An overview

# of local European flexibility markets

Executive summary

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Across Europe, the ways in which people consume and produce electricity are changing. The massive deployment of distributed generation and new uses of electricity (such as heat pumps and electric vehicles) are changing the way the grid is operated in a fundamental way.

Flexibility, the actions taken by grid users to modulate power intake based on an external signal, is one lever that can empower distribution system operators (DSOs) to cope with the changes to grid.

Flexibility has become so important that the European Commission has taken steps to regulate, through Article 32 of the Directive 2019/944, market-based approaches for DSOs aiming to procure flexibility.To understand the impact of these regulations, analyze key trends and identify best practices, Accenture and Delta-EE have analysed the market-based approaches for flexibility procurement deployed by DSOs in the European Union and the UK, scanning the 173 DSOs with over 100,000 clients in Europe.

The key findings of the in-depth analysis of the most advanced use cases are detailed below.

The need for flexibility markets is driven by local, country-specific drivers, with two different approaches identified

The five countries analyzed in depth can be split into two clusters:

1. The first cluster is composed of French and British DSOs, which take a similar approach to flexibility use—flexibility is mostly sought proactively to address specific DSO needs.
2. The second cluster consists of DSOs aiming to solve congestion on the DSO network caused by lack of transmission capacity on the upstream transmission grid.

Overview of the clustering criteria for the advanced DSO

	Country	DSO Name	System operator leading the approach	Voltage level of the flexibilities	Main driver for flexibility
Cluster 1		Enedis	DSO	MV, LV	**DSO needs** (planification & operation)
		Scottish & Southern Electricity Network	DSO	LV, MV, HV	
		SP Energy Networks	DSO	LV, MV, HV	
		UKPN	DSO	LV, MV, HV	
		WPD	DSO	LV, MV, HV	
Cluster 2		Stromnetz Berlin GmbH	TSO – DSO collaboration	MV & HV	**HV congestion**
		Schleswig-Holstein Netz AG	Consortium (DSO led)	MV	
		EWE NETZ GmbH	TSO-DSO collaboration	MV & HV	
		Stedin	Multi SO consortium	MV & HV	
		Enexis Groep	Multi SO consortium	MV & HV	
		Alliander N.V.	Multi SO consortium	MV & HV	
		Vattenfall Eldistribution AB	Multi SO consortium	MV & LV	
		Ellevio AB (publ)	Multi SO consortium	MV & LV	
		E.ON Energidistribution AB	Multi SO consortium	MV & LV	

In the UK and France, DSOs are pushing for planned integration of flexibility into network operations to solve DSO-specific needs

In the UK and France, DSOs proactively seek flexibility to solve specific issues.

Flexibility is purchased using long-term tenders, and the approach is often years in the making: French DSOs started planning their approach in 2016, with the UK following soon afterwards in 2018.

Both countries' DSOs have a systematic approach to push the use of flexibility whenever and wherever it is economically optimal on medium voltage. Pilots are currently underway on low voltage in France, while the UK has started tendering capacity for these voltage levels.

Even though the approaches differ at the deployment phase, with different valuation processes, the use cases for flexibility are very similar, and include both grid planning and grid operations.

The Netherlands, Sweden and Germany deploy flexibility in response to congestion across high voltage (HV) networks, which often cascades onto lower voltage grids

Dutch, German, and Swedish DSOs' priority is to solve congestion arising on their networks due to lack of transmission capacity on the upstream transmission grid. These DSOs mostly buy flexibility on short-term markets with the sole purpose of solving the HV grid congestion that stems from injection.

In these cases, flexibility is not integrated into the grid planning process, but rather developed as a short-term solution to solve network congestion once an issue has been identified.

Local flexibility provides solutions for both planning and operation activities, with five use cases identified for the procurement of flexibility.

The different use cases for flexibility identified in this study arise from the different types of congestion identified, and can be divided into five main areas:

- Investment deferral
- Permanent embedded solution
- Demand congestion
- HV injection congestion
- Outage management

Investment deferral is used to postpone investment during the planning phase until the ideal investment date. In this case, flexibility competes with other economic alternatives in the DSO's grid planning process. Evaluating the use of flexibility relies on economic drivers and is clearly assessed.

Permanent embedded solutions are deployed as an integrated solution in the planning process, a good example of TSO-DSO cooperation. This approach is specific to Enedis' grid planning.

Demand congestion management is a key driver for the deployment of local flexibility in areas where a significant growth in consumption puts the network at risk. Two sub-cases have been identified:

- Load patterns see a rise in demand, driven by factors like higher electrification, urban growth and growing EV adoption, that is faster than anticipated. This creates a gap between the scheduled (and sometimes already funded) reinforcements and the actual occurrence of congestions.
- Demand-driven congestion risks can also be identified in the planning phase. However, if the economic valuation shows that reinforcements are not economically viable, or that the optimal date to complete the work is later, flexibility can be sought to mitigate the existing situation by reducing the value of the lost load.

