2022 Market Monitor

For Demand Side Flexibility

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LCP Delta would like to thank all those who gave us their time to be interviewed for this report – your knowledge and insights were greatly appreciated. A special thank you to the research team at smartEn, and the members who took time to comment on the draft report.

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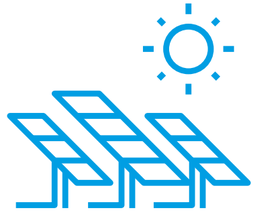


Contents

About LCP Delta and smartEn

LCP Delta introduction

LCP Delta combines the expertise of LCP Energy and Delta-EE to provide a single partner across the whole energy value chain. LCP Delta provides focussed subscription research, consultancy, technology and data as well as training services.

This research is part of our Flexibility Research Service which provides insight into key markets, service providers, business models and issues shaping the sector, including the potential for demand side flexibility.

smartEn introduction

smartEn is the European business association integrating the consumer-driven solutions of the clean energy transition.

We aim to create opportunities for every company, building and car to support an increasingly renewable energy system.

www.smarten.eu

Executive summary

- **Purpose, scope and definitions**
- **2022 European Market Monitor Map for Demand Side Flexibility**
- **Country ranking and score**

Market Monitor for Demand Side Flexibility

Michael Villa
Executive Director
smartEn

The energy crisis prompted by the war in Ukraine put a spotlight on flexible demand.

While many measures have been developed over the past year outside the usual market structures, we need to remember the importance market-based solutions have in offering consumers and system operators the best value.

The teachings of 2022 included in this new edition of the Market Monitor for DSF shall pave the way for a robust revision of the Electricity Market Design to address in a structural way the current energy resilience and energy affordability crisis, while supporting the clean energy transition with consumers in the lead (from households to energy intensive industries, acting individually or collectively).

Jon Ferris
Head of Flexibility and Storage Research
LCP Delta

The energy crisis has overshadowed market developments over the past year, with the war in Ukraine, nuclear outages and restricted hydro generation all contributing to high and volatile prices.

There has been no lack of intervention in markets, with financial support for consumers, windfall taxes on generators, and increasing recognition and reward for the role of demand side flexibility.

But the ongoing debate about electricity market design, whether price controls, marginal pricing or splitting renewable and thermal markets, is challenging investor confidence in the market signals that influence flexibility.

Despite high prices and policy uncertainty affecting investment decisions, the long term direction is clear – demand side flexibility has an increasingly important role in managing the electricity system.

Purpose, scope and definition

This report provides a holistic and independent assessment of the progress of demand side flexibility across 30 European markets

What the Market Monitor is, and how to use it:

- This report provides a high-level summary of 30 European markets and their **demand side flexibility market activity**.
- Using this report you can benchmark markets against each other to track their progress on enabling DSF.
- The findings are based on our primary and secondary research across each market.
- Our approach and research findings have been challenged by internal and external experts to corroborate our view.

Scope of Market Monitor:

- Regulatory progress to enable DSF
- Development of local flexibility and energy communities
- Potential market size of flexibility
- Future development of DSF

This report focuses on market based flexibility and regulations, and does not consider tariff-based implicit flexibility.

Typically in Europe, ancillary services are the first markets to open up to DSF. Hence they are the focus of this report.

What is flexibility?

Flexibility is the ability of electrical generators and consumers to alter their output or consumption on demand. It can be provided by assets ranging from large front of meter generation to residential appliances.

What is Demand Side Flexibility?

DSF is the deviation to the planned consumption, generation and use of storage, in response to price signals or instruction, from residential, commercial or industrial customer sites, individually as well as through aggregation.

Flexibility helps ensure system stability

2022 Market Monitor for Demand Side Flexibility

Eastern and Southern European countries are opening services to DSF while growth in some more developed markets is stagnating

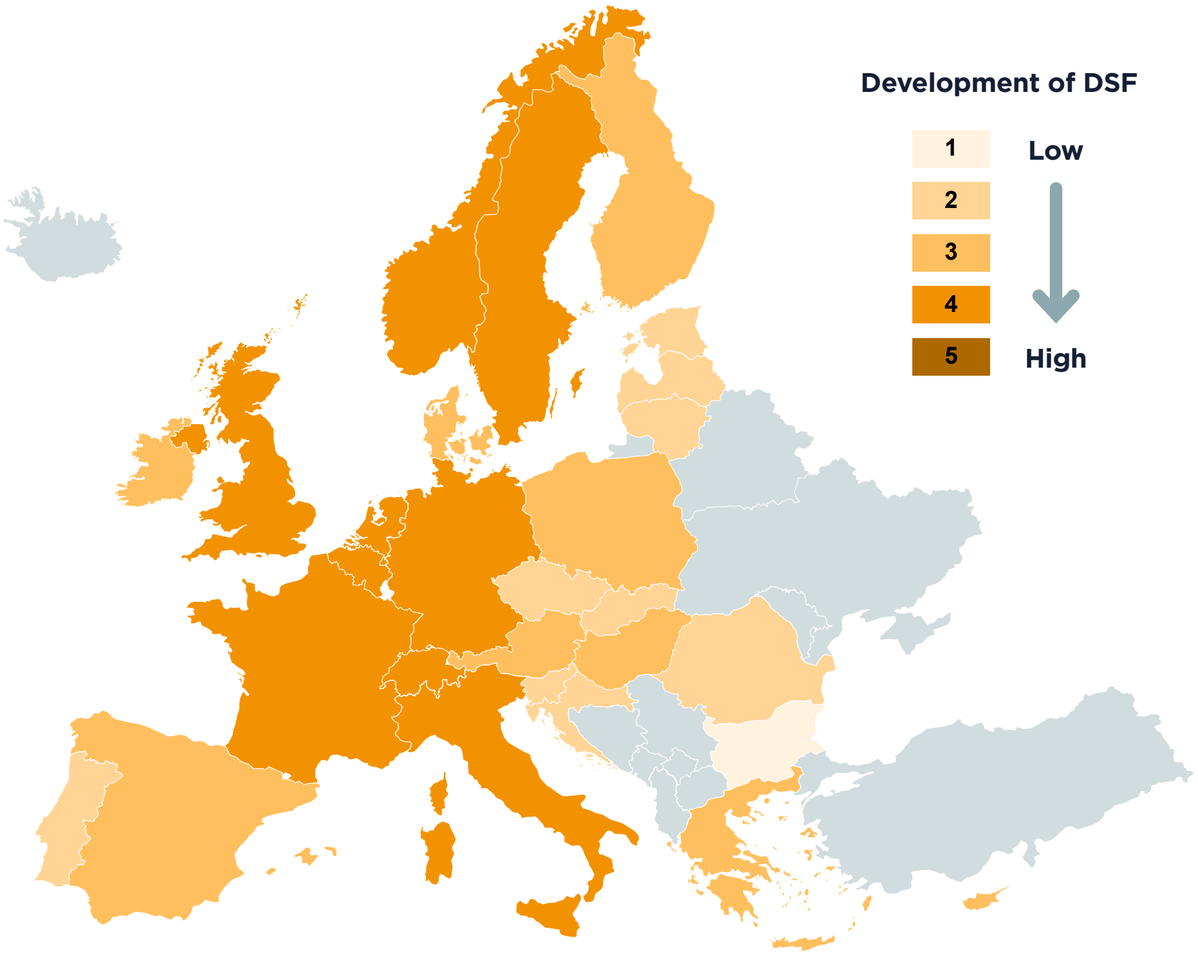
Assessment criteria for Market Monitor:

- Regulatory progress to enable DSF
- Potential market size of flexibility
- Development of distribution system flexibility
- Development of local energy systems
- Future development of flexibility

This report provides a high level summary of the current state of demand side flexibility and highlights the emerging opportunities based on our research across 30 European markets.

