

A SECURE AND

RESILIENT

EU ENERGY SYSTEM?

LOCAL STAKEHOLDERS

CAN HELP!

THROUGH FOSSIL-FREE
FLEXIBILITY AND
DECENTRALISED PRODUCTION



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EXECUTIVE SUMMARY

HOMEGROWN WIND AND SOLAR POWER ARE BECOMING A PILLAR OF EUROPE'S ENERGY SYSTEM, AND A MASSIVE ELECTRIFICATION OF END USES IS EXPECTED IN THE COMING YEARS. THIS PAPER PROVIDES INSIGHTS THE ROLE OF LOCAL STAKEHOLDERS – CITIZENS, LOCAL AUTHORITIES, SMES, ETC. – IN PROVIDING FOSSIL-FREE FLEXIBILITY TO CONTRIBUTE TO ENERGY SECURITY AND AFFORDABILITY IN THIS FAST-MOVING CONTEXT, AND HOW IT BRINGS LOCAL STAKEHOLDERS TO THE CENTRE STAGE OF THE EU'S ENERGY SYSTEM. THE PAPER CONCLUDES WITH POLICY RECOMMENDATIONS.

KEY MESSAGES

- 1. A decarbonised energy system based mainly on renewable energy and end-use electrification will:**
 - » Make the EU less vulnerable to geopolitical risks and to energy price volatility.
 - » Increase the share of variable renewable energy sources in Europe's energy mix.
- 2. Fossil-free flexibility¹ is a central piece of the puzzle in building a secure, affordable and decarbonised EU energy system. However:**
 - » Financial and political support for fossil based flexibility remains too strong, keeping prices high, while legal barriers and lack of funding slow the deployment of fossil-free flexibility.
 - » Energy storage is a mature technology, ready for rapid deployment, yet the potential of demand-side flexibility remains largely untapped, despite being cost-effective and free from grid-constraint.
- 3. Through their key role in fossil-free flexibility and decentralised production, local stakeholders (municipalities, citizens, SMEs, etc.) are crucial for an affordable, secure and sustainable energy system.**
- 4. Microgrids can provide consumers with resilience in the event of grid issues. They can also provide grid operators with a solution for demand-side flexibility and free up grid capacity.**
- 5. There are still many actions that the EU and Member states can take to enable fossil-free flexibility and allow local stakeholders to play their part.**

¹ Storage, demand-side flexibility and low carbon flexible power generation



ENERGY SECURITY IS EVOLVING

The way to ensure the security of the European energy system is significantly changing as the energy transition progresses and fossil fuel generators are phased out. Other less desirable developments are also impacting energy security, such as the effects

of climate change, cyberattacks and an unstable geopolitical context, which threatens the integrity of European territory and its energy infrastructures.

RENEWABLES AND ELECTRIFICATION ARE RESHAPING THE ENERGY SYSTEM

Before the arrival renewable of wind and solar power, energy security in Europe mainly meant ensuring access to fossil fuels – most of which were imported from outside the EU – as well as maintaining the infrastructure needed to transport them and operate large power plants. Energy security thus relied almost exclusively on energy imports and on a centralised, controllable system of production, owned by a small number of actors and able to easily adjust to demand.

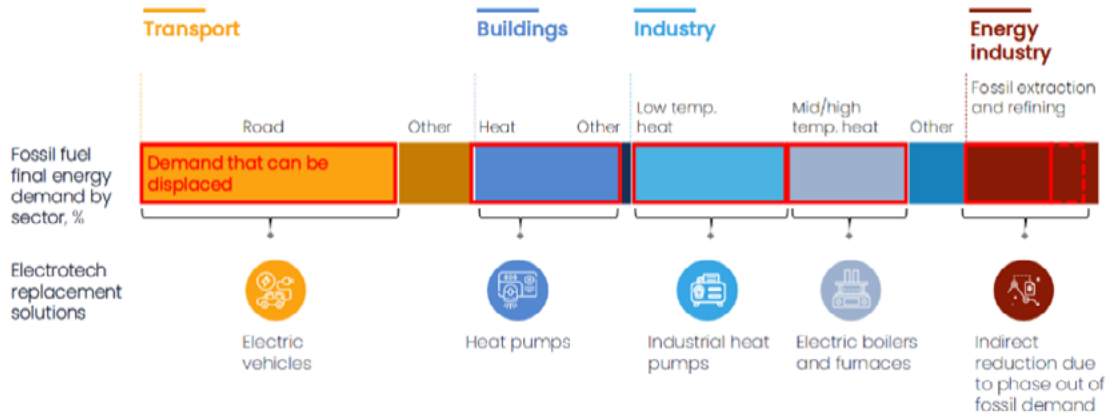
EU energy supply mix in 2023. This share must reach at least 42.5% by 2030 to put Europe on track for climate neutrality by 2050. In the power sector, renewables are on course to generate 66% of EU electricity by 2030², up from 44% in 2023.

Massive end-use electrification is another key transformation expected in the EU energy system, although it has not yet materialised. In 2025, electricity demand remained 4% below 2019 levels. Nevertheless, electricity has the potential to replace most fossil fuel demand (see the figure below).

The EU energy system is undergoing a profound transformation. Although fossil fuels still dominate, especially in the heating and transport sectors, **renewable energy sources accounted for 19% of the**

Electricity can now displace most fossil fuel demand

A new generation of electrotech can replace the vast majority of final demand for fossil fuels



Source: <https://ember-energy.org/app/uploads/2025/04/Slidepack-Energy-Security-in-an-Insecure-World.pdf>

² <https://ember-energy.org/latest-updates/eu-member-states-target-66-renewable-electricity-by-2030-slightly-short-of-the-repowerEU-69-goal>



This matters for energy security. In 2024, 81% of the electricity consumed in the EU was homegrown (nearly 100% by 2040)³. Increasing the share of electricity to 50% of the EU's final energy consumption by 2040, compared to 23% today, would eliminate nearly two-thirds of fossil fuel imports⁴. Geothermal

energy represents another major, homegrown renewable resource that remains largely underexploited for heating and power generation, despite its strong potential to displace fossil fuels.

STRATEGIC GAINS BRING NEW SYSTEM CHALLENGES

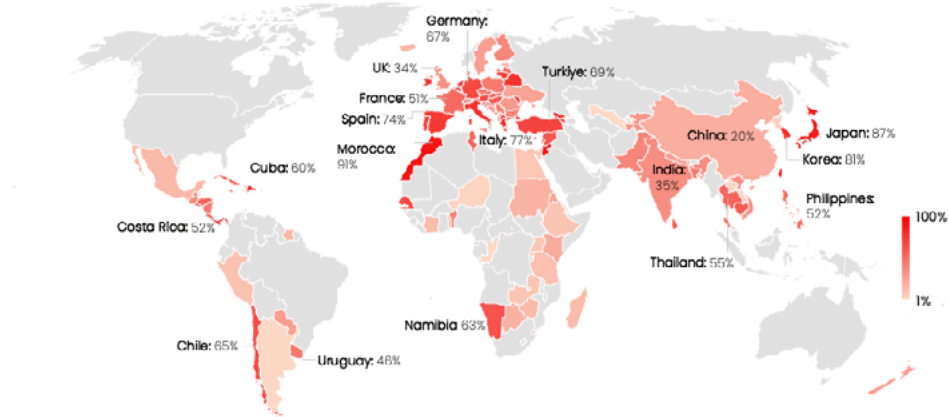
Renewable energy sources have the advantage of being available locally. As their deployment continues to grow, concerns over the availability of energy resources and dependence on foreign countries diminish. Today, Europe remains one of the most energy-import-dependent regions in the world (see the figure below). Thus electrifying end uses and producing

domestic renewable energy would significantly strengthen Europe's energy security by making its energy system more autonomous and less exposed to geopolitical risks such as wars or trade disruptions—an advantage that is crucial in today's context of instability.

