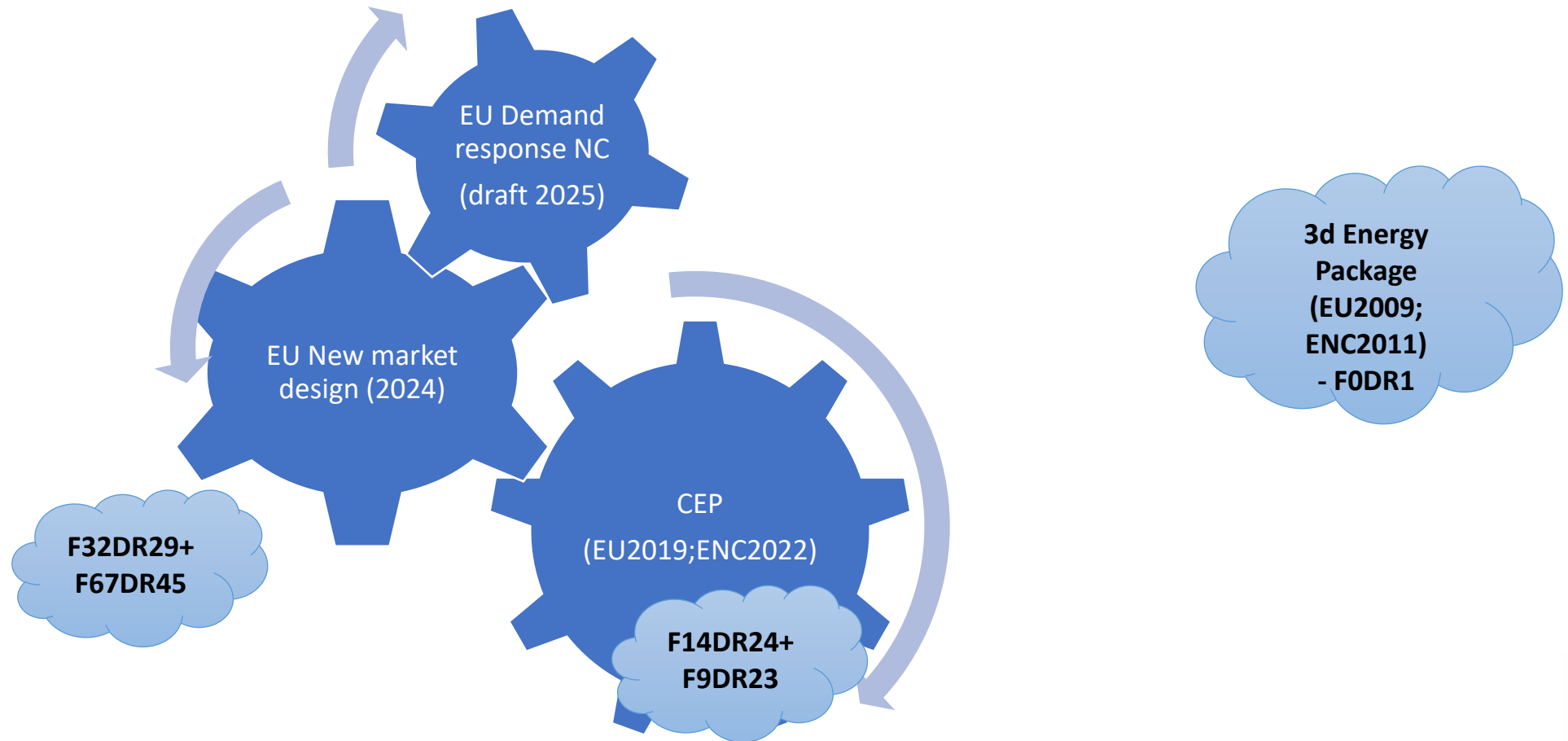
SCOPE

- Need for flexibility
- Energy Community and EU acquis
- Flexibility and Demand Response: products, planning, procurement, operators of demand response
- County cases: Germany, UK
- Key features of the flexibility market



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ENERGY COMMUNITY and EU ACQUIS



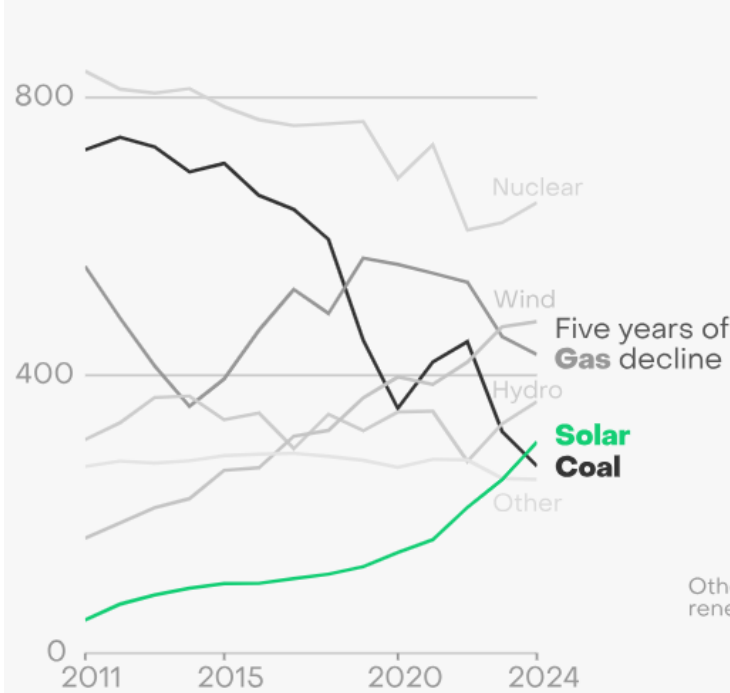


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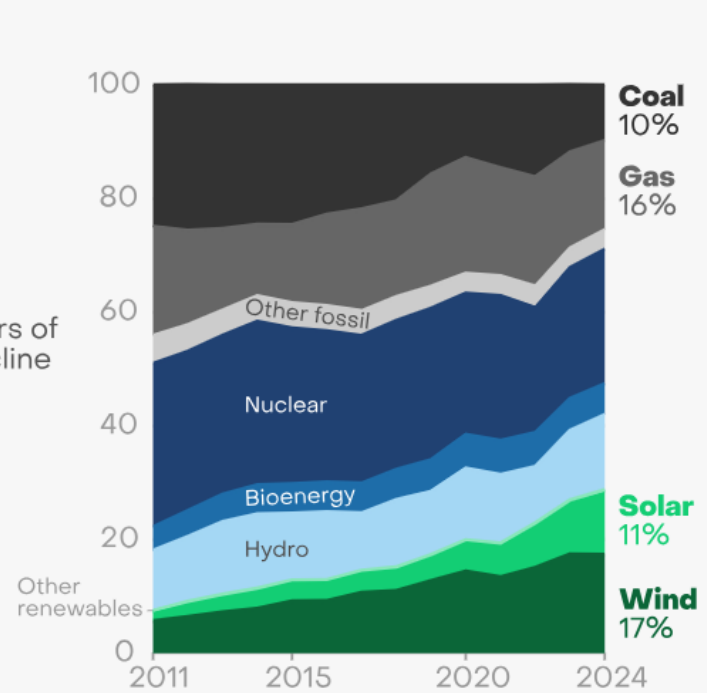
Markets are getting greener

Solar overtakes coal generation in the EU for the first time in 2024

Electricity generation (TWh)



Share of generation (%)



Source: Yearly electricity data, Ember
'Other' includes bioenergy, other fossil and other renewables

EMBER

Source: EMBER, <https://ember-energy.org/latest-insights/european-electricity-review-2025/>