From our research we find:

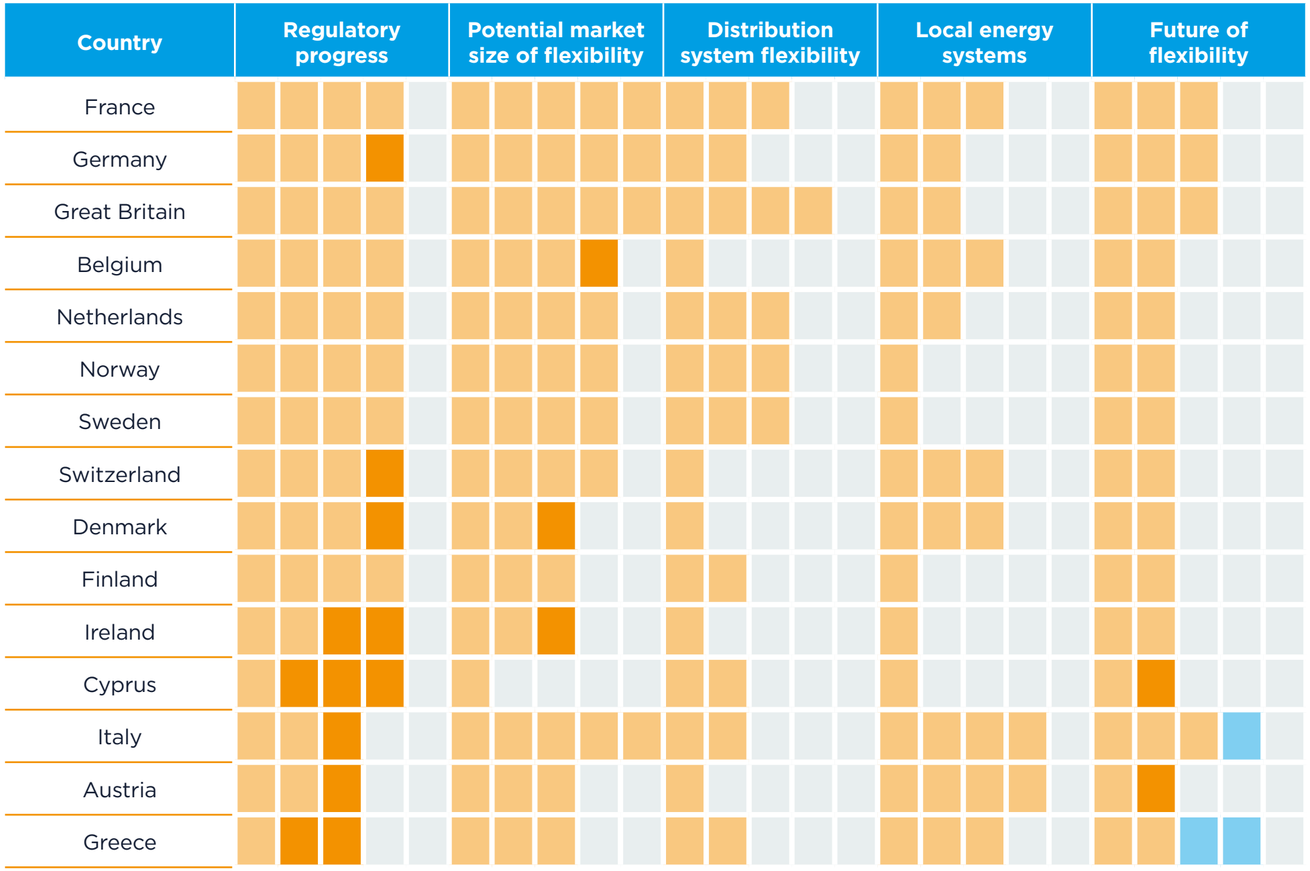
- TSO spend on ancillary services has increased dramatically in 2022. This is primarily due to high wholesale prices that are reflected in utilisation payments.
- Regulatory growth has stagnated in **Spain and Italy** with less than expected progress in 2022.
- Several markets have opened their ancillary services markets to DSF **(Cyprus, Slovakia, Romania and Greece)**. While this is a positive step forward there are still prohibitive barriers.
- **GB and the Netherlands** are leading the development of DSO flexibility markets.
- **Austria, Portugal, Spain and Switzerland** have the most accessible regulations for local energy systems.
- **Poland and Portugal** remain key markets to watch for future development.



Country summary 1/2

Ranked in order of regulatory progress (then market size and alphabetically)

Category:	Feature:
Demand side flexibility regulatory progress	• Is the ancillary service market operational? • Can DSF participate? • Is aggregation allowed? • Is a BRP agreement required? • Is the country part of co-ordinated markets?
Potential market size of flexibility	• Ancillary services (FCR, aFRR, mFRR, RR or local equivalent)
Distribution system flexibility	• Is DSO flexibility commercial? • Are there DSO flexibility trials? If so, how many?
Local energy systems	• Is collective self-consumption allowed? • Is there a national framework for citizen energy communities? • Is there a national framework for renewable energy communities? • Are there subsidies that enable local energy systems?
Future of flexibility	• Markets opening to DSF by 2025 • 2030 renewable targets. • Future participation in FCR co-operation, PICASSO, MARI and TERRE.