Fossil import dependency is widespread

52 countries import more than half their primary energy as fossil fuels

Fossil net imports as a share of primary energy demand 2022, %



Source : <https://ember-energy.org/app/uploads/2025/04/Slidepack-Energy-Security-in-an-Insecure-World.pdf>

³ <https://ember-energy.org/app/uploads/2025/10/Report-electrification-and-security.pdf>

⁴ <https://strategicperspectives.eu/wp-content/uploads/2025/12/Boosting-Electrification-in-Europe.pdf>



The war in Ukraine has highlighted another key asset of renewable energy systems: their decentralised nature. Built around many small, distributed generation units, they offer greater resilience and a strategic advantage, as they are far harder to disrupt than energy systems reliant on large, centralised power plants and major storage or transport infrastructures. For instance, In Kharkiv, one of Ukraine's largest cities nearly 90% of thermal capacity has been neutralised. Modular cogeneration units, local renewables, and autonomous systems have therefore become essential for keeping water pumps and heating systems in high-rise buildings functioning. The shift to a distributed model has enhanced the city's security as smaller, renewable assets, are not only more flexible; they are also harder targets than large plants.

On the flip side, producing power with variable renewables such as wind and solar is not fully controllable as it is highly weather-dependent, and end-use electrification may just further amplify this variability.

As a result, adequacy—defined as the ability of the electricity system to meet current and projected demand—becomes more complex both to achieve and to assess⁵.

In addition, the International Energy Agency (IEA) identifies the increasing frequency of extreme weather events driven by climate change as a key source of adequacy risks in many regions, including

Europe. The European Environment Agency (EEA) raises similar concerns, noting that both the likelihood and the impact of extreme weather events will vary across European regions⁶. For example, several power generation, transmission, and distribution assets in Southern Europe are particularly vulnerable to rising heatwaves and declining water availability⁷.

Infrastructure security is also becoming a growing concern in an increasingly unstable geopolitical context. Different assets are at risk of extreme weather events, cyberattacks or sabotage : gas (e.g. Nord Stream) or electricity grid infrastructure⁸, nuclear power plants (e.g. Zaporijjia in Ukraine), some offshore wind farms (e.g. in the North and Baltic Seas⁹, etc.

In summary, while the growing use of renewable energy reduces some vulnerabilities of the European energy system, it also creates new ones.

In this context, flexibility must become the cornerstone of the European energy system, as it is essential to mitigating some of these emerging risks and ensuring a secure, affordable, and sustainable energy supply. Before exploring why, it is necessary to define this broad concept more precisely.

5 https://www.acer.europa.eu/sites/default/files/documents/Individual%20Decisions_annex/ACER%20Decision%2002-2022%20-%20Annex%20I%20-%20Detailed%20ERAA%202021%20review_0.pdf

6 <https://www.eea.europa.eu/en/analysis/publications/adaptation-in-energy-system>

7 [https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU\(2025\)769347_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU(2025)769347_EN.pdf)

8 <https://eudsoentity.eu/news-knowledge/dso-entity-publishes-new-report-on-the-key-role-of-electricity-distribution-grids-in-strengthening-the-resilience-of-europes-energy-system>

9 [https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU\(2025\)769347_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU(2025)769347_EN.pdf)



FLEXIBILITY NEEDS ARE GROWING

WHAT FLEXIBILITY MEANS?

Flexibility is a broad and multidimensional concept.

First, flexibility is *the ability of an electricity system to adjust to the variability of generation and consumption patterns and to grid availability*¹⁰.

While adequacy policies (e.g. Capacity Remuneration Mechanisms) are mainly focus on covering demand peaks, flexibility deals with both supply and demand fluctuations. This makes flexibility increasingly important within a European power system that experiences increasingly frequent episodes of excess electricity, which can cause grid congestion, negative prices, and curtailment to keep the grid balanced.

Second, flexibility solutions are activated by an **external signal**, such as dynamic tariffs, or grid operator notification. Some resources may have flexibility for their own sake but not responding to external actors/needs¹¹. As a result, activities such as self-consumption cannot be considered as flexibility resource.

Finally, flexibility encompasses **temporary actions** that are implemented under limited timeframes (see below). This excludes, for instance, energy efficiency as a flexibility resource.

FLEXIBILITY TAKES PLACE UNDER DIFFERENT MARKET TIMEFRAMES

- » **Seconds or minutes (sub-hourly needs):** to ensure real-time balance between supply and demand, in order to contain or restore the grid frequency in case of forecast deviations
- » **Daily:** to integrate mostly solar PV production and demand variability during the day
- » **Weekly:** to integrate mostly wind production and demand variability during the week
- » **Seasonal:** to integrate solar PV, wind and hydro-power production and demand variability across the seasons¹²

Inter-annual variability (colder winter, hotter summer...) affects particularly adequacy needs, although it also must be considered to estimate flexibility needs in shorter timeframes (seasonal and weekly)¹³.

¹⁰ <https://eur-lex.europa.eu/eli/reg/2024/1747/oj>

¹¹ <https://www.sciencedirect.com/science/article/pii/S037877962100002X>

¹² [https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU\(2025\)769347_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU(2025)769347_EN.pdf)

¹³ [https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU\(2025\)769347_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU(2025)769347_EN.pdf)



THE CORE FLEXIBILITY ACTIVITIES

Flexibility solutions fall into three categories:

FLEXIBLE POWER GENERATION

» Flexible fossil generation

The main technologies used are open and combined cycle gas turbines, which currently deliver most of the flexibility¹⁴. To a much lesser extent, there are also combustion engines fuelled by other fossil energy sources, such as oil generators.

» Renewable flexible generation

This includes dispatchable renewable electricity generation: hydropower, power generation using biomass, biogas or green hydrogen. Wind and solar can also provide flexibility by curtailing production. This may be total, stopping all generation for a short period, or partial, where a set percentage of output is permanently or temporarily limited, depending on the grid operator's needs¹⁵. By combining dispatchable and curtailable renewable generation, these practices allow renewables to provide many of the same flexibility services as thermal gas plants¹⁶. However, curtailment can undermine a generation asset's business model unless it is financially compensated (e.g., through a premium), paid for in flexibility markets (for grid congestion, frequency or voltage regulation, etc.), or is limited enough that its impact on the business model is negligible. From the grid operator perspective, it might be a more cost-effective solution compared to grid expansion, which are usually expensive (page 14)¹⁷.

DEMAND-SIDE FLEXIBILITY

It's the ability to adjust electricity consumption in terms of both time and magnitude in response to demand or supply peaks¹⁸.

» Sub components of demand side flexibility

- » **Load shifting:** Moving consumption from high price/peak periods to low price/off peak periods.