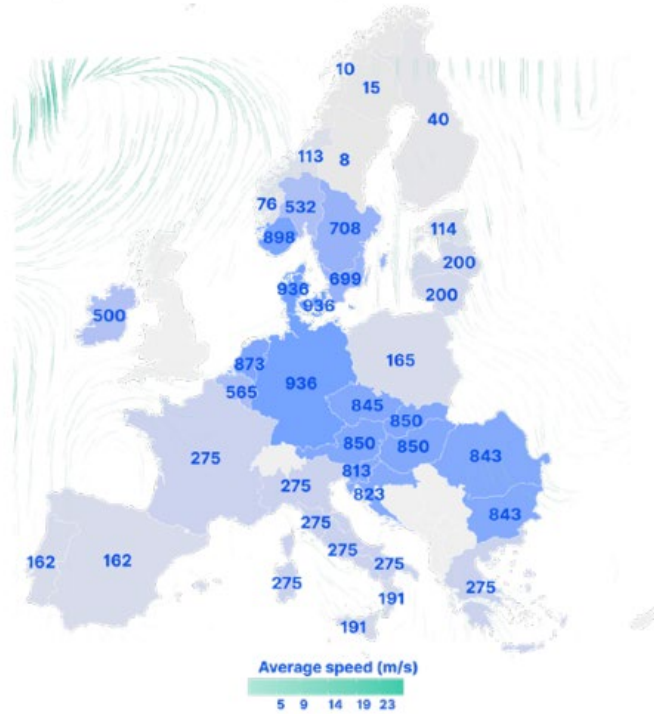




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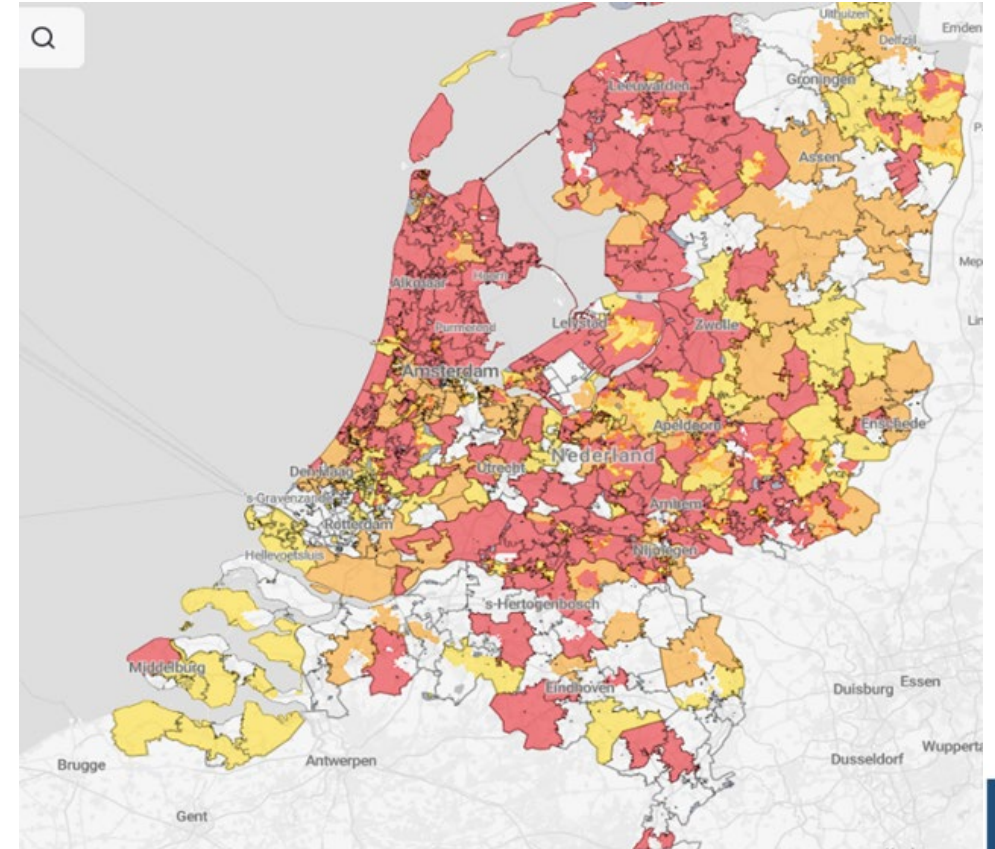
Markets are getting less predictable

Day-ahead prices and wind speed in the EU and Norway, 12 December 2024 at 17:00 CET (EUR/MWh)



Source: ACER elaboration based on ENTSO-E Transparency Platform data and Copernicus data – ERA5.