Country summary 2/2

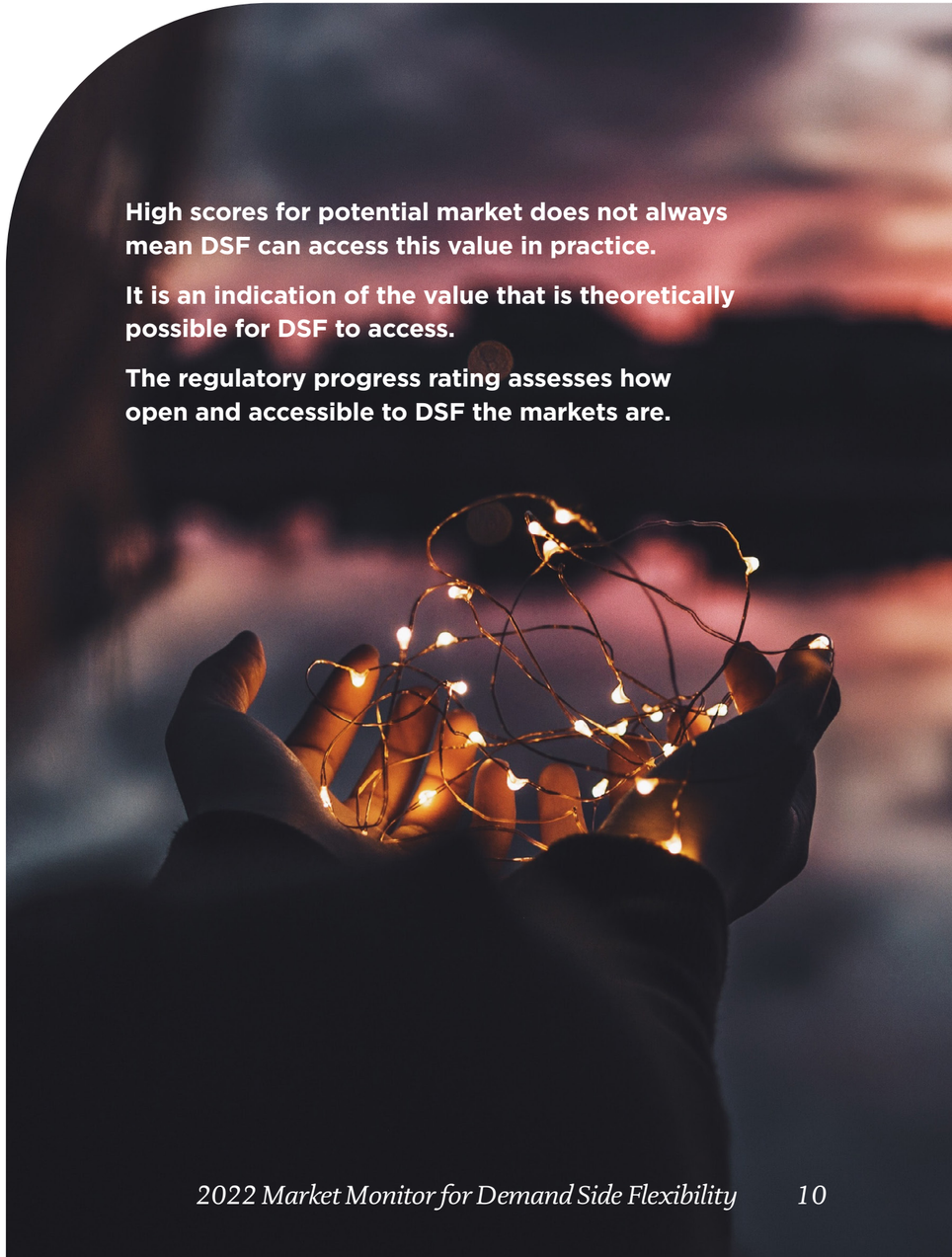
Ranked in order of regulatory progress (then market size and alphabetically)

Country	Regulatory progress	Potential market size of flexibility	Distribution system flexibility	Local energy systems	Future of flexibility
Hungary					
Cezch Republic					
Slovakia					
Slovenia					
Estonia					
Spain					
Romania					
Croatia					
Bulgaria					
Latvia					
Lithuania					
Poland					
Portugal					
Luxembourg					
Malta					

High scores for potential market does not always mean DSF can access this value in practice.

It is an indication of the value that is theoretically possible for DSF to access.

The regulatory progress rating assesses how open and accessible to DSF the markets are.



Summary score guide

Our research assesses the development of European Flexibility markets

Early Markets

'Low' scoring countries typically are markets which are not established or are yet to open fully to DSF and have limited activity.

- These markets have few, if any, value streams open commercially to DSF.
- These markets often have limited need for DSF due to low renewable targets, bilateral contracts with generators, or lack a transmission system (as is the case with Malta).
- With time these markets will develop the need for DSF, however commercial interest will remain limited over the next 3 years.

Emerging Markets

Countries scoring 'medium' are generally active markets undergoing development to open more fully to DSF.

- Some value streams are open to DSF but there are often significant barriers in high minimum bid sizes, challenging metering requirements or regulatory constraints.
- Despite the (current) lack of accessibility to DSF these countries have a high spend on flexibility, including Poland, Romania and Greece.
- These countries are aiming to join the coordinated EU markets for ancillary service (MARI, PICASSO, TERRE) over the next two years.

Maturing Markets

Countries scoring 'high' are more developed markets for DSF. This does not necessarily mean there are no barriers to participation.

- Maturing markets have most (if not all) markets open to DSF, although barriers to entry are still present.
- Local flexibility is developing, with some examples of commercial offerings (e.g. the Netherlands) at distribution level.
- Even at their current stage of development, some markets have the potential to grow further due to increasing renewable targets (e.g. France, Germany and Great Britain).

Introduction

+ Methodology
+ Scoring System

Methodology

The Market Monitor is based on extensive primary and secondary research

The report is based on LCP Delta's high-level qualitative primary research across 30 countries and more detailed research into twelve.

Demand Side Flexibility Market Monitor

We extended the research process undertaken for previous Market Monitors to include substantial quantitative assessment to estimate market value. Our approach was as follows:

- **Interviewed ~100 industry contacts** with knowledge on demand side flexibility across all markets, including TSOs, DSOs, Energy Suppliers, Aggregators, independent specialists, technology companies and industry associations.
- **Analysed over 40GB of market data** (price and volumes of ancillary services) from TSOs, regulators and ENTSO-E.
- **Calculated** the annual capacity or energy volume, average price and total market value for each value stream with available data.
- **Assessed and scored** each country against four categories as described on the methodology slide.
- **Aggregated scores** to produce an overall country ranking.
- **Proofed and ensured consistency** across the scores, valuations and rankings with **internal and external challenge** on the results.

Detailed Country Reporting

Alongside the Market Monitor maps we have also carried out more detailed research in order to produce detailed country reports. These reports are available for LCP Delta Flexibility Research Service subscribers.

We focused on twelve countries to give a range of examples of markets actively developing demand side flexibility.

This report includes a review of the following countries:

This report includes reports for the following countries:

- Belgium
- Finland
- France
- Germany
- Great Britain
- Ireland
- Italy
- Netherlands
- Norway
- Spain
- Sweden
- Switzerland

Scoring system 1/2

Category	Feature:	Scoring system:	Description:
Potential market size of flexibility	• Ancillary services (FCR, aFRR, mFRR, RR or local equivalent)	**1 – 5 based on the volume and prices of ancillary services procured by TSOs.**	This score highlights the countries that have the highest spending on ancillary service. Please note that this is total spend on flexibility, not that specifically spent on DSF.
Demand side flexibility regulatory progress	• Is the ancillary service market operational? • Can DSF participate? • Is aggregation allowed? • Is a BRP agreement required? • Is the country part of co-ordinated markets?	**1 – 5 based on the availably and accessibility of DSF into ancillary services.**	A high score indicates that not only are markets open to DSF, but that aggregation is allowed and an agreement with a balancing responsible party (BRP) is not required. If the score is low then DSF is either not permitted or there are high barriers to entry.
Distribution system flexibility	• Is DSO flexibility commercial? • Are there DSO flexibility trials? If so, how many?	**1 – 5 based on the development of distribution system flexibility.**	Countries with commercial DSO offerings scored the highest. Those with pilot projects or part of European funded projects were also awarded scores. The scale of commercial market and pilot projects were also considered with higher scores given to markets/projects with higher volumes traded.
Local energy systems	• Is collective self-consumption allowed? • Is there a national framework for citizen energy communities? • Is there a national framework for renewable energy communities? • Are there subsidies that enable local energy systems?	**1 – 5 based on the development and accessibility of local energy systems.**	Countries that have legislation in place to enable citizen and energy communities score the highest. Those countries with progressive subsidies that actively reduce barriers to participate in local energy systems also score well.