- » **Load curtailment:** Temporarily turning off or reducing non critical consumption to relieve the grid.

If the demand-side-flexibility activity is contract based or incentivised by a price signal, it will be covered under the heading of **demand response**¹⁹.

» Main enabling demand-side flexibility technologies

The main assets that can provide demand-side flexibility are heat pumps, electric boilers, storage systems²⁰ and industrial processes.

They can operate efficiently thanks to several technologies:

- » **Smart meter:** meter that provides (almost) granular consumption and production data that enables monitoring, control, and optimisation of energy use in response to grid conditions and price signals.
- » **Smart appliance control:** technology that autonomously adjusts devices' (HVAC, washers, dryers) operation based on signals. It's a device level tool.
- » **Energy management system:** technology that integrates data from smart appliances, batteries, PV, HVAC, etc., and runs optimisation/forecasting algorithms to coordinate all these devices simultaneously.

» Most demand-side flexibility is aggregated because of scale

While all types of consumers (industrial, commercial and residential) can technically provide demand-side-flexibility individually to the electrical system. However, except for some large industrial consumers, they usually do so through an aggregator to have an impact on the grid, since they are too small on their own.

14 [https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU\(2025\)769347_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU(2025)769347_EN.pdf)

15 [https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU\(2025\)769347_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU(2025)769347_EN.pdf)

16 <https://www.brattle.com/wp-content/uploads/2026/02/Clean-Flexibility-Opportunities-in-Europe.pdf>

17 [https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU\(2025\)769347_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU(2025)769347_EN.pdf)

18 [https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU\(2025\)769347_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU(2025)769347_EN.pdf)

19 <https://www.iea.org/energy-system/energy-efficiency-and-demand/demand-response>

20 https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/10/electricity-grids-and-secure-energy-Buidlinds_a_transitions_9559dcb0/455dd4fb-en.pdf



GOPACS (THE NETHERLANDS)

TenneT, the Dutch TSO, and six regional DSOs created in 2019 the GOPACS platform to jointly purchase flexibility for congestion management. When a grid segment may congest, the grid operator posts a call on GOPACS, flexibility providers send flexibility bids, and the platform communicates to them accepted bids with activation details. The Electricity Network Code allows aggregator for <1 MW assets

to participate, and long term capacity products to be traded. **As a result, local stakeholders play key roles in reducing grid congestion by using flexibility assets (heat pumps, batteries, etc.) to provide flexibility through aggregators.** About 20 market parties now trade on GOPACS, with 114–181 GWh traded annually.

LOCAL CONSTRAINT MARKET (LCM) (SCOTLAND)

NESO, the British TSO, launched in 2023 a day ahead and intraday marketplace to relieve congestion on Scotland's transmission boundaries. **By harnessing local flexibility, it provides a cost effective alternative to the national Balancing Mechanism, enabling small consumers and producers to reduce grid congestion, through distributed resources such as EV chargers, residential demand response,**

and small scale generation. Its purpose is mainly to manage episodes of surplus renewable power in specific areas. In 2024 NESO ran a pilot initiative within LCM system, where households in Scotland adjusted the timing of their electricity use to absorb excess wind power generation. Over a 10-day period, 3 megawatts of demand response were contracted.

ROMAFLEX (ITALY)

This community-based flexibility project - developed by Enostra - brings together local producers and consumers within the same territory. It operates by coordinating electricity use from households, small businesses, and public buildings equipped with renewable generation, batteries, and flexible loads. Through an energy management sys-

tem, consumption and production are monitored in real time to shift demand when renewable energy is available. This flexibility is traded to the local DSO (Areti) to cover day ahead and daily flexibility needs. **The project is implemented at neighbourhood scale, creating a local energy perimeter that reduces stress on the grid.**



GRID INTERACTIVE BUILDINGS (UTRECHT)

To enable grid connection for a new district (4,000 new homes), the Merwede housing development project entered into a group electricity contract with the local DSO (Stedin). The contract foresees a series of innovative measures, based on the grid-interactive housing method. It provides an optimised

blend of energy efficiency, energy storage, renewable energy, and demand-side flexibility technologies enabled through smart appliance and energy management systems. This results in a lower, “flatter,” more flexible energy consumption profile, requiring less grid capacity and making grid connection easier²¹.

STORAGE AS A CROSS CUTTING FLEXIBILITY ASSET

Storage can act as both a producer, injecting power, and a consumer, absorbing power. This makes it a bridge between production-side and demand-side flexibility. Storage solutions can also cover all time-frames. The main storage technologies are:

» **Batteries:** these are increasingly being installed at both utility scale – connected to the grid – and behind the meter – off-grid – in industrial, com-

mercial and residential buildings, as well as co-located with renewable energy installations.

» **Mobile batteries (EVs):** while a standard EVs’ smart charging can only deliver flexibility by charging during production peaks, Vehicle-to-grid (V2G) technology is able to operate to both take off and feed electricity into the grid.

UTRECHT ENERGIZED: CAR SHARING V2G (THE NETHERLANDS)

Utrecht has launched the first V2G car sharing service in Europe, turning its fleet of electric vehicles into a flexibility resource. **In partnership with local authorities, energy suppliers, and the car sharing operator, the initiative allows drivers to charge their vehicles when solar energy is abundant and discharge stored electricity back into the grid**

during peak demand. This is particularly effective in Utrecht, where 35% of rooftops are fitted with solar panels. The pilot, which began in early 2024, integrates a fleet of 50 V2G cars equipped with a smart appliance that coordinates charging and discharging schedules in real time.

²¹ <https://rmi.org/our-work/buildings/pathways-to-zero/grid-interactive-energy-efficient-buildings>



» **Thermal energy storage:** a storage system that transform electricity into heating or cooling. This can be achieved, for example, by combining solar PV with a heat pump in a building, or by heating a

large water tank to supply a district heating network. Industrial processes and facilities offers great potential for thermal storage, primarily through water tanks²².

OPTIMISING GRID LOAD WITH SMART WATER HEATERS (URUGUAY)

UTE, the Uruguayan TSO, exploits the flexibility potential of Uruguayan households equipped with electric boilers by providing smart plugs that allow residents to programme water heaters through a mobile application. Households can monitor their consumption and remotely switch on their boiler when electricity prices are low. UTE can also use the data collected through the smart plugs to remotely switch off boilers for very short periods when local grid overloads are identified, without

compromising the warm water availability for households. UTE also monitors heaters' energy consumption to identify potential malfunctions and inform users. In 2024, the number of brief power interruptions to water boilers imposed by UTE within the programme was estimated at 1,600. 87% of residential boilers in Uruguay are electric, accounting for more than one third of total household energy consumption in the country. Therefore, the impact of such practices can be substantial.

AALBORG'S DISTRICT HEATING (DENMARK)

Denmark offers many examples of district heating that uses renewable electricity to produce heat at off-peak times, when prices compete with biomass or gas prices, or when other options are unavailable or take too long to start up. For example, four large

electric water boilers supply heat to *Aalborg's district heating*. They smooth electricity production peaks by converting power when it's abundant and cheap into heat.

» **Other storage solutions:** pumped-hydro storage, hydrogen electrolysers, compressed air energy storage (CAES) or renewable or low-carbon synthetic fuels.