Source: ACER 2025 Monitoring Report

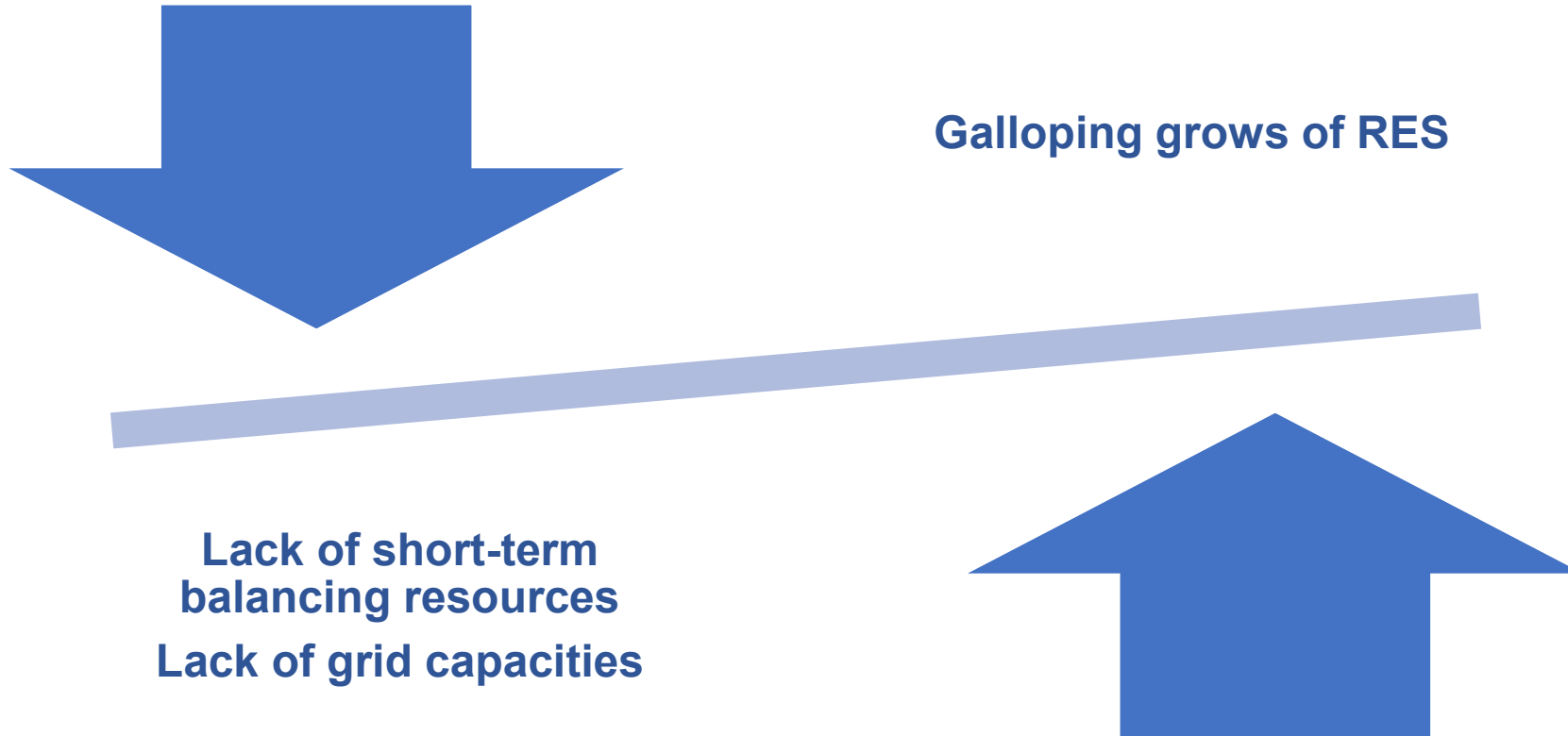


Source: Tennet - Grid Capacity Map



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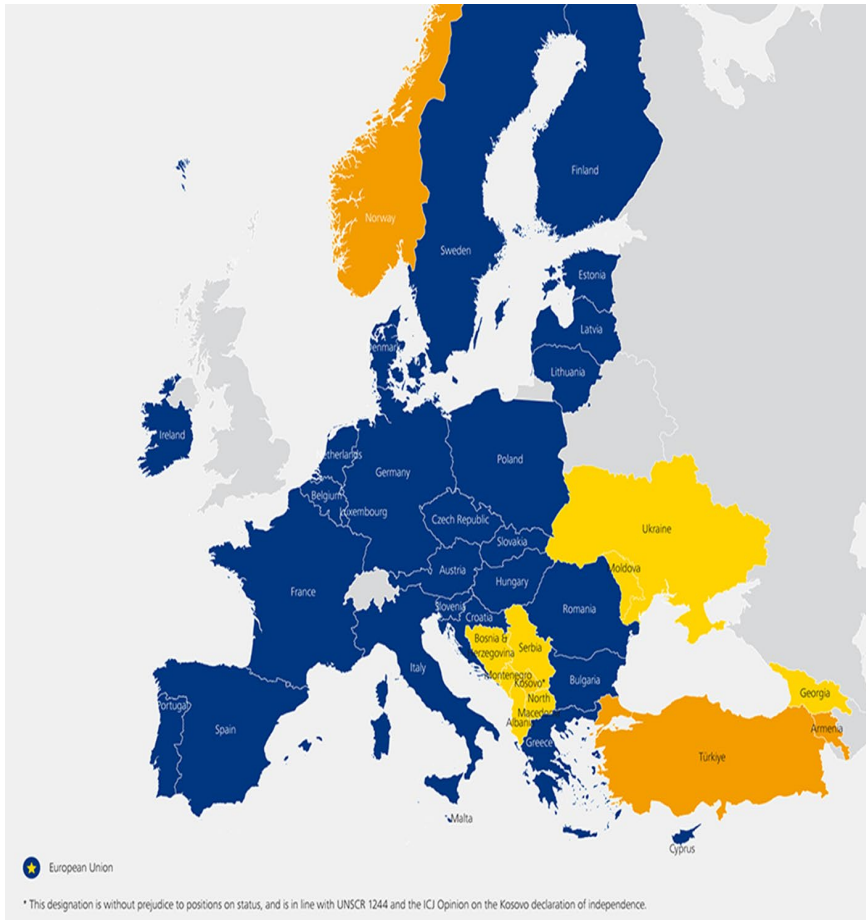
Markets need additional flexibility





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Clean Energy Package/EIP in ENC



- **A design for electricity market shall adapt to new commercial realities – more flexible, more market-based and better placed to integrate a greater share of renewables.**
- **New definitions:** “active customer”, “citizen energy community”, “dynamic electricity price contract”, “aggregation”, “demand response”, “recharging point”, “smart metering system”, “energy storage”...
- **flexibility as a part of the network development plans of TSO and DSO.**
- **regulatory framework to allow and provide incentives to DSOs to procure flexibility services**
- Establish the **specifications for the flexibility services** procured and, where appropriate, **standardised market products** for such services at least at national level.
- **DAM/IDM min bid side of 500kW** to allow for the effective participation of demand-side response, energy storage and small-scale renewables including direct participation by customers.



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EU: New market design

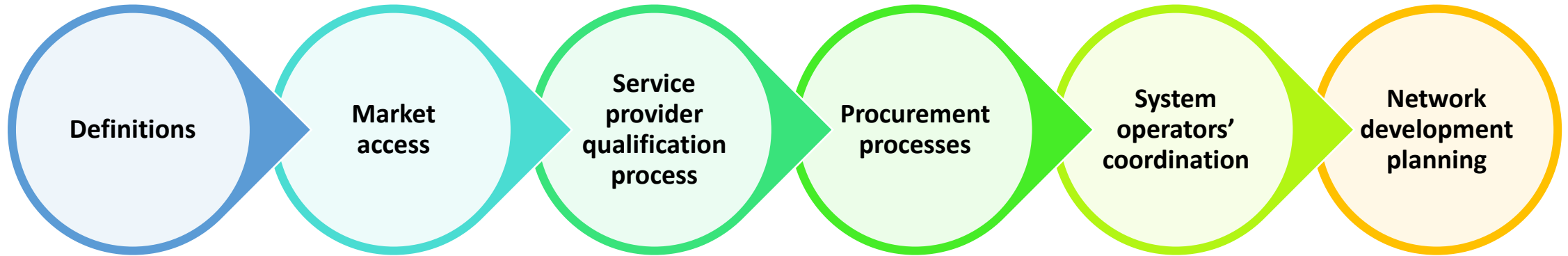


- **Markets need to adapt to better integrate renewable energies and attract investment in fossil-free flexible technologies such as demand side response and energy storage.***
- Amending Directive EU/2024/1711 and the amending Regulation EU/2024/1747 were adopted on 21 May 2024 and entered into force on 16 July 2024.
- New definitions: “flexibility”, “energy sharing”, “flexible connection agreement”, “dedicated measurement device”, “peak shaving”.
- **Integrating flexibility into the energy planning architecture:** national report on flexibility needs based on EU-wide methodology; **national non-fossil flexibility targets.**
- **Non-fossil flexibility support schemes** for demand response and storages.
- **enabled the use of dedicated measurement solutions**
- **DAM/IDM minimum bid sizes of 100 kW or less**



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NC ON DEMAND RESPONSE (draft proposal)



Flexibility (including by means of demand response) is growing into a separate market segment.



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Flexibility

Flexibility means the ability of an electricity system to adjust to the variability of generation and consumption patterns and to grid availability, across relevant market timeframes.

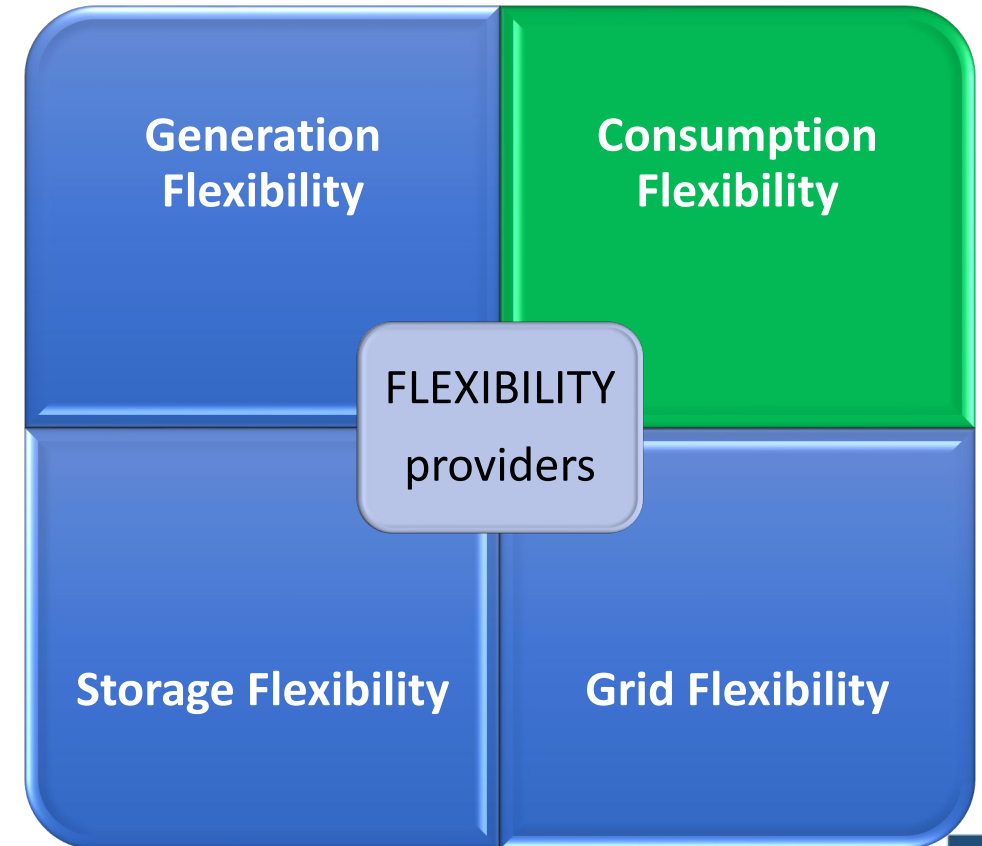
EU-wide methodology:

Network flexibility needs- flexibility needed to adjust for grid availability, by means of preventing or solving congestion or voltage issues, across relevant timeframe

Fast flexibility - the capacity able to react to aggregated D-1 or shorter error variations (15 to 60 minutes before real-time)

Slow flexibility -the capacity able to react to aggregated D-1 or shorter horizons forecast error (60 minutes to 24 hours before real-time)

Very fast flexibility - capacity able to react to aggregated D-1 or shorter horizons forecast error variations (5 to 15 minutes before real-time).