Scoring system 2/2

Category	Feature:	Scoring system:	Description:
TSO Flexibility data	**Transparency** • What data is available on procurement and activation of DSF across different ancillary services.	**1-5 based on data available for prequalification, procurement and activated DSF, technology types and number of BSPs.**	This data was collected by SmartEn via multiple questionnaires with TSOs and desk-based research. Those with a high score responded to the request 'with all data available'. Those TSOs who did not respond are not included in this map.
	DSF participation • The total volume of DSF procured in ancillary services • DSF being allowed to trade in the wholesale market (not takers of variable tariffs)	**1- 5 based on procured capacity of DSF in ancillary services and access to wholesale markets.**	
Future of flexibility	• Participation on FCR co-operation, PICASSO, MARI and TERRE. • Installed base of residential assets. • Difference between current and 2030 renewable generation targets.	**1 – 5 based on a planned development of DSF and future potential.**	High scores highlight the countries that have the most potential to increase the monetisation of DSF in the future, reflecting those with large flexibility markets and plans to open to DSF in the next 1-2 years. Where markets are already open, high renewable targets in relation to current renewable generation capacity will increase the need for flexibility.

The 2022 European Market Monitor for Demand Side Flexibility

Regulatory progress to enable demand side flexibility

Which countries have open and accessible value streams for DSF?

We looked at:

- Is the market commercially operational?
- Can DSF participate?
- Is aggregation allowed?
- Is storage allowed?
- Min bid size of 1MW or less
- Is a BRP agreement required?
- Is there a a-symmetrical product design?

While progress is being made to implement the Clean Energy Package, there are still significant improvements required to increase accessibility to DSF.

Cyprus, Estonia, Greece and Slovakia have opened multiple ancillary service markets to DSF. Spain and Italy have not shown as much progress as anticipated.

Interpreting the results

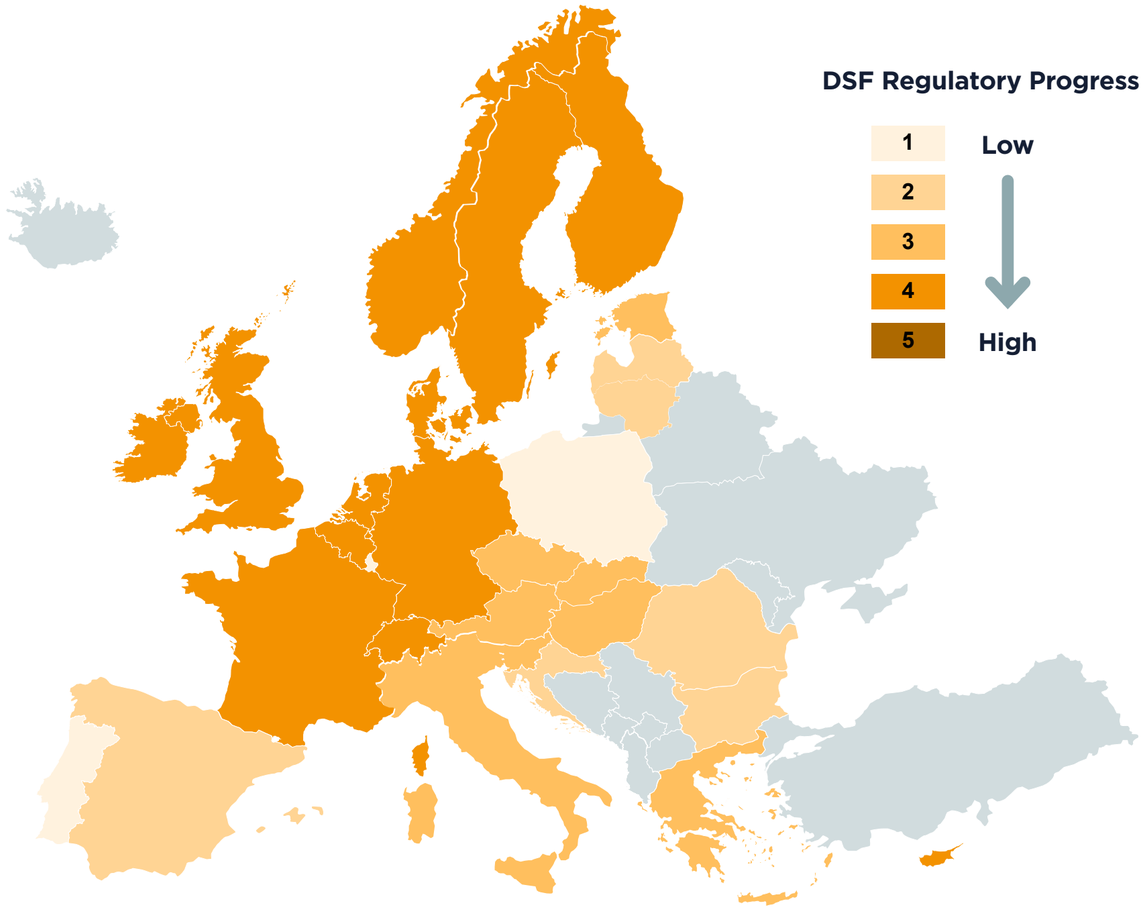
There has been a noticeable increase in the accessibility of ancillary services with **~80% FCR, aFRR and mFRR value streams across Europe open to DSF** (up from 50% in 2021). Most progress has been made in Southern and Eastern Europe. Value streams that require a faster response than FCR are less accessible, with the Nordics and Ireland allowing participation, while requirements in GB and Italy are prohibitive.

DSF participation is expected to increase as markets open to all assets.

Market coupling is further increasing the potential participation of DSF, however many Member States are delaying implementation.

Snapshot: Greece

In July 2022 Greece fully opened its FCR, aFRR and mFRR markets. Unlike more mature countries the markets were opened fully with both DSF and aggregation allowed, 1MW min bid size, no BRP agreement required and an asymmetrical product design.



Potential market size of flexibility

Shows the value of all market-based and remunerated ancillary services

We looked at:

- Volume of ancillary services procured and activated.
- Price paid for reservation and activation of ancillary services.

This map illustrates the total spend by TSOs on ancillary services (FCR, aFRR, mFRR and RR). High scores for monetisation does not always mean DSF can access this value in practice.

Total spending on flexibility has increased from ~8 bn to ~16 bn in 2022. This is largely due to higher utilisation prices.