High voltage injection congestion occurs when the increase in the amount of connected renewable capacity means that excess power cannot be dispatched, which creates a risk of grid overload. Usually, it means that the queue of renewable capacity "willing" to connect to the grid has maxed out the grid capacity, or that the renewable capacity that is already connected is injecting more power than the grid can take. This problem often stems from the fact that the Transmission System Operator (TSO)-managed HV grid cannot take the additional generation, which leads to congestion on the DSO-managed grid (medium and low voltage).

Outage management is another use of flexibility, focused on network operations such as:

- Planned work, where flexibility can be used to limit the scope and duration of the outage and/or extend the period to schedule work without inducing temporary outages
- Unplanned incidents, where flexible capacity can be used to re-supply the network in a cheaper, faster manner

In France and the UK, DSOs cover most of the use cases, while the rest of the analyzed DSOs cover only one or two use cases.

Use cases identified for the selected DSOs

Grid planning		Grid operation		
Investment deferral	**Permanent embedded solution**	**Demand congestion**	**HV injection congestion**	**Outage management**
Enedis	Enedis	Enedis	Stedin, Enexis, Alliander	Enedis
UKPN, SSEN, WPD, SPEN		Vattenfall, Ellevio, E-On	Vattenfall	UKPN, SSEN, WPD, SPEN
		UKPN, SSEN, WPD, SPEN	Stromnetz Berlin, EWE, S.H Netz	

Network visibility affects the DSO's approach to procurement (short term vs. long term): Long-term approaches are used when the visibility on network needs is high, while short-term markets focus on short-term needs.

There are two market types, each with a different time horizon:

- Long-term markets, where capacity is tendered in advance and activation notices sent afterwards as needed by the DSO
- Short-term markets, where flexibility is bought shortly before it is needed on the network (day-ahead, or even intraday)

These market designs stem directly from the type of network visibility that DSOs have over their network and their congestion risks.

French and British DSOs operate in a long-term market, using flexibility for grid planning: either as an investment deferral solution, or for TSO-DSOs to jointly optimize regional schemes to host renewable energy sources (pilot on 10 primary substations to start in France). Their availability needs therefore to be secured in advance, and their reliability ensured, to solve congestion stemming from normal schemes or unplanned outage schemes.

Those prerequisites have led to the development of long-term markets for planning-related flexibility in France and the UK, as well as the development of capacity reservation.

On the other end of the spectrum, it is difficult to gauge the size (duration and power) of the flexibility needed to address short-term congestion, which is why DSOs in Germany, Sweden and the Netherlands have deployed local short-term trading platforms to manage short-term congestion.

However, there are exceptions. Some DSOs have backup contracts to ensure security of supply in case of market failure; Vattenfall in Sweden has purchased seasonal flexibility contracts, while Alliander in the Netherlands has a bilateral contract with an aggregator to meet the needs of the Nijmegen Noord market. Both are long-term contracts with capacity reservation.

Different contract types per DSO

	Contract with capacity reservation	Contract without capacity reservation
Long-term market	*Capacity reservation ensures that the flexibility provides the same reliability guarantees as the other alternatives* Enedis Alliander UKPN, WPD, SSEN, SPEN Vattenfall	*No reservation is needed when no alternative solutions provide a better service* Enedis WPD, SPEN, SSEN
Short-term market	NA	*Approach to find economical alternatives to existing solutions, for grid operation use cases* Alliander, Enexis, Stedin E-On, Vattenfall, Ellevio Stromnetz Berlin, SH Netz, EWE Netz

As the type of flexibility contracted is use case-dependent, the valuation process also depends on local context and available alternatives.

Valuation processes comparing flexibility costs to existing available solutions

As stated in the EU Directive 2019/944, flexibility must be tendered if it is considered an economically viable alternative to regular options. As such, the different use cases for flexibility define the alternative investments and the valuation methods.

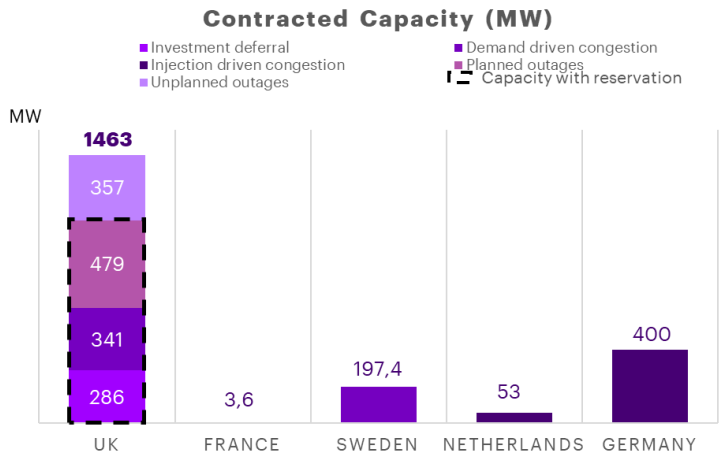
Those alternatives solutions are described below, clustered by the use cases developed above:

	Grid planning		Grid operations		
	Investment deferral	Permanent embedded solution	Demand congestion	HV injection congestion	Outage management
Alternative solution	Network reinforcements	Network reinforcements	Backup generation or re-supply solution	Curtailment Temporary cabling	Manual network operation or backup generation units

Local flexibilities are on the journey towards industrialization, with rules and legal frameworks being drafted in the scoped countries

The DSOs analyzed contracted 2GW of flexibility in 2020, with high variations depending on countries and DSO-specific needs

The total capacity contracted by DSOs is high, particularly in the UK where over 1GW is contracted (with a reservation fee)[1]. Activated capacity is usually not disclosed by the DSOs analyzed.



The capacity contracted varies between countries due to several reasons:

- Actual needs and the DSO's experience of local flexibility
- Long-term approach to provide visibility of available flexibility
- High reservation fee set up by some UK DSOs to secure flexibility contracts (£500/MW/h for UKPN)
- Nature of congestion: injection vs demand
- Possibility of value stacking between different voltage levels

[1] In the UK, several products are available with capacity reservation:
- "Sustain": bought with firm capacity reservation and used for investment deferral
- "Secure": reserved on week ahead among the eligible FSPs (selected during the tendering phase) and used for demand-driven congestion
- "Dynamic": bought with week ahead reservation and used for planned outages
- "Restore": bought without capacity reservation and used for unplanned outages

As the markets analyzed have only been developed recently, there are no clear trends around market access rules and tender results. However, there are some notable takeaways: Barriers to entry are set quite low for local flexibility markets, with minimum bid sizes ranging from 0,1 MW to 0,5 MW.

- Activated capacity volume data is rarely shared.
- The capacity contracted, particularly through non-reservation capacity contracts, is high in markets such as the UK, as the DSO bears no cost unless flexibility is activated.
- Electric vehicles and storage are often listed as useful sources of demand-side flexibility.

The regulatory framework is still evolving, with discussions pending in most European countries.

The regulatory framework for DSOs to procure local flexibility will play a definitive role in the development of local flexibilities. The process has started in most countries in accordance with the directive from the European Union, but none of the countries analyzed have finished deploying a full regulatory package on the topic.

The same is true of the other countries assessed in this benchmark, who have yet to finalize their approach to, or fully transpose, European Directive 2019/944. Although all countries seem to have started the transposition process to stay compliant with European law, they are far from having a full regulatory package in place.

However, this situation could change in coming years as discussions about implementing a network code around flexibility, which would standardize the flexibility approaches around Europe for both TSOs and DSOs, have started.

The current trend is towards co-construction with stakeholders (aggregators, regulators, TSOs) to ensure markets are competitive

In all the countries scoped, co-construction and collaborative approaches between DSOs and flexibility providers have started.

These approaches often start with the DSOs, which define common approaches with DSO associations, such as:

- The common vision defined by the Energy Networks Association in the UK
- The discussions around flexibility in the Netherlands through Netbeheer Netherlands
- The SINTEG project in Germany, which aims to improve the visibility vision of flexibility approaches
- The collaborative approaches in Sweden, such as the common Vattenfall-Ellevio market and the use of the E-On decision tool across all flexibility markets

These initiatives also include stakeholders such as aggregators and flexibility services providers, with collaborative market designs being built in France, Sweden and the UK.

What's more, TSOs are also starting to get involved in the process in both short-term markets, where their involvement has always been strong, and long-term markets. Projects and discussions built on DSO-TSO collaboration, such as the S3REnR collaborative approach in France and the IntraFlex approach for Western Power Distribution in the UK, are good examples of this emerging willingness to collaborate.

Conclusion

Across Europe, market-based procurement of flexibility is developed with localized approaches driven by country specific needs and DSO maturity. Discussions around market design and the approach to procurement are still taking place. It is expected that the full transposition of Article 32 of the Clean Energy Package will help to create a clearer framework for the deployment of flexibility markets.

Although there are several issues to be addressed as the approach to procuring flexibility is industrialized, it is critical to:

- **Ensure that there are no obstacles to prevent the value stacking of flexibilities, which requires strong coordination between DSO-led mechanisms and other existing markets**
- **Continue the definition of future market designs while aiming at simple mechanisms with few restrictions to support the development of flexibility for local use, ensuring customer acceptance and lower operation costs**
- **Develop a consistent overall framework for flexibility assessment and procurement that considers the different ways DSOs access flexibility (mandatory provision, time of use tariffs, variable connection agreements and local markets)**
- **Support the various needs of the transition phase regarding the development of platforms, processes and flexibility portfolios for long-term consumer benefit.**

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