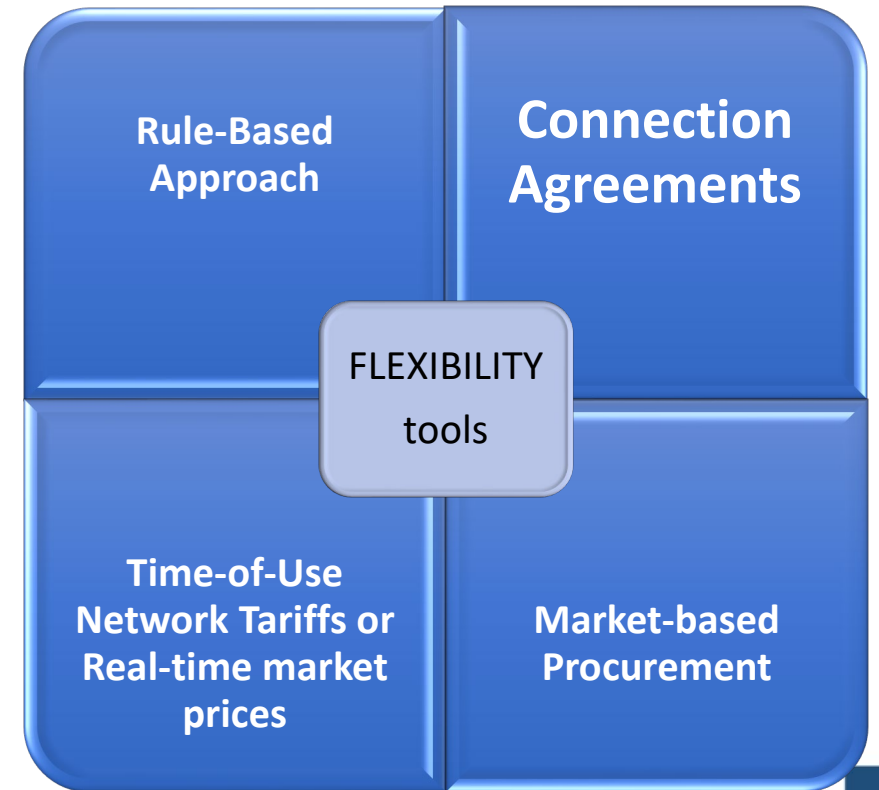
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Flexibility and demand response

Price-Based Demand Response: response to dynamic price signals, such as time-of-use tariffs or real-time market prices.

Incentive-Based Demand Response: explicit financial incentives to reduce or shift electricity consumption during peak demand periods or when the grid is stressed.

Different flexibility tools shall complement each other, avoiding the reverse effect.





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Interruptible connections for residential loads in Germany

- Limited control over the power consumption of energy-intensive devices in return for the reduced network charge for end-users with high-power flexible loads.
- The targeted loads are EVs, electric heating and cooling systems, and batteries with max power consumption of more than 4.2 kW and are connected after 1 January 2024.
- To avoid network overload when congestion occurs in the grid, the network operator can curtail them to a minimum of 4.2 kW. If the device cannot reduce power consumption to this level, it is entirely curtailed to 0.
- DSOs and customers with newly connected qualifying loads are obliged to participate.
- A second variant of control - the network operator does not control the individual device but limits the power consumption of the network connection point by means of an intelligent energy management system. This allows the consumer who has installed PV panels or batteries to use them behind the connection point.



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Time-of use differentiation of network tariffs

- Helps to consider costs which depend on the fact of network usage and time when it was used.
- May reflect the difference in during the day and seasonal capacity utilization (summer and winter periods, working day or weekends)
- The time differentiation may be static or dynamic.
- Time-of-use differentiation may be applied for both, volumetric and capacity based components

		AT	BE	BG	HR	CY	CZ	DK	EE	FI	FR	DE	GR	HU	IS	IE	IT	LV	LT	LU	MT	NL	NO	PL	PT	RO	SK	SI	ES	SE
Transmission	Energy (€/MWh)		●		●				●	●	●		●			●					N/A	●			●		●	●	●	
	Power (€/MW)		●		●						●		●			●						N/A	●	●		●		●	●	●
Distribution	Energy (€/MWh)	●	●		●		●	●	●	●	●		●			●				●	●	●	●	●	●		●	●	●	●
	Power (€/MW)				●		●		●	●	●		●												●		●	●	●	●

Note: In Denmark, the TSO has considered introducing ToU tariffs and submitted a tariff methodology to the NRA for approval. In Greece, charging is based on energy demand measured during predefined system peak periods, which is converted into a power-based component. In the Netherlands, in distribution, only some non-household users pay energy-based ToU-tariffs (two periods), the power-based tariff currently has no ToU-signal²⁵².

2025 ACER report on network tariff practices





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Procurement of flexibility

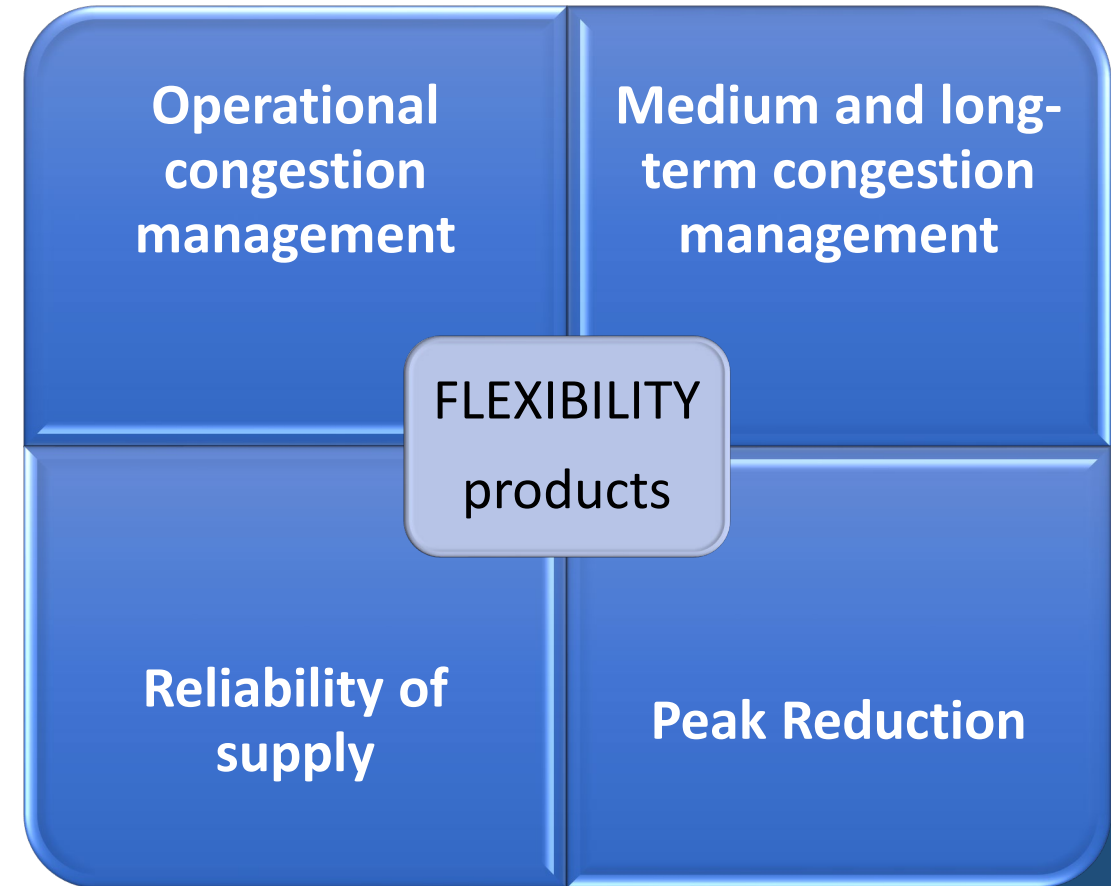
- Directive 2019/944 – **competitive, market-based, procurement of flexibility services.**
- **Draft DR NC - market-based procurement for local services, unless NRA has granted a derogation** to procure local services based on a non-market-based mechanism according to Article 13 (3) of Regulation 2019/943.
- Regulation 2019/943 (Article 13) – **conditions for derogation:**
 - no market-based alternative is available;
 - all available market-based resources have been used;
 - the number of available capacities is too low to ensure effective competition;
or
 - the current grid situation leads to congestion in such a regular and predictable way that market-based redispatching would lead to regular strategic bidding.