Interpreting the results

This is the total market value that is **theoretically open to DSF – not the actual participation of DSF** in those markets.

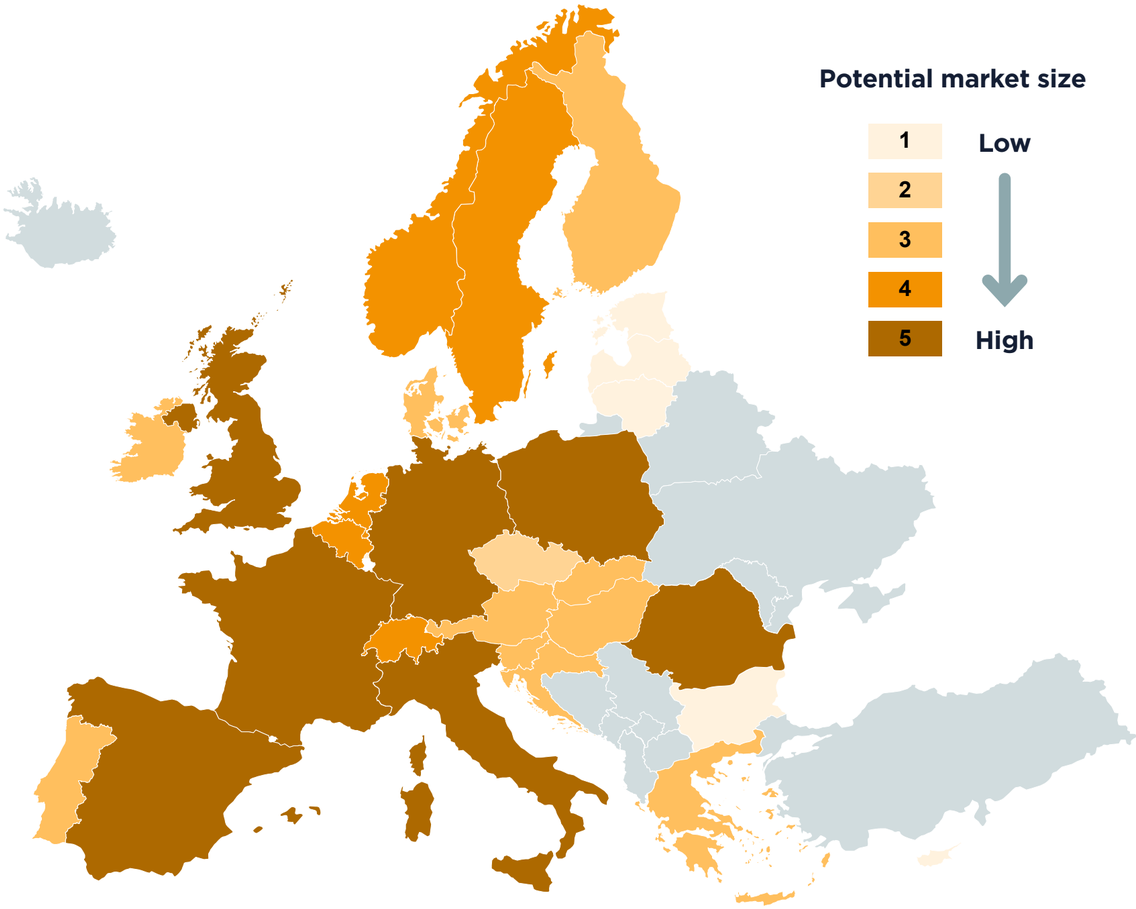
The highest ranking seven countries (France, Germany, Great Britain, Italy, Spain, Poland and Romania) account for 70% of total spend.

All countries saw an increase from 2021.

While procured volumes have largely remained stable, utilisation prices have seen a noticeable increase.

Snapshot: France

France has seen a significant increase in total spend from ~€1.4bn in 2021 to ~€2.6bn in 2022. While all value streams increase in spend, Reserve Rapide (mFRR) saw a 231% increase in total spend increasing to >€1bn in 2022.



Development of distribution system flexibility

DSO flexibility markets are an emerging value stream in a select few countries

We looked at:

- Whether there are commercial DSO flexibility markets.
- How many DSO flexibility trials are happening in the country?
- What is the volume of flexibility being traded in the commercial market and trials?

Countries with commercial DSO offerings scored the highest. Those with pilot projects or part of European funded projects were also awarded scores. Those countries included in this market monitor but with no commercial and trial activity are coloured grey.

Great Britain is leading the way, followed by the Netherlands, France, Sweden and Norway. There is slow progress in the rest of Europe.

Interpreting the results

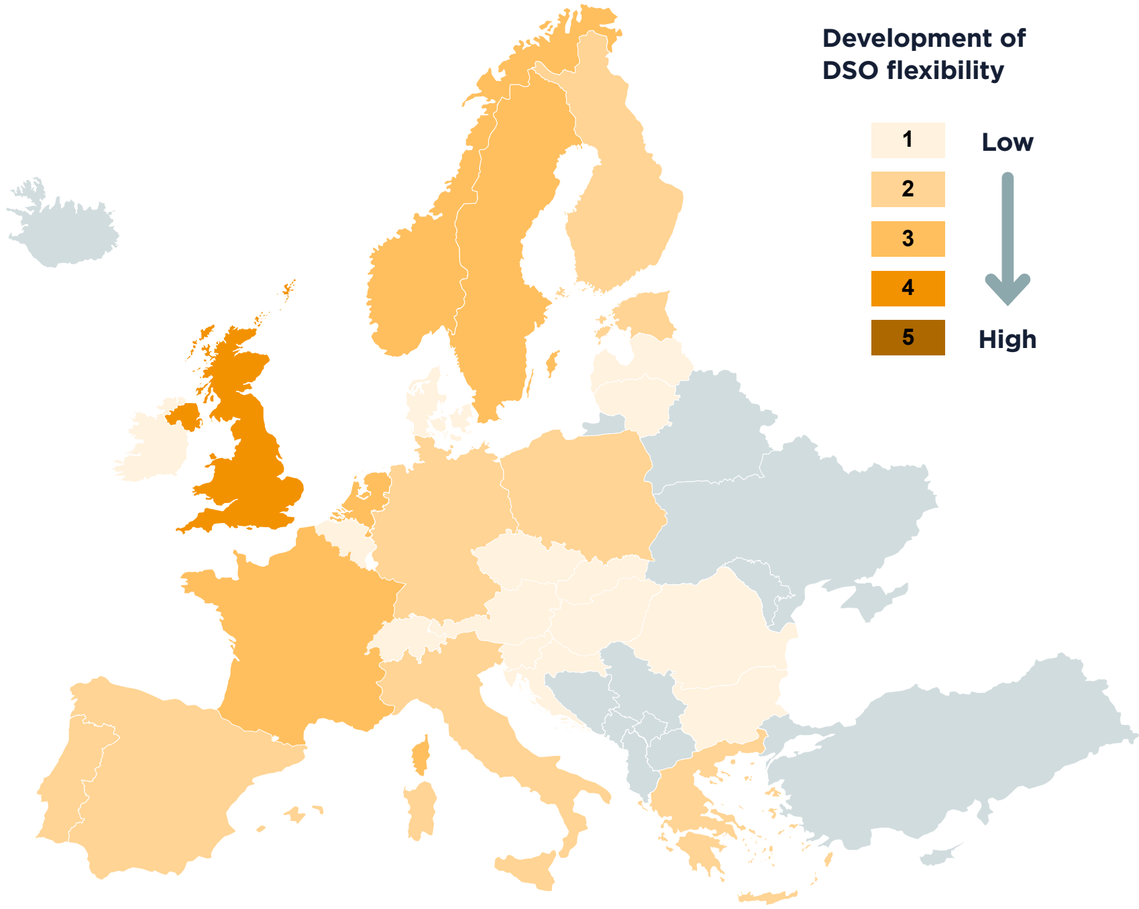
DSO flexibility markets are growing in a select few European countries, with little progress being seen elsewhere.