²² https://solarheateurope.eu/wp-content/uploads/2025/04/Renewable-industrial-heat-navigator-brief_Solar-thermal-solutions.pdf



TWO PATTERNS TO DELIVER FLEXIBILITY ACTIVITIES

If the flexibility activity is constrained or not financially compensated by the grid operator, as it typically happens with curtailment or flexible connection, flexibility takes place according to two patterns:

» **Implicit flexibility:** a reaction to a price signal reflecting variability in demand, supply and grid availability, through automation or personal choices. *Typical signal:* dynamic tariffs, negative electricity prices or grid tariffs that vary according to different timeframes.

» **Explicit flexibility:** A contract-based service provided by a single actor (i.e. an industry) or smaller actors gathered through an aggregator and traded on the different energy markets (i.e. wholesale, balancing, system support and reserves markets). *Typical contract:* Capacity markets, balancing reserve contracts or ancillary service bids.

OTHER SOLUTIONS TO COMBINE WITH FLEXIBILITY

Other solutions, rather than being proper flexibility measures, reduce flexibility needs. This makes them also useful for enhancing grid resilience and securing the energy system. These solutions are not considered proper flexibility activities because they are either permanent or not initiated by an external signal.

ENERGY EFFICIENCY

In general, reducing our energy needs will reduce the need to produce variable renewable power and therefore reduce our flexibility needs. In addition, energy efficiency and flexibility work best together. An efficient building has more thermal inertia. It can maintain a desired inside temperature for longer without requiring further heat input, providing both healthy living conditions and stability for the grid. Furthermore, its occupants can choose to use electricity for heating from the grid when prices are low (often aligning with high renewable generation periods) and avoid it when prices are high, without sacrificing comfort²³. This reduces electricity bills, peaks demand on the grid and decreases the need for flexibility.

SELF-CONSUMPTION

This can be defined as using for its own consumption electricity generated by an on-site renewable energy system, such as rooftop solar panels, rather

than purchasing it from the public grid. As a result, it reduces the production peaks and the amount of power injected into the grid. Self-consumption can be maximised using a smart appliance or energy management system, which automatically synchronises on-site power generation with the operation of certain assets, such as heat pumps, electric vehicles and batteries. There are two types of self-consumption:

» **Individual:** One user produces and consumes electricity, behind the meter (off-grid). This mechanism is largely contributing to making rooftop PV profitable.

» **Collective:** Multiple consumers (e.g., occupants of a condominium) share through the public grid the power produced by a local source (e.g. solar panels on the roof of the condominium). Collective self-consumption schemes, also known as electricity sharing schemes, help to prevent grid congestion by maximising the consumption of electricity generated within the same cabin. Such initiatives are emerging across the EU, but their development is slowed down by inadequate legal frameworks, which create complexity and undermine business models.

²³ <https://www.raonline.org/wp-content/uploads/2023/12/rap-yule-bennett-sunderland-flex-ability-all-socially-inclusive-demand-side-flexibility-europe-2024-january.pdf>



GRID OPERATIONS AND EXPANSION

Flexibility is closely linked to the expansion and operation of electricity grids and cross-border connections. The greater the deployment of flexible solutions, the less expansion is needed. However, expansion remains essential for addressing structural grid congestion issues, particularly in the long term, when considering the deployment of further variable renewable generation assets and economic development and urbanisation.

Besides expansion, grid operation can be optimised by using grid-enhancing technologies i.e. hardware and software solutions (e.g. dynamic rate lines, power flow control, etc.) that maximise the capacity and efficiency of existing grid infrastructure and decrease flexibility needs.

FOSSIL-BASED GENERATION STILL DOMINATES FLEXIBILITY SYSTEMS

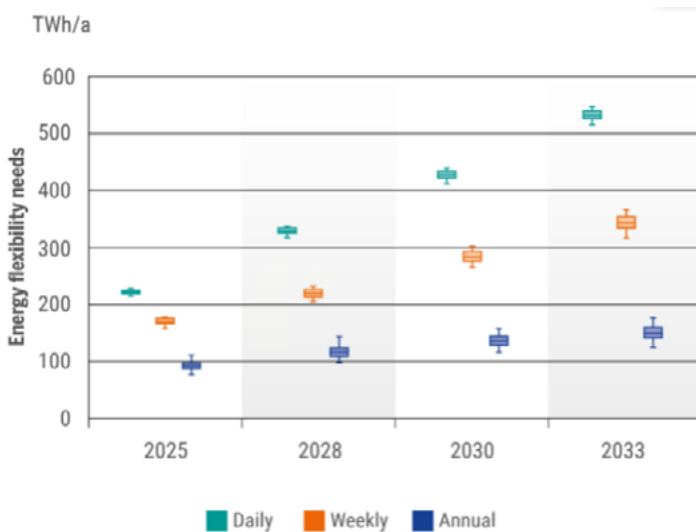
Flexible fossil generation, mainly through combined cycle gas turbines, is currently the main solution to cover our flexibility needs. About 50% of these needs

in the EU was in 2023 covered by fossil energy based dispatchable power generation²⁴.

FLEXIBILITY NEEDS ARE RAPIDLY RISING

The growth of variable renewable power generation and demand variability, as well as the phase-out of fossil fuel generation, are expected to increase flexibility needs until at least 2050. These needs are expected to double by 2033 compared to current levels (see figure below).

This figure also shows that the growing need for flexibility will vary according to timeframes. By 2030, the need for daily flexibility driven by solar PV generation, will be much greater than annual flexibility, while weekly needs, driven by wind, will be at about two-thirds of daily needs²⁵.



Source: <https://www.entsoe.eu/system-flexibility>

²⁴ [https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU\(2025\)769347_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU(2025)769347_EN.pdf)

²⁵ https://www.acer.europa.eu/sites/default/files/documents/Publications/EEA-ACER_Flexibility_solutions_support_decarbonised_secure_EU_electricity_system.pdf



CONTRIBUTION OF FLEXIBILITY ACTIVITIES TO FLEXIBILITY NEEDS OVER TIMEFRAMES

As shown in the table below, the impact of flexibility activities varies according to timeframes and leads us to an important conclusion: **demand-side flexi-**

bility, renewable flexible generation and storage will be key to meeting our flexibility needs.

Main Flex activities	Up to daily	Weekly	Seasonal
Demand-side flexibility	Major	Mid-relevant	
Batteries	Relevant		
Hydropower	Relevant	Relevant to major	Relevant to major
Renewable flexible generation	Relevant to major	Relevant to major	Relevant to major
Thermal storage	None to relevant	None to relevant	None to relevant
Gas generation	None to relevant	None to relevant	None to relevant

Source : author's own work, inspired by [https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU\(2025\)769347_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU(2025)769347_EN.pdf)



FOSSIL-FREE FLEXIBILITY IS THE SOLUTION

IT MAKES ENERGY MORE AFFORDABLE

Besides security and sustainability, affordability is the third pillar of the European energy system. [ACER's 2024 Security of electricity supply report](#) highlights that electricity prices are still higher for consumers than pre-crisis levels. The current situation in the Middle East is showing worrying signs of a new energy price crisis. In addition, negative or very low prices are hitting electricity producers more strongly and frequently²⁶. In 2025, seven EU countries recorded negative prices in 5% or more of all hours²⁷.