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Demand response products

- Buyers: network operators
- Different trading platforms
- Separate trading or integrated with other electricity market segments (e.g., DAM, IDM);
- Local flexibility markets are often organised spatially in local congestion zones








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Flexibility-first approach

- Flexibility as an option for meeting demand capacity requirements where there is an underlying network thermal constraint;
- NDP includes the quantified minimum level of flexibility required;
- DSOs publish flexible service requirements on a bi-annual basis (March and October) for all forecasted EHV (Extra High Voltage – 132kV to primary substations) capacity requirements two years in advance;
- Detailed flexibility requirements, such as half-hourly capacity per day/month/season, are developed at the tender stage.

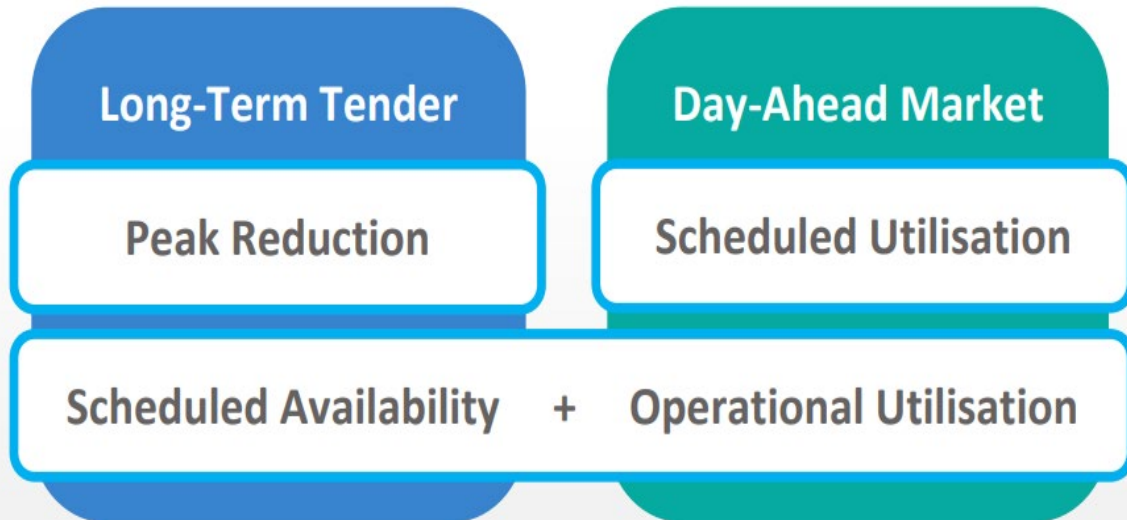
Site Name (& location co-ordinate)	Need	Asset Solution	Flexible Services Option								
Heaton Moor  X- 387623 Y- 391345	FC ² first exceeded in FY32 0.5MVA exceedance of FC by FY33	Marginal overload to be managed by transfers on the 6.6kV network									
Heaton Norris  X- 388860 Y- 391967	FC first exceeded in FY32 0.3MVA exceedance of FC by FY33	Marginal overload to be managed by transfers on the 6.6kV network. If required, install an HV interconnector to Reddish Vale to transfer demand off Heaton Norris, cable route ~2.5km. 4.0MVA spare capacity on Reddish Vale in FY33 Start date: FY31 Completion: FY32	Operational Utilisation & Variable Availability or Peak Reduction <table border="1"> <thead> <tr> <th>Max Flex Required at 2050 (FY51) - Winter Peak</th> <th>MVA</th> </tr> </thead> <tbody> <tr> <td>Best View</td> <td>15.4</td> </tr> <tr> <td>Leading the Way</td> <td>14.5</td> </tr> <tr> <td>Falling Short</td> <td>-</td> </tr> </tbody> </table>	Max Flex Required at 2050 (FY51) - Winter Peak	MVA	Best View	15.4	Leading the Way	14.5	Falling Short	-
Max Flex Required at 2050 (FY51) - Winter Peak	MVA										
Best View	15.4										
Leading the Way	14.5										
Falling Short	-										
Levenshulme  X- 387494 Y- 394155	FC first exceeded in FY26 2.9MVA exceedance of FC by FY33	Firm capacity limited by T12 which is a 10/14MVA transformer. Replace T12 with a 11.5/23MVA transformer in ED3. Expect marginal overloads in ED2 to be managed by transfers on the 6.6kV network	Operational Utilisation & Variable Availability or Peak Reduction <table border="1"> <thead> <tr> <th>Max Flex Required at 2050 (FY51) - Winter Peak</th> <th>MVA</th> </tr> </thead> <tbody> <tr> <td>Best View</td> <td>21.3</td> </tr> <tr> <td>Leading the Way</td> <td>19.1</td> </tr> <tr> <td>Falling Short</td> <td>4.0</td> </tr> </tbody> </table>	Max Flex Required at 2050 (FY51) - Winter Peak	MVA	Best View	21.3	Leading the Way	19.1	Falling Short	4.0
Max Flex Required at 2050 (FY51) - Winter Peak	MVA										
Best View	21.3										
Leading the Way	19.1										
Falling Short	4.0										

Source: ENWL NDR



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Demand response market-based procurement in UK



- Biannual long-term tenders
- ~0.5-3 years ahead of need
- Procuring PR and SAOU
- Enables reinforcement deferral

- Regular D-1 auctions
- Optimise SU procurement with utilisation of SAOU
- Top-up and drives competition

Peak reduction – Contract awarded through a long-term tender where the flex provider reduces their highest demand peaks during contracted windows.

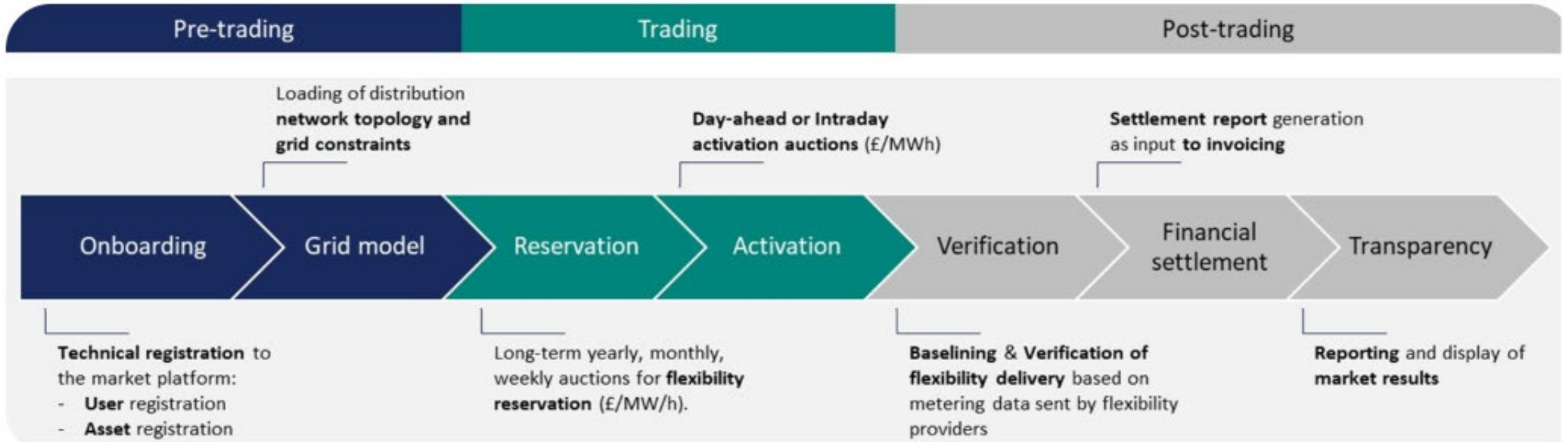
Scheduled Availability + Operational Utilisation - Contract awarded through a long-term tender where the flex provider commits to be available during contracted windows, with utilisation confirmed at day-ahead.

Scheduled Utilisation - Contract awarded through a day-ahead auction where the flex provider agrees to deliver their flex for the following day.