Great Britain, the Netherlands and France are the only countries to have commercial markets. Outside of this, Norway and Sweden have advanced trial offerings with relatively high traded volumes.

Those countries included in this market monitor but with no commercial and trial activity are coloured grey.

Snapshot: Great Britain

All six DSOs in GB have procured flexibility through market tenders. Additionally, several trials are also being conducted to identify additional services for DSO flexibility markets (including Reactive Power services). While contracted volumes of flexibility being procured by GB DSOs are increasing annually, activations remain low. This is limiting the value of these flexibility markets to the flexibility service providers.



Development of local energy systems

Commercial offerings for energy communities are emerging

We looked at:

- Is collective self-consumption allowed?
- Is there a national framework for citizen energy communities?
- Is there a national framework for renewable energy communities?
- Are there subsidies that enable local energy systems?

Countries that have legislation in place to enable citizen and energy communities score the highest. Those countries with progressive subsidies and actively reduce barriers to participate in local energy system also score well.

Portugal, Spain, Italy and Austria are currently the leading countries for energy communities but there is developing interest in other European countries.

Interpreting the results

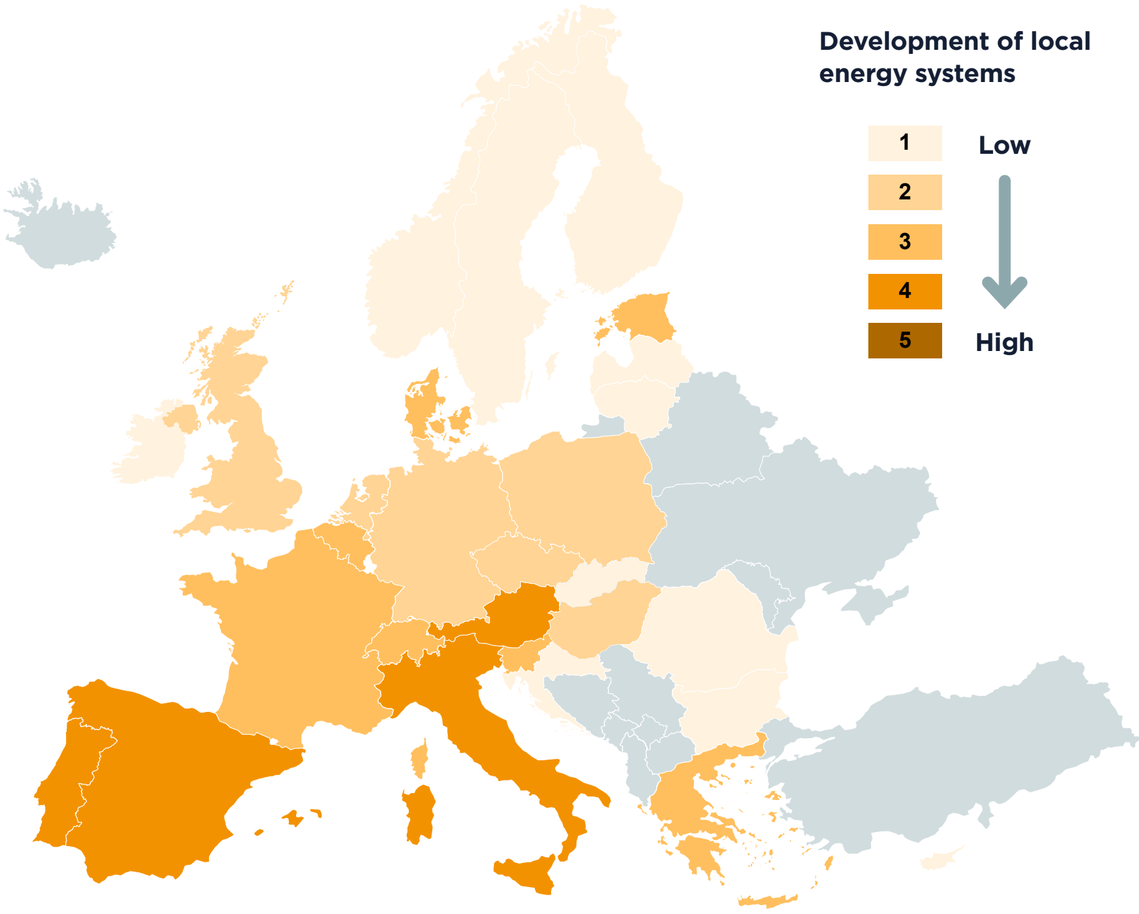
Clearer regulations and subsidy schemes make **Portugal, Spain, Italy and Austria the leading countries for energy communities**. In these countries, replicable business models are being deployed outside of regulatory sandboxes.

Rising electricity prices due to the energy crisis is a strong driver for countries to incentivise energy communities. France is a clear example of this with more interest in energy communities.

In Germany, there is a strong customer appetite. Nevertheless, the regulations are lagging behind, hindering the development of energy communities.

Snapshot: Spain

In Spain, collective self consumption (CSC) is allowed using the public network without the formation of a legal entity. This lowers start-up costs and enables participation from a range of users. As a result, there are a range of examples of CSC schemes including energy co-operatives, local communities, municipalities and energy utilities.



Transmission System Operator flexibility data

Which TSOs are most transparent on DSF participation?

We looked at:

- What data is available on procurement and activation of DSF across different ancillary services.
- The total volume of DSF procured in ancillary services.
- Is DSF allowed to trade in the wholesale market (not takers of variable tariffs).

Those countries with high scores have TSOs which responded to smartEn queries with detailed information on procurement and activation of DSF.

This map evaluates data available for pre-qualification, procurement and activation of DSF.