Fossil-free flexibility is crucial to reducing energy system costs and ensuring affordable energy for all European households, public bodies, businesses and industries. For instance, European consumers participating in demand-side flexibility could earn up to €86 million per year by 2030, or €600 per household²⁸.

In many EU countries, gas-heavy hours pushed up electricity prices in 2025, while sunny and windy hours pulled them down²⁹, while fossil-free flexibility reduce the cost of grid expansion and adaptation³⁰. In other words, the more fossil-free flexibility

will replace fossil-based flexibility – particularly during the peaks in consumption in the morning and evening – and makes grid interventions spread out or unnecessary, the more stable and low electricity prices will be.

In addition, periods when renewable electricity is abundant and electricity prices are low or even turn negative, we still largely waste this cheap electricity. In many EU countries, renewable power plants are asked to reduce their output without compensation, or they are given flexible grid connections that limit when they can feed electricity into the system. Whereas more demand-side flexibility and increased storage capacity could enable consumers to benefit from this cheap electricity much more than they currently do. For example, Germany could have saved €830 million in 2025³¹ by doing so. Without additional fossil-free flexibility, 50–131 TWh of renewable electricity (equivalent to the annual consumption of Portugal and Sweden), could be curtailed annually in the EU by 2030³².

IT STRENGTHENS ENERGY SECURITY AND SYSTEM RESILIENCE

As explained at page 06, end-uses electrification and more decentralized renewable will make Europe more autonomous and resilient, while making adequacy trickier and stressing out the grids. That's where fossil-free plays a role by increasing the EU energy system's ability to adjust to fluctuations in both energy generation and consumption, while relieving the grids at lower cost.

A wide range of organisations consider fossil-free flexibility to be a strong ally of adequacy and energy security. For instance, IEA considers demand-side flexibility as a key driver reinforcing energy security and enabling more efficient integration of clean energy into the energy system³³. The EU Agency for the Cooperation of Energy Regulators (ACER) and the European Environment Agency (EEA) also claim that

26 [https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU\(2025\)769347_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU(2025)769347_EN.pdf)

27 <https://ember-energy.org/latest-insights/european-electricity-review-2026>

28 <https://www.brattle.com/insights-events/publications/brattle-releases-new-report-on-clean-flexibility-benefits-in-europe>

29 <https://ember-energy.org/latest-insights/european-electricity-review-2026>

30 https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/10/electricity-grids-and-secure-energy-transitions_9559dcb0/455dd4fb-en.pdf

31 <https://ember-energy.org/latest-insights/european-electricity-review-2026>

32 <https://www.brattle.com/insights-events/publications/brattle-releases-new-report-on-clean-flexibility-benefits-in-europe>

33 <https://iea.blob.core.windows.net/assets/96446057-0154-4796-92f4-fbe6ae4f1585/TheValueofDemandFlexibility.pdf>



fossil-free flexibility technologies are available to meet flexibility needs and will mostly replace fossil-based flexibility resources by the end of the decade³⁴.

The speed of this transition hinges on political choices: on one hand, how quickly subsidies to fos-

sil-based flexibility and fossil fuel plants are phased out, and on the other, how quickly enabling laws and policies for storage and demand side flexibility are enacted. How evolve the cost of fossil-free flexibility technologies, as well as the rate at which end uses are electrified, will also have an impact.

THE POTENTIAL FOR FOSSIL-FREE FLEXIBILITY REMAINS SIGNIFICANT

LOW CARBON FLEXIBLE GENERATION, AN ALTERNATIVE TO FOSSIL FLEXIBLE GENERATION

As mentioned above, flexibility is currently largely sourced from fossil fuels, which are supposed to be phased out. Besides flexible renewable production assets (page 09), some of these fossil generation assets can be converted to run on hydrogen, biogas or biomass or even equipped with carbon capture technology. However, the impact assessment study for the 2040 climate target predicts a limited role for carbon capture, mainly due to its cost.

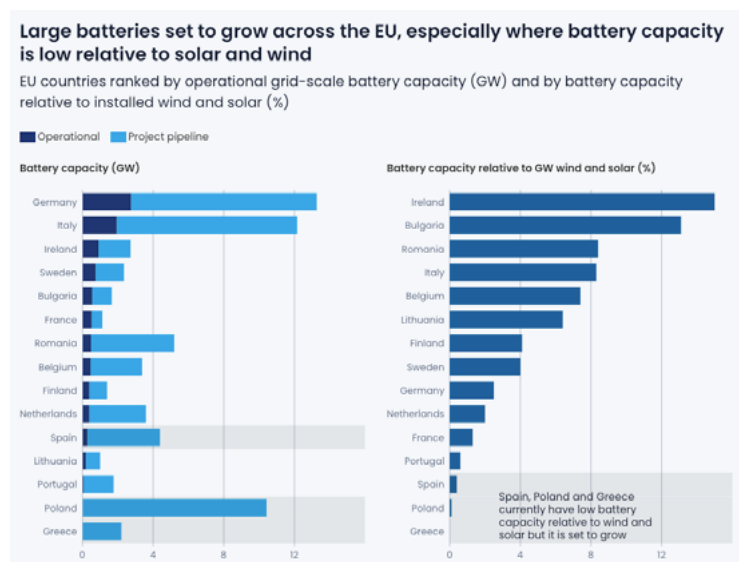
STORAGE AND DEMAND-SIDE FLEXIBILITY, AT THE CORE OF EU FLEXIBILITY CAPACITY

Demand-side flexibility and storage have a big growth potential. In addition, they will cover the timeframes of flexibility needs (up to weekly) that will be most requested in the coming years. Nevertheless, their development – especially that of demand-side flexibility – is still constraint by many barriers.

» Storage

Storage solutions, especially batteries, could be rapidly scaled up, notably thanks to mature economic conditions. An average 20% annual decline in battery costs over the last decade, combined with large and widening intraday price spreads, made investing in battery storage more financially attractive than ever in 2025.

As an example, in September 2025 in Italy, large-scale battery systems discharged an average of 1.1 GW during the early evening hours (7–8 pm). However, this accounted for only 3% of demand in those hours, compared to fossil power’s 52% share³⁵. There is significant room for improvement, as also illustrated by the figure below which shows the low battery capacity in many EU countries compared to wind and solar. Nevertheless, the increasing congestion of grids, unable to accommodate new batteries, is already slowing down the deployment of storage solutions.