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Demand response market-based procurement in UK



Source: EPEX

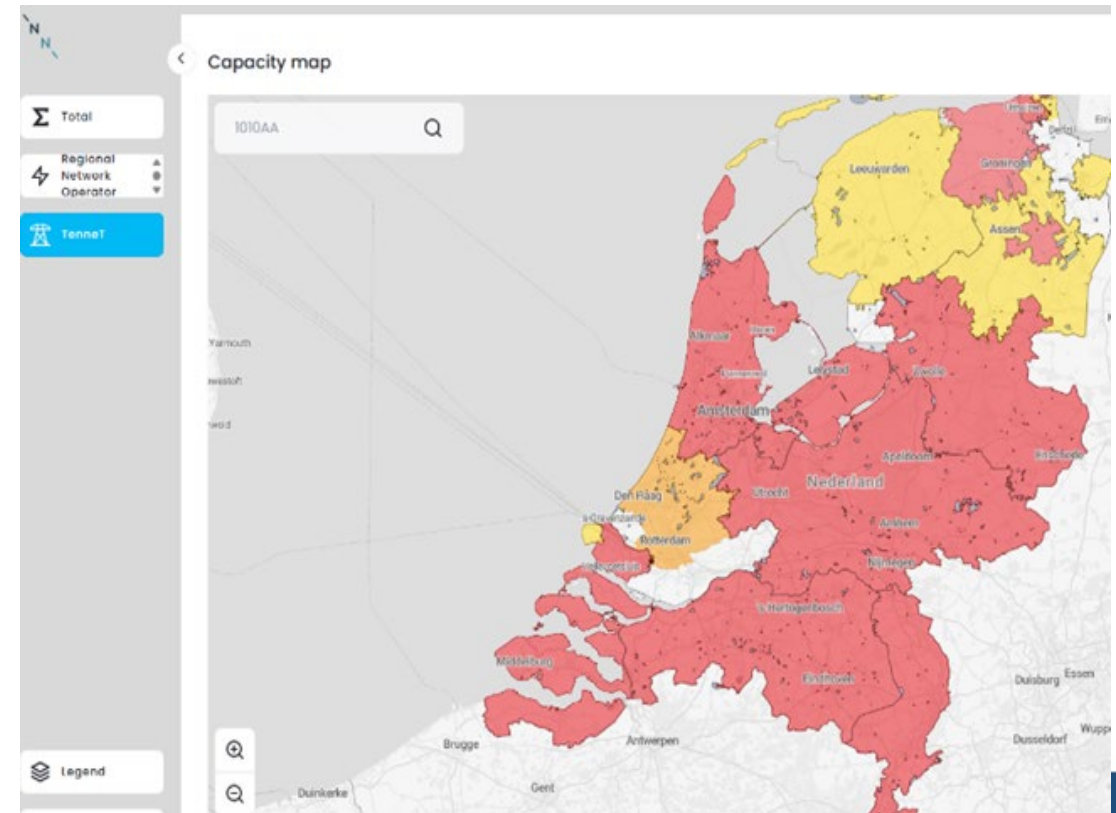


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Flexibility first approach

- Flexibility is used as a congestion management tool: the redispatch product and the capacity limitation product, which are provided on a voluntary or obligatory basis
- TSO/DSOs check the congestion status at different time frames for the purpose of:
 - drawing up the investment plan;
 - periodically system status assessments, towards applicable network design criteria, and operational safety limits;
 - analysis of adequacy of the transport capacity to meet the requested transport capacity for each relevant request for transport services.

Technical limit of available capacity - 100% of available transport capacity plus available controllable capacity, up to a maximum of 150% of the available transport capacity.



Source: Tennet - Grid Capacity Map



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Demand response: customer perspective


For customers, aggregators work more as an energy service provider.

Customer offers differ from “market products” and have a form of energy-saving/management services

Price-related demand response is offered by suppliers (time of use pricing) or through the time-of-use network tariffs.

Pricing

NEW feature added: Solar monitoring. Read more [here](#).


 For one air-to-air heat pump
Lite

4€/month

What's included

- ✓ Control of one air-to-air heat pump
- ✓ Electricity price optimization
- ✓ Energy optimization based on weather
- ✓ Customer support
- ✓ 30-day Free trial

[Start free trial](#)

 For whole home
Standard

8€/month

What's included

- ✓ Unlimited number of devices
- ✓ Electricity price optimization
- ✓ Energy optimization based on weather
- ✓ Hot Water Boost
- ✓ NEW! Solar monitoring
- ✓ Customer support
- ✓ 30-day Free trial

[Start free trial](#)

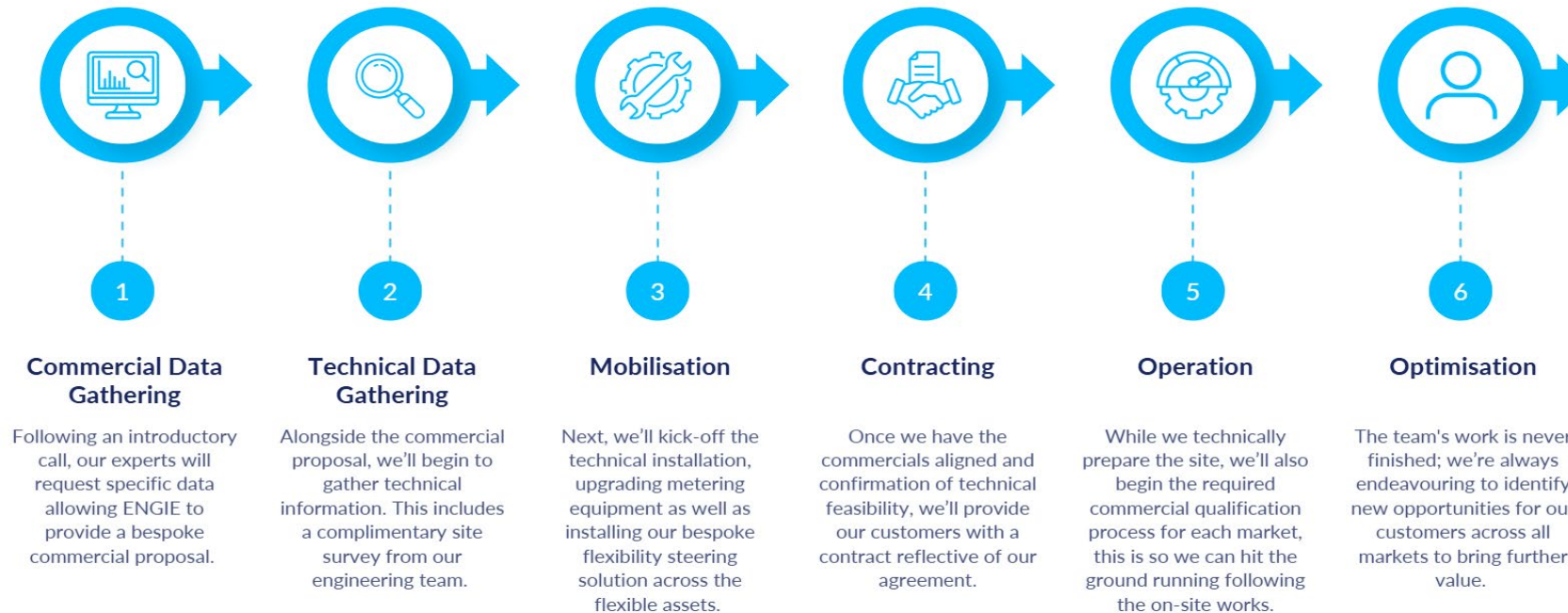
Source: Kapacity.io



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Demand response: customer perspective

Our Customer Journey



Source: <https://www.engie.co.uk/energy-management/demand-response-flexibility/>



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Demand response as a flexibility service provider