Interpreting the results

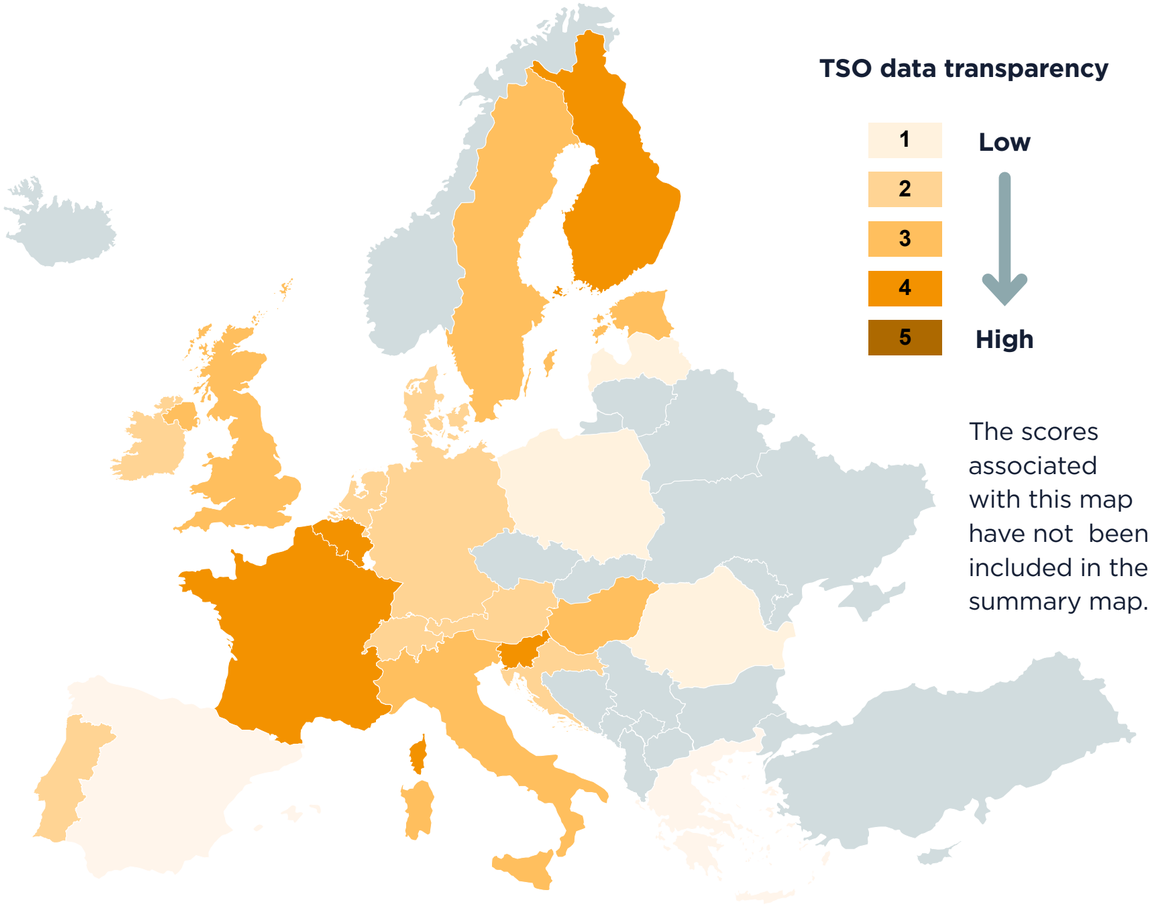
Those countries with high scores have TSOs which responded to smartEn queries with detailed information on procurement and activation of DSF. These markets also have high levels of DSF participation (relatively to the rest of Europe).

Overall, across Europe transparency on DSF participation is minimal with very few examples of this information publicly accessible.

Those countries included in this market monitor where TSOs did not respond when contacted have been coloured grey.

Snapshot: Belgium

Elia is a good example of a transparent TSO with accessible information online and downloadable ancillary services data. They also provide data on the level of DSF participation.



The scores associated with this map have not been included in the summary map.

Future development of demand side flexibility

Where are the emerging markets for flexibility?

We looked at:

- Participation on FCR co-operation, PICASSO, MARI and TERRE.
- Installed base of flexible residential assets.
- Targets for growth of renewable generation.

The creation, and opening of markets to DSF in addition to ambitious renewable generation targets influences the future market for DSF.

There is still room for improvement in all countries but several, newly opened markets are showing progress.

Interpreting the results

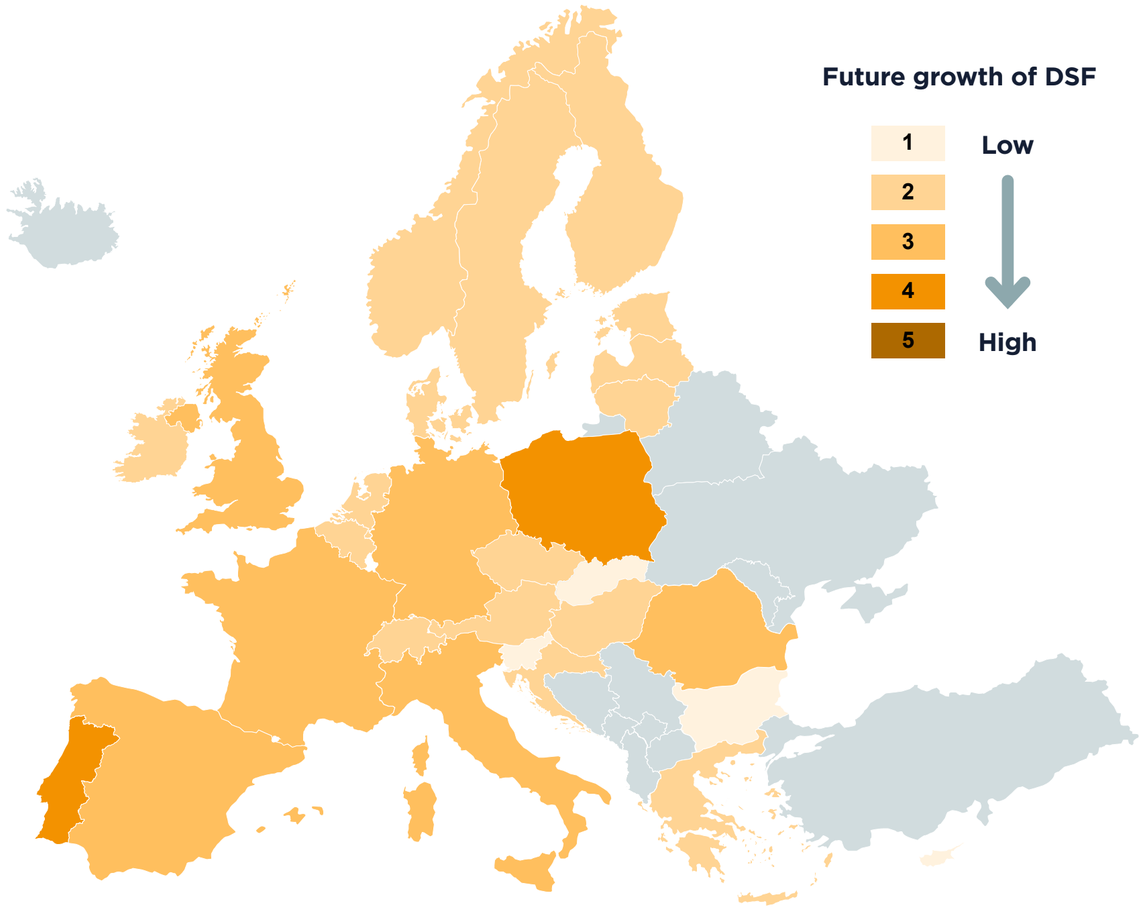
Due to the positive development that several countries opened their markets to DSF in 2022, overall scores for future development are lower than 2022.