Source: <https://ember-energy.org/latest-insights/european-electricity-review-2026/>

³⁴ https://www.acer.europa.eu/sites/default/files/documents/Publications/EEA-ACER_Flexibility_solutions_support_decarbonised_secure_EU_electricity_system.pdf

³⁵ <https://ember-energy.org/latest-insights/european-electricity-review-2026>

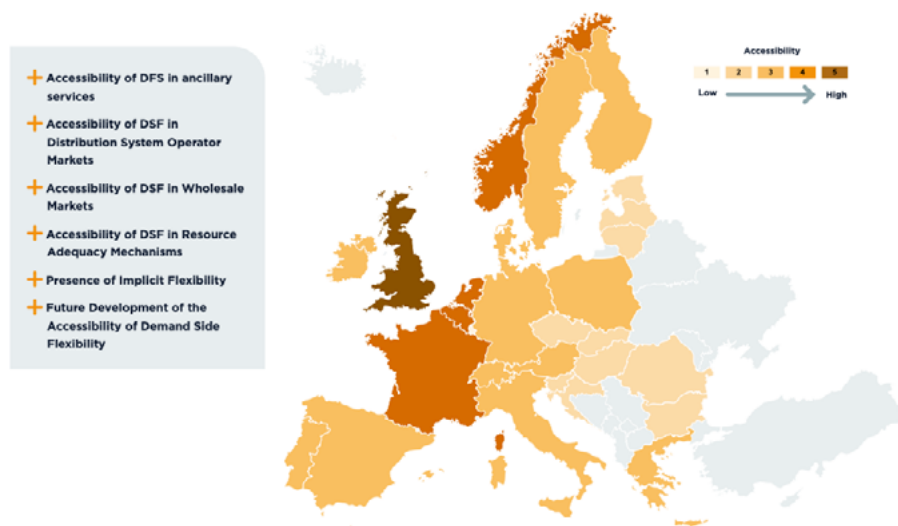


DEMAND-SIDE FLEXIBILITY

The outlook for demand-side flexibility is less promising as long as stronger implementation of EU rules is lacking, especially when it's aggregated. The figure below shows that many EU countries do not have a legal framework that enables the widespread im-

plementation of demand-side flexibility solutions. Many requirements of the Electricity Market Design Directive (2019), that are very useful for demand-side flexibility development, have not been fully transposed by Member States.

2024 Market Monitor for Demand Side Flexibility



Source : <https://smarten.eu/wp-content/uploads/2025/02/Market-Monitor-for-DSF-2024.pdf>

Currently, participation of demand-side flexibility in all power markets without discrimination is possible in only two EU countries³⁶. Furthermore, market-based procurement of flexibility services by DSOs is still a niche practice in most EU countries³⁷.

utilised their potential to adjust their energy use for demand response⁴¹.

Regarding demand-side flexibility technologies, the rollout of smart meters is still behind schedule in many EU countries. In 2024, fewer than 30% of households in 10 Member States had access to smart meters³⁸. Furthermore, to offer flexibility, flexible assets are needed. They are not being deployed as quickly as expected. For instance, around 12% of European households had a heat pump in 2024³⁹. Plug-in electric vehicles (BEV & PHEV) represented 3.25% of the European vehicle fleet in 2025⁴⁰.

If demand-side flexibility can be traded on power markets, you can use those flexible assets to earn money and make them more profitable. This can help to offset the high initial costs of such assets. Despite these challenges, the European association of the Flexible Demand Management Industry (Smarten) remains optimistic. They claim that, over the coming years, we are likely to see more service providers working within the current regulations to combine both implicit and explicit flexibility opportunities at both the commercial/industrial and residential levels⁴².

Another trigger for demand-side flexibility is industrial processes. Many industries have not yet fully

36 <https://ember-energy.org/latest-insights/how-to-scale-demand-flexibility-in-europe>
 37 <https://publications.jrc.ec.europa.eu/repository/handle/JRC130070>
 38 <https://www.ceer.eu/publication/acer-ceer-2024-market-monitoring-report-energy-retail-and-consumer-protection>
 39 <https://www.ehpa.eu/wp-content/uploads/2025/07/EHPA-Market-Report-2025-executive-summary.pdf>
 40 <https://alternative-fuels-observatory.ec.europa.eu/transport-mode/road/european-union-eu27/vehicles-and-fleet>
 41 [https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU\(2025\)769347_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2025/769347/ECTI_STU(2025)769347_EN.pdf)
 42 <https://smarten.eu/wp-content/uploads/2025/02/Market-Monitor-for-DSF-2024.pdf>



THE LOCAL LEVEL IS CRUCIAL FOR AN AFFORDABLE, SECURED AND SUSTAINABLE ENERGY SYSTEM

Such an energy system will mainly lean on decentralised renewable energy production combined with fossil-free flexibility. This makes local stakeholders

- municipalities, citizens, SMEs, etc. - essential to building such an energy system where they can play a more active role than ever before.

LOCAL STAKEHOLDERS CAN PRODUCE A LOT OF RENEWABLE ENERGY

Many renewable technologies, such as solar thermal or geothermal for heating, and photovoltaic, or even wind for electricity, can be deployed at a small scale, requiring reasonable amount of space and investments. This enables citizens, SMEs or local authorities to own and operate them, and many already do. They provide the necessary space and financial resources either individually by providing their own funding, or through third-party investment schemes or collectively, for example and through an energy community or a co-ownership scheme with private developers.

There is still huge potential for energy production by local stakeholders. Regarding photovoltaic panels, for instance, installations on buildings account for nearly 215 GW, or 61% of the total EU's solar capacity. However, these buildings could potentially accommodate 2.3 TW of PV, which would cover 40% of the EU's electricity demand in 2050⁴³. Plug-in PV technology also opens new possibilities in this regard.

Local stakeholders can also reduce the need for flexibility by self-consuming - both collectively and individually - the renewable power they produce themselves.

LOCAL STAKEHOLDERS ARE ESSENTIAL FOR FOSSIL-FREE FLEXIBILITY

A MAJOR PROVIDER OF DEMAND-SIDE FLEXIBILITY

Local stakeholders are potential users of the main assets that are considered demand-side flexibility resources, according to the IEA⁴⁴: heat pumps, electric boilers or storage systems as mentioned above.

A MAJOR PROVIDER OF SMALL AND MEDIUM SCALE STORAGE

Storage systems can be deployed at different scales: residential, commercial, industrial and large scales. The two first ones are mainly driven by local stakeholders and represent 65% of the EU's total storage capacity⁴⁵. These systems are usually stationary batteries installed behind the meter (i.e. disconnected from the grid) or batteries for electric vehicles.

⁴³ <https://www.nature.com/articles/s41560-025-01947-x#MOESM3>

⁴⁴ https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/10/electricity-grids-and-secure-energy-transitions_9559dcb0/455dd4fb-en.pdf

⁴⁵ <https://www.ceer.eu/wp-content/uploads/2024/04/CEER-Short-paper-on-the-ownership-of-Storage-Facilities-in-the-Electrical-Distribution-System.pdf>



NEIGHBOURHOOD OR COMMUNITY BATTERIES

This is an emerging concept in Europe that is more common in Australia. Such batteries are connected to the public grid and allow prosumers to store their excess solar PV energy to use it later in the day. They can thus capture more value from their solar production and lower their electricity bills, without investing in home batteries, which remain expensive and are not suitable for all houses.

The battery profitability can be maximised by collectively increasing the self-consumption of prosumers and providing flexibility services to DSOs. However, this is dependent on there being a local flexibility market that allows the community battery's operator to trade to the DSO the flexibility provided by the battery. Being connected to the grid also means that, in many EU countries, they pay grid

tariffs twice when charging and discharging. This is often a major constraint to building a strong business model.

Such a storage system could provide local stakeholders with a new way of bringing more flexibility to the energy system, lowering their energy bills, and preventing local grid congestion.

DSOs could also own and operate such systems to ensure grid balance themselves and avoid local grid congestion. However, such a scheme raises two main concerns. Firstly, Directive 2019/944 strictly restricts DSO ownership of batteries⁴⁶. Secondly, the business model is unclear, since such batteries could potentially be used very few times during the year, making the scheme less profitable for the DSO.