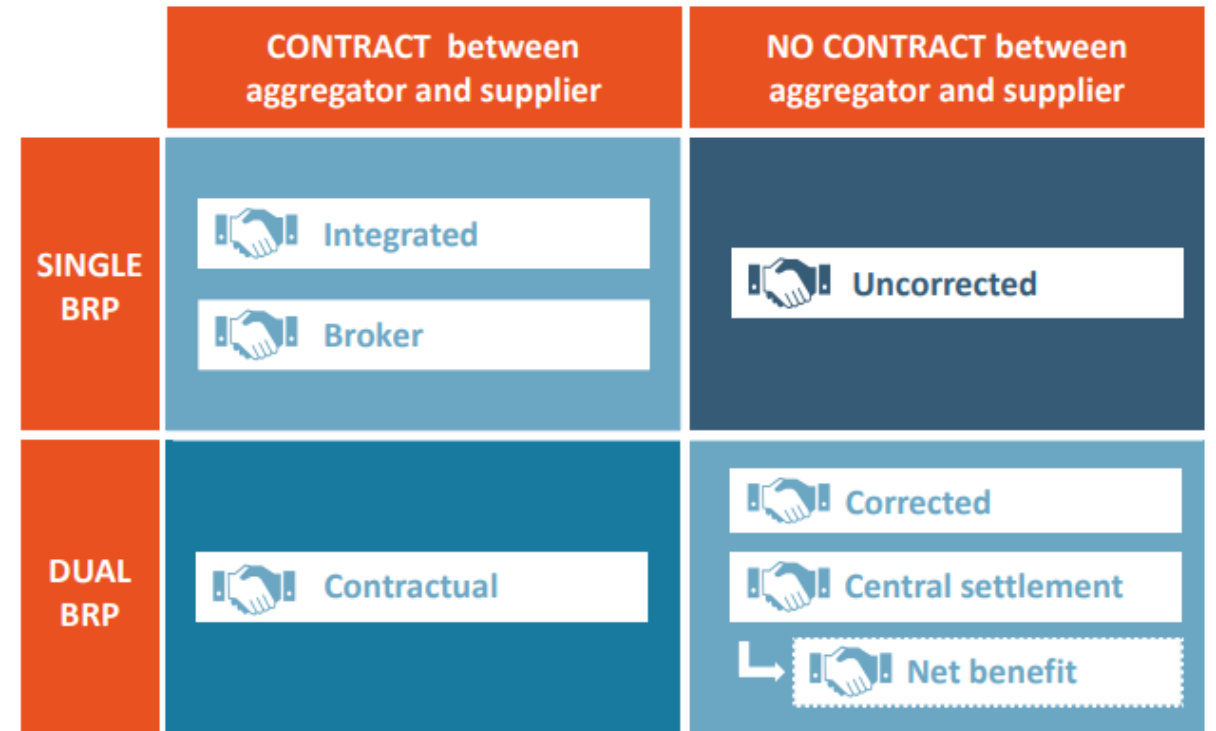
- The form of demand response participation in different electricity market operations varies by segment and by type of consumer.
- Usually, demand response is voluntary, but there is a practice where they may be obliged to support system operators in congestion management.
- Markets are getting closer to customers, allowing for accommodating even small capacities, e.g., lower minimum volume and resolution of capacity offers.
- Aggregators represent small and residential users in most cases.
- Large and small customers may act individually.



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Market integration: Models of Independent Aggregator

- Aggregator responsible for activation of flexibility; Supplier - for the energy supply.
- IA may be BSP or propose its services through the BSP.
- Demand response may cause an imbalance for BRS/Supplier; thus, the relevant compensation model shall be in place.
- Aggregator shall be responsible for its imbalance if it fails to provide required services or wants to trade on the market.

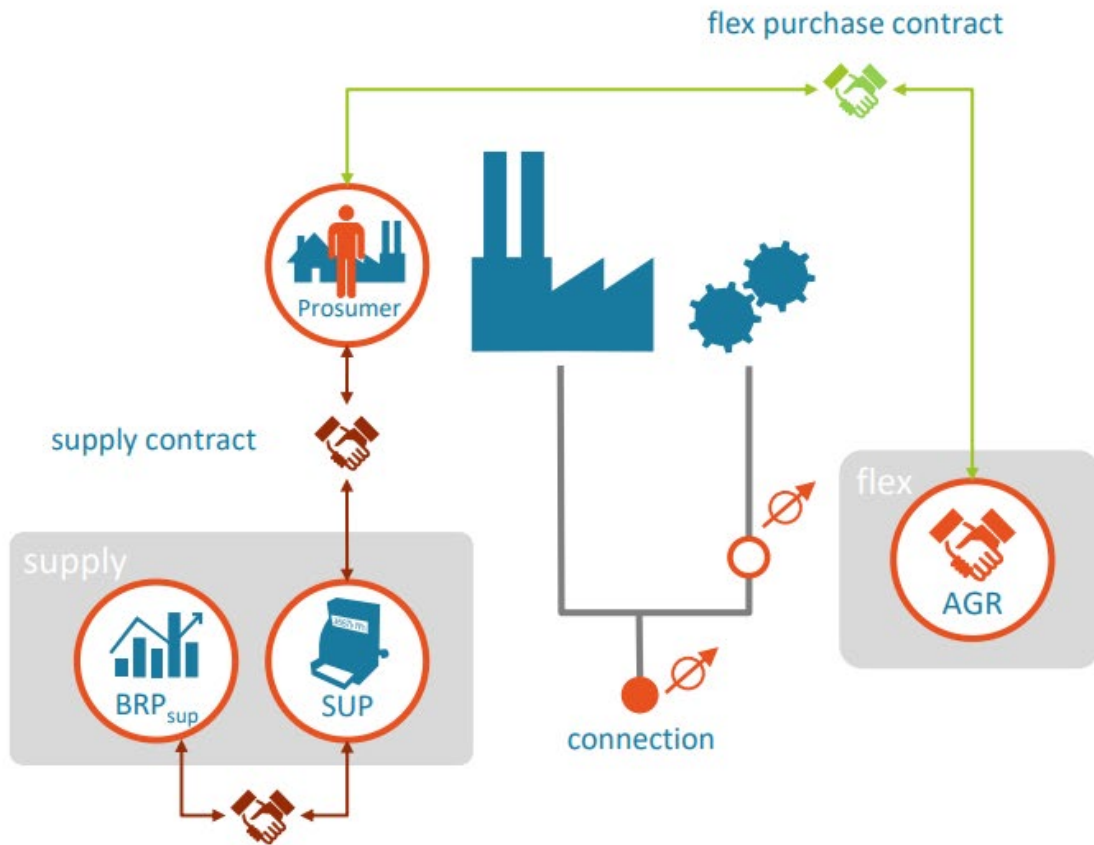


Source: USEF



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Uncorrected model of Independent Aggregator



No energy transfer

No compensation for imbalance (AGR associated with the BSP)

Implemented through balancing market: supplier is remunerated for "passive contribution to balance restoration"

Used when the activation is very small or rare (including the testing phase)

Legend:

BRP_{sup} = BRP of the Supplier;

BRP_{agr} = BRP of the Aggregator

= existing contract relation

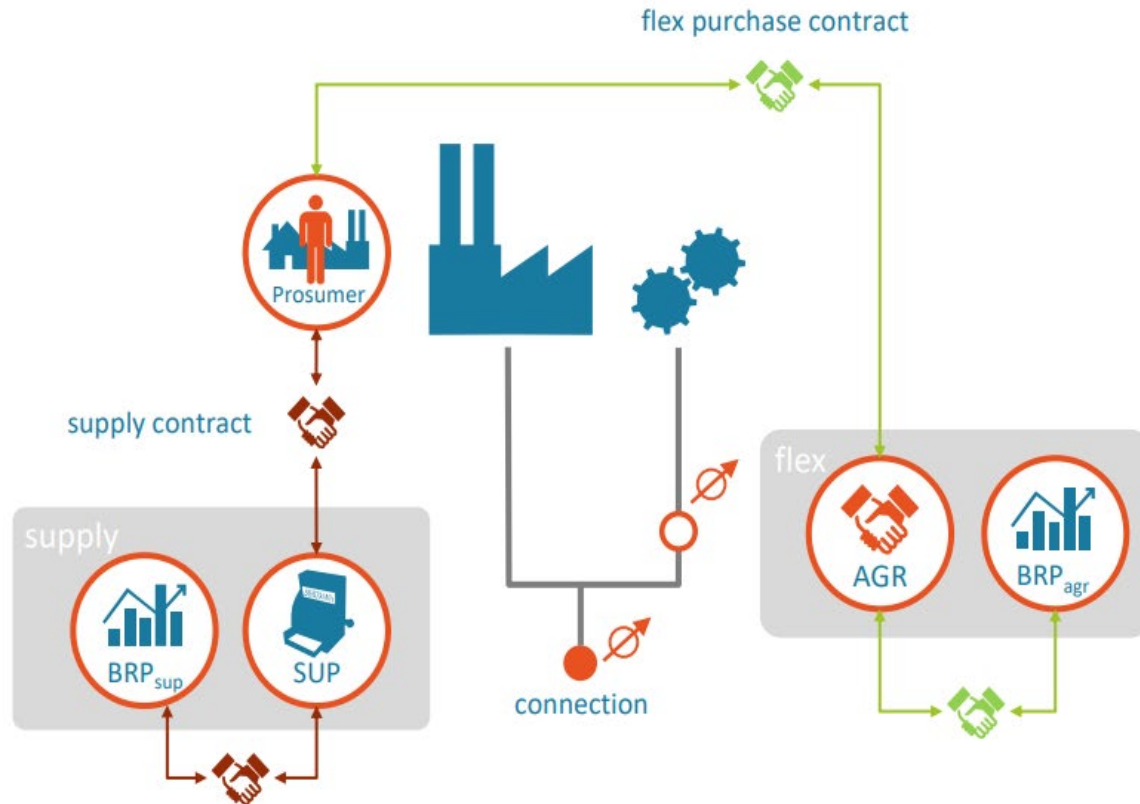
= new contract relation

Source: USEF



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Corrected model of Independent Aggregator



Energy transfer through the customer (modification of the customer's meter readings based on baseline)

Aggregator is balance (and financially) responsible for the imbalances from activation (BRP).