We still expect to see growing needs for flexibility in Western Europe due to increased renewable generation targets and the introduction of faster acting frequency services (albeit to a small range of assets).

We expect to see most development in Poland and Portugal as their markets transition from almost fully closed to DSF to open within the next 2-5 years.

Snapshot: Italy

Where DSF can access ancillary services via the UVAM pilot project the fixed regulatory strike price does not reflect the increase in energy prices and future participation may be impacted without reforms.

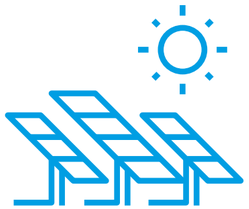


Glossary

Country	Acronym	Name	Description
EU	aFRR	Automatic Frequency Restoration Reserve	The reserves primary purposes are to continually: (1) balance the supply and demand, and (2) maintain system frequency. This reserve is activated automatically. The use of aFRR enables activated FCRs to deactivate and be ready to use in case of new disturbances.
EU	AS	Ancillary Services	Services procured by the transmission system operator to support the transmission of electric power from generators to consumers. They are used to maintain the proper flow and direction of electricity, address imbalances between supply and demand, and help the system recover after a power system event.
EU		Availability	Price and volume of balancing capacity reserved in EUR/MW/hr and MW
GB	BM	Balancing Mechanism	One of the tools used by National Grid ESO, the Transmission System Operator in Great Britain, to balance electricity supply and demand close to real time.
GB	BMU	Balancing Mechanism Unit	Units of trade within the Balancing Mechanism. Each BM Unit accounts for a collection of plant and/or apparatus, and is considered the smallest grouping that can be independently controlled.
EU	BRP	Balancing Responsible Party	Entities responsible for maintaining supply and demand on the energy markets. Each BRP must strive to be balanced in real time, and that BRP is financially responsible for the imbalances to be settled with the connecting TSO.
EU	BSP	Balancing Service Provider	A market participant providing balancing services to its Connecting TSO.
EU	BTM	Behind the meter	An asset located behind a demand meter on a customer site.
EU	C&I	Commercial and Industrial	Non-domestic customers
EU	CEP	Clean Energy Package	A set of eight EU directives and regulations aims to provide an update to the European energy policy framework, aiming at facilitating the energy transition and providing a modern European energy market.
EU	CHP	Combined heat and power	A technology that generates electricity and captures the heat that would otherwise be wasted to provide useful thermal energy. CHP can be located at an individual facility or building, or be a district energy or utility resource.

Glossary

Country	Acronym	Name	Description
EU	DA	Day ahead	The day before delivery. Generally used in the context of electricity spot markets.
EU		De-rating	Rating factors applied to assets to represent the confidence of system operators in the reliability of the contribution they make to the system.
EU	DSO	Distribution System Operator	The operating managers (and sometimes owners) of energy distribution networks, operating at low, medium and, in some EU member states, high voltage levels (LV, MV and HV).
GB	DHL	Dynamic High Low	This is a dynamic service that delivers equal volumes of Primary, Secondary and High frequency response.
IE	DS3		Collective name for Ireland's ancillary and reserve services markets.
EU	EBGL	Electricity Balancing Guidelines	The EBGL was created as a result of an EU Regulation that aims to enable countries to share balancing resources.
EU	FCR	Frequency Containment Reserve	Active power reserves which are automatically controlled to maintain system frequency as supply and demand constantly changes.
EU	FCR-D	FCR - Disturbance	Frequency Containment Reserve for Disturbances contains the frequency during disturbances, and aims to limit the deviation when the frequency goes outside the standard range.
EU	FCR-N	FCR - Normal	Frequency Containment Reserve for Normal Operation contains the frequency during normal operation, and aims to keep the frequency within the standard frequency range.
EU	FFR	Fast Frequency Reserve	Fast Frequency Reserves are being introduced as grid inertia declines. It is currently the fastest acting ancillary service and higher volumes are required for period of low inertia. In the GB market this is referred to as Dynamic Containment (DC).
EU	FOM	Front of meter	An asset connected directly to the electricity network, instead of behind a customer meter.
GB	GSP	Grid Supply Point	Connection point between the transmission network and the distribution network
EU	ID	Intraday	The day of delivery. Generally used in the context of electricity spot markets.



Glossary

Country	Acronym	Name	Description
EU	mFRR	Manual Frequency Restoration Reserve	This reserve is activated when a serious grid imbalance or congestion issues arise. The primary purposes of mFRR are to resolve: (1) major or systematic supply and demand imbalance, (2) a significant frequency variation, and (3) major congestion issues. This reserve is activated manually.
EU		Net-metering	Net-metering refers to charging electricity consumers based on the net volume of imports and exports. The exports are remunerated at the full retail import tariff, and unreflective of the prevailing wholesale price.
EU	RR	Replacement Reserve	Replacement reserves enable activated FRRs to deactivate and be ready to use in case of new disturbances. This is an ancillary service in approximately half of the EU countries.
EU	RA	Resource Adequacy	Inclusive term referring to the products countries use to ensure peak demand can be met. For example, capacity market/ mechanism, strategic reserve or capacity renumeration scheme.
GB	STOR	Short-term operating reserve	STOR is a reserve product in Great Britain that maps to the EBGL definitions of mFRR and RR.
EU	SME	Small, medium enterprise	Non-subsidiary, independent firms which employ fewer than a given number of employees. This number varies across countries. The most frequent upper limit designating an SME is 250 employees, as in the European Union.
GB	TCR	Targeted Charging Review	A significant code review being conducted by the regulator in Great Britain, Ofgem, which will bring in changes to the charging methodology of transmission network use of system charges.
EU	TERRE	Trans European Replacement Exchange	The European implementation project to create a common marketplace across Europe for exchanging replacement reserves
GB	TNUoS	Transmission Network Use of System Charges	Network charge in Great Britain used to cover the cost of transmission system operation, paid by all customers and generators
EU	ToU	Time-of-use	A type of electricity tariff that varies at different times of day
EU	TSO	Transmission System Operator	The operating manager of the transmission system and party responsible for system balance.
EU		Utilisation	Price and volume of balancing energy activated in EUR/MWh and MWh
IT	UVAM	Virtually Aggregated Mixed Units	Italian ancillary service product dedicated to distributed resources

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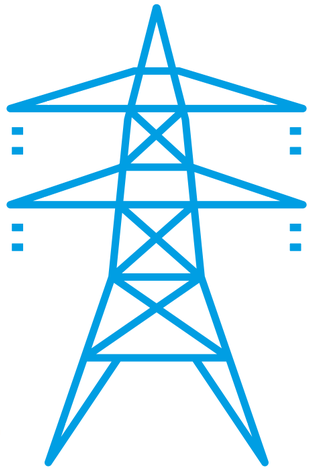

Thank you for reading

For further information please contact our team.

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