LOCAL STAKEHOLDERS ARE RELEVANT FOR THE MOST NEEDED FLEXIBILITY TIMEFRAMES

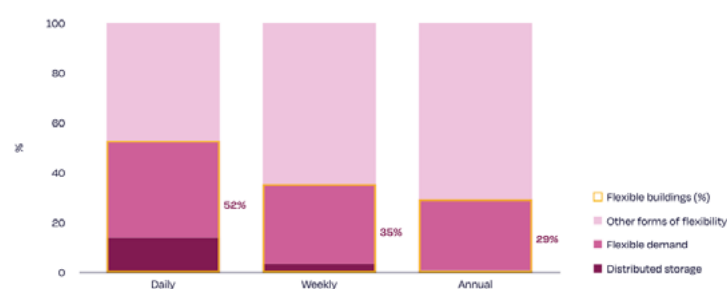
As explained above, flexibility needs will increase differently according to the timeframes. Daily flexibility and to a lesser extent weekly flexibility are expected to be in high demand. The table (see page 16)

has shown that demand-side flexibility, renewable flexible generation and storage are very suitable solutions to meet those needs.

BUILDINGS ARE A MAJOR FIELD FOR FOSSIL-FREE FLEXIBILITY

Buildings are the main field where local stakeholders can implement fossil-free flexibility solutions. According to Solar Power Europe, by leveraging synergies between rooftop solar, battery storage, heat pumps, electric vehicles and smart energy management systems, buildings could provide, by 2030, solutions to meet 52% of daily, 35% of weekly, and 29% of annual flexibility needs (see the figure on the right). In addition, as mentioned above make buildings more efficient help flexibility to take place.

Buildings' contribution to EU flexibility needs 2030



Source: <https://www.solarpowereurope.org/insights/thematic-reports/flexible-buildings-resilient-grids>

⁴⁶ <https://www.solarpowereurope.org/insights/outlooks/eu-battery-storage-market-review-2025-1#download>



LOCAL AUTHORITIES AND ENERGY COMMUNITIES CAN HELP TO ENGAGE LOCAL STAKEHOLDERS, INCLUDING VULNERABLE HOUSEHOLDS IN FOSSIL-FREE FLEXIBILITY CONSIDERED

Regarding explicit flexibility (i.e. a contract-based service to trade its flexibility to the grid operator (see page 13), energy communities or even local authorities can play a role.

The “informality” in energy communities is a resource: a lower degree of formalisation translates into lower administrative burden for community groups and businesses, making it easier and more desirable to engage with energy activities⁴⁷. The challenge then becomes striking the right balance between informality and the very real formal requirements that come with doing business in energy markets⁴⁸.

Regarding implicit flexibility (i.e. a reaction to a price signal), energy communities organise electricity sharing – usually based on cheap solar electricity - between its members. This gets people used to consuming as much as possible when cheap shared electricity is produced.

Local authorities are knowledgeable about the local situation, including specific adaptation needs and options raised by the growth of distributed energy solutions⁴⁹. As spatial planner authorities, municipalities could coordinate relevant stakeholders and organise space to ensure room for flexible assets and collaborate with DSOs to ensure the grid capacity to connect them to the grid.

Local authorities are close to citizens, and therefore have a good understanding of to encourage them to be more flexible. Local authorities are able to identify where vulnerable households are located and can help involve them in flexibility solutions. Energy communities can actively integrate vulnerable households into their activities, and many already do so with the support of local authorities.

VALENCIA (SPAIN)

Energy poverty mapping study conducted in 2016 with the Polytechnic University of Valencia, the city has taken a leading role in defending the Right to Energy. A key milestone is the Requiem in Power (RIP) initiative, where city-owned municipal cemeteries are transformed into public urban solar farm.

By installing photovoltaic panels on coffin niche rooftops, the city manages an innovative electricity

sharing model: while 75% of the power supplies municipal buildings, **the remaining 25% is shared for free with approximately 1,000 vulnerable households identified by the mapping**. To maximize this impact, **the city’s Energy Office provides specialized training to these families, helping them to adapt their consumption habits to align with solar production hours**.

⁴⁷ <https://www.sciencedirect.com/science/article/pii/S0301421520307643>

⁴⁸ <https://www.raponline.org/knowledge-center/energy-communities-with-grid-benefits-a-quest-for-a-blueprint>

⁴⁹ <https://www.eea.europa.eu/en/analysis/publications/adaptation-in-energy-system>



MICROGRIDS ARE A LOCAL SOURCE OF FLEXIBILITY AND RESILIENCE

DEFINITION

A microgrid is a group of interconnected loads and electric assets within clearly defined electrical boundaries, enabling them to act as a single controllable entity⁵⁰. Concretely, a microgrid can power a university campus, a hospital, or an industrial park using its own solar panels, batteries, and generators.

There are two different types of microgrid:

- » **Off-grid or isolated** with no connection to the grid. It generally combines renewable power production with battery storage to make one or several buildings, a business park, or a village fully autonomous from the grid and 100% renewable. These are not relevant in mainland Europe since electricity grids are strong and extensive.
- » **Integrated** into the grid, through a single connection point (one meter). As the examples below explain, an integrated microgrid brings together a group of buildings, industrial facilities or electrical assets, such as electric vehicle charging stations, that would usually have their own connection

point, behind one connection point. It also typically integrates combined renewable electricity production with battery storage, making this group of buildings or electric assets more self-sufficient. Despite being connected to the grid, integrated microgrids can temporarily disconnect from the grid in case of an actual or potential outage, if they have an island mode, which is not always the case.



Source: <https://www.sciencedirect.com/science/article/pii/S0142061524001352>

LEAF COMMUNITY (ITALY)

The Leaf Community microgrid distributes energy between the facilities of Loccioni company within a 2 km radius. It is integrated to the public grid but able to be disconnected if needed. It aims to ensure continuity of supply for its users during grid outages and increase energy self-sufficiency thanks to local renewable generation and storage. It combines 2 MW of PV systems, four micro hydropower plants, a pellet biomass cogeneration and a 1.8 MWh bat-

tery. The project was mainly financed by private investment from Loccioni, with support from industrial partners such as Enel and Nissan. Energy flows are managed locally through an energy management system to optimise self-consumption. Over 90% of the energy produced on-site is self-consumed, increasing self-sufficiency to 55% and decreasing the amount of energy that is bought from external suppliers.

50 https://www.energy.gov/sites/default/files/202402/46060_DOE_GDO_Microgrid_Overview_Fact_Sheet_RELEASE_508.pdf



BROOKLYN'S ELECTRIC BUS MICROGRID (USA)

In 2024, a bus depot was turned into a solar powered, bidirectional energy hub. The site hosts a 500 kW rooftop PV and 2 MWh of stationary batteries, and electric school buses that can feed power back into the grid (V2G) thanks to an energy management system. The system allows buses to charge when solar power is abundant and discharge during

peak demand, providing peak shaving, demand response, and backup power. By leveraging the predictable schedules and seasonal idleness of school buses, **the project demonstrates a new way to blend renewable generation, vehicle electrification, and grid resilience in dense urban areas.**

ISPATSER (SPAIN)

Conceived by the municipality in 2014, the Ispaster's microgrid is integrated to the grid. It supplies 11 municipal buildings and, more recently, 12 households, combining several renewable plants (90 kW biomass boiler, 42 kW solar thermal and 28.3 kWp of PV). Together, they cover the town's heating, domestic hot water and electrical needs. A thermal storage tank buffers excess heat, while a 49.5 kW battery provides electrical autonomy for up to three

days of low solar periods. **The successful deployment relied on a broad coalition of local stakeholders, including Ispaster municipality and technology providers. Together they coordinated design, installation, and operation, ensuring that the microgrid not only delivers renewable energy but also promotes local engagement and economic resilience.**

ENABLING RENEWABLE INTEGRATION INTO THE GRIDS AND FREE UP CAPACITY ON THE GRID

By combining storage systems and renewable production behind the same connection point, microgrids can smooth the generation profile of renewable assets and increase their self-consumption rate.