Supplier bills the same energy volume to the customer as if no activation had taken place. AGR compensates the customer for this.

BRP_{agr} is responsible for balance during the demand response delivery: the difference between actual consumption and the baseline

Legend:

BRP_{sup} = BRP of the Supplier;

BRP_{agr} = BRP of the Aggregator

= existing contract relation

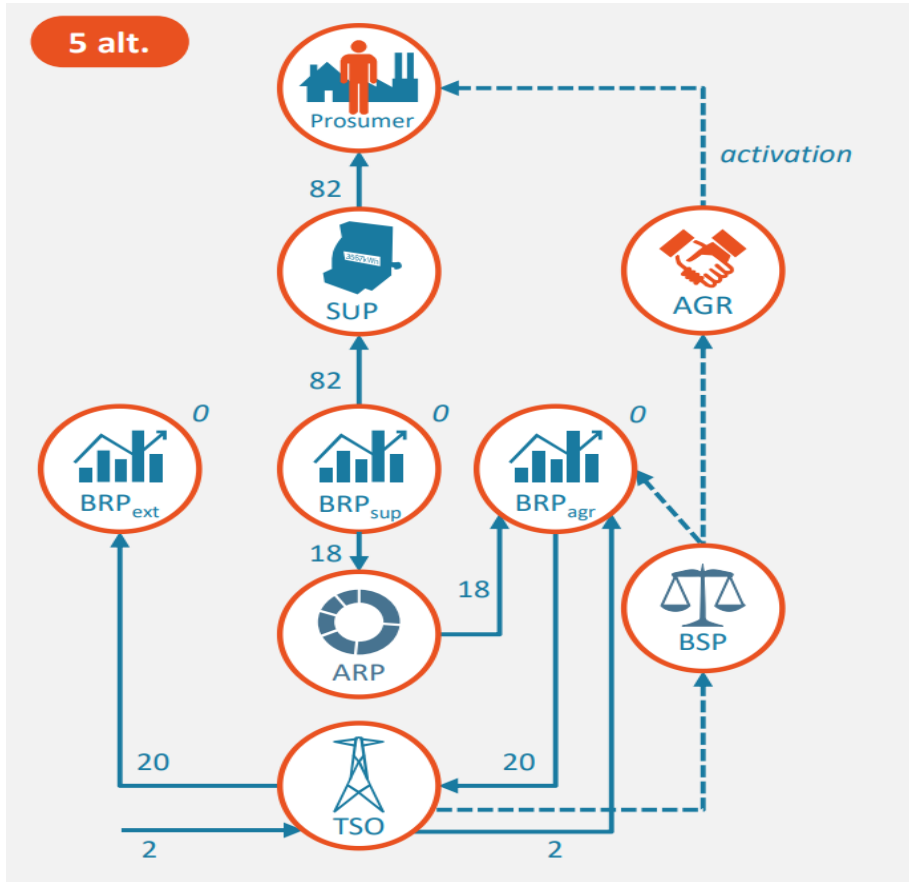
= new contract relation

Source: USEF



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Central Settlement model of Independent Aggregator



Energy transfer by central entity (e.g. TSO) which corrects the balancing perimeter of the supplier's BRP and settles the compensation for the ToE based on a predefined formula set by the regulator

Aggregator pays for the sourced energy, at the Transfer of Energy price

Aggregator is balance (and financially) responsible for the imbalances from activation (BRP).

BRP_{agr} is responsible for balance during the demand response delivery: the difference between actual consumption and the baseline

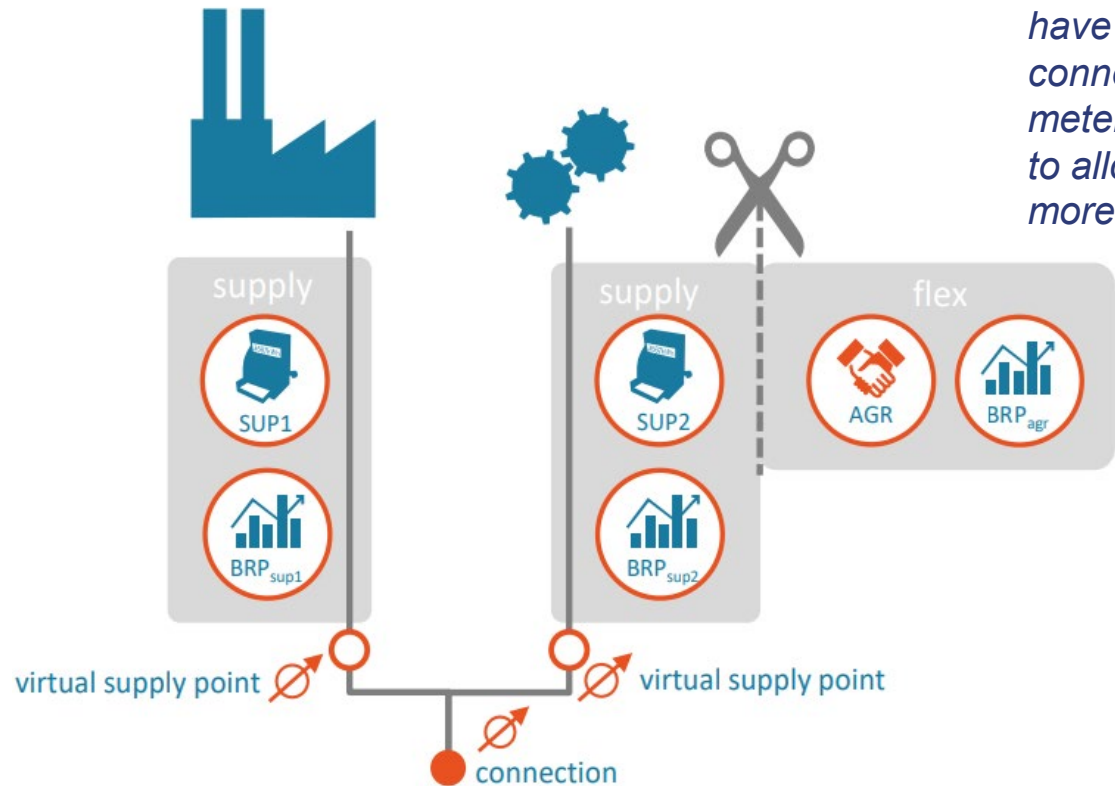
Source: USEF



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Split Supply Model

“Member States shall ensure that ... all customers are free to have more than one electricity supply contract or energy sharing agreement at the same time, and that, for that purpose, customers are entitled to have more than one metering and billing point covered by the single connection point for their premises. Where technically feasible, smart metering systems deployed in accordance with Article 19 may be used to allow customers to have more than one electricity supply contract or more than one energy sharing agreement at the same time.”



Left part - supply to the uncontrollable load

Right part - supply to the controllable asset.

Aggregator may want to operate DR on the flexible asset without being responsible for the supply.

Then the Aggregator Models can be applied to the right part, separating flex from supply

Source: USEF



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Key features of flexibility market

- Terminology
- Definition of flexibility requirements by the relevant system operator (TSO/DSOs)
- Procurement mechanism
- List of products and their attributes (characteristics) and pricing approach.
- Defining the Flexibility Service Providers (FSP)
- Participation of aggregators
- Baseline methodology
- Metering
- Pre-qualification and testing
- Activation and controllability
- Settlements of imbalances/compensations between relevant stakeholders
- Liability of FSP for failure to provide the service
- Information flows between the parties and the confidentiality aspect.



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References and Useful Reading

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