Consequently, the power of the microgrid's connection point to the public grid can be reduced, and grid capacity is freed up to connect new facilities or renewable production assets.



ACTING AS AN AGGREGATOR FOR DEMAND-SIDE FLEXIBILITY

Integrated microgrids can provide grid operators with demand side flexibility to alleviate grid congestion, primarily through ancillary services that help ensure grid stability. Depending on their size, a microgrid can act as a single customer that aggregates flexible loads, small production assets, and storage devices all connected to the grid behind the same connection point.

This aggregation provides to the grid operators a clear and predictable flexibility capacity within clearly defined geographical boundary⁵¹.

However, as all users are connected via a single connection point, the grid operator cannot monitor each user's consumption individually. It is therefore more difficult for the operator to verify whether each user in the microgrid has actually adjusted their consumption in line with the network's needs and thus made a real contribution to the grid's balance. If this were not the case, it would be unjustified to remunerate users who have not actually adjusted their consumption in response to a signal sent by the grid operator.

ENHANCING GRIDS AND USERS' RESILIENCE

PREVENTING THE OUTAGES

The ability of some microgrids to disconnect from the grid can relieve to the main grid when frequency drops or increases dangerously⁵². They help by subtracting loads from the grid to either slow down or increase the frequency.

KEEPING CONSUMERS SUPPLIED DURING GRID ISSUES

Microgrids can keep their users supplied with electricity in case of an outage by being able to disconnect from the grid. By contrast, when a grid operator disconnects a portion of the main grid, the users of this portion are shutdown.

Microgrids are particularly useful for critical loads (such as hospitals, police stations, water supply infrastructure, data centres, and airports), reducing their dependence on costly backup generation⁵³.

At the same time, island mode must be clearly and strictly regulated to ensure fairness. If fewer users contribute financially towards grid costs, those who are not part of microgrids will have to pay more. A balance must be struck between fairness and resilience. The responsibility of the decision to disconnect must be clearly defined between the grid operator and the microgrid operator.

MAKING EASIER RESTORATION AFTER OUTAGES

Microgrids accelerate restoration of frequency after a grid disruption and reduce its cost. They complete the traditional way to restore a grid.

⁵¹ <https://publications.jrc.ec.europa.eu/repository/handle/JRC139668>

⁵² <https://www.microgrids-research.eu>

⁵³ https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/10/electricity-grids-and-secure-energy-transitions_9559dcb0/455dd4fb-en.pdf



15 RECOMMENDATIONS TO ENHANCE AT LOCAL LEVEL A SECURE, AFFORDABLE AND SUSTAINABLE ENERGY SYSTEM

THE EU ENERGY SECURITY FRAMEWORK

Regarding the upcoming revision of the EU Energy Security Framework, we recommend that the European Commission:

- 1. Consider fossil-free flexibility as a crucial resource to:**
 - a. substitute flexible fossil generation to ensure adequacy
 - b. ensure a secure, affordable and decarbonised EU energy system
 - c. strengthen the independence of EU energy system and economy
 - d. boost market resilience against failures and grid issues
- 2. Recognise local stakeholders' role in driving fossil-free flexibility and in bringing decentralised, homegrown energy production capacity to the energy system.**
- 3. Consider decentralised renewable energy production, combined with resilient grids as a military advantage in case of war.**
- 4. Consider microgrids as a source of resilience in the event of grid or supply issues, as well as a mean of providing demand-side flexibility and free up grid capacity.**

EU & NATIONAL STRATEGIES AND SUPPORT FOR FOSSIL-FREE FLEXIBILITY [

- 5. EU must ensure that the forthcoming EU Competitiveness Fund and national/regional partnership plans will fund storage and demand-side flexibility solutions, also at local level.**

SPAIN

The national Government has adopted new rules to fast-track battery deployment. It includes an €840 million call to fund 143 energy storage projects un-

der the European Regional Development Fund. More than half awarded projects were for co-located energy storage with other renewable energy projects.



AUSTRALIA

The national Government has launched in October 2025 the Community Batteries for household Solar program. With a \$200 budget, it will help the Australian DSOs to purchase and install on their grid 400 batteries across Australia to provide shared storage for households. The nameplate capacity of batteries can vary from 50 kW to 5000 kW and can be installed

behind-the-meter (i.e. disconnected from the grid) or connected to the grid.

Victoria's state Government has launched a similar programme to enable the installation of 100 community batteries (also called neighbourhood batteries).

EU & NATIONAL STRATEGIES AND SUPPORT FOR FOSSIL-FREE FLEXIBILITY

6. Future Nation Climate and Energy Plans (NECPs) must include measures and KPI's that encourage fossil-free flexibility development. Only a minority of members states (including Germany, Spain, Denmark, and Netherlands) have truly addressed flexibility and storage in their NECPs.

7. The European Commission should prevent gas lock-in by approving a support scheme for adequacy that only funds services to the system, rather than the construction of specific assets, and fully integrates fossil-free flexibility.

ESTONIAN STRATEGIC RESERVE (POSITIVE EXAMPLE)

The Estonian strategic reserve scheme, approved by the European Commission in October 2025, provides a strong example of public support for fossil-free flexibility solutions. The mechanism is open to all projects that can contribute to security of electricity supply until 2035, thereby offering long-term visibility for investments. **Eligible projects include electricity generation, electricity storage, and demand-side response.**

The mechanism rewards the provision of a system service rather than the construction of specific assets, ensuring genuine technology neutrality and allowing different flexibility solutions to compete on equal footing.

To be eligible, projects must comply with the CO₂ emission limits set out in the EU Electricity Regulation, which effectively prioritises low-carbon and fossil-free flexibility options and prevents long-term fossil lock-in.

GERMANY (NEGATIVE EXAMPLE)

The German's plan approved EU Commission in January 2026, which aims to fund 12GW of flexibility capacity follows another pattern. It will fund specific assets, 10 gigawatts (GW) of gas power plants, that

will run when power is missing to meet the demand. Only 2 GW would be open to other technologies, including battery storage.



EU & NATIONAL STRATEGIES AND SUPPORT FOR FOSSIL-FREE FLEXIBILITY

- 8. EU legislation should establish a flexibility-first approach to grid development and include binding fossil-free flexibility targets.**
- 9. EU legislation should mandate grid operators to provide available granular and timely data on grid capacity to facilitate investment decision.**
- 10. Member states and regulators should encourage time-of-use network tariffs and innovative retail offerings for consumers. They should also remove double charging for grid tariffs and offer targeted exemptions for storage systems in congested areas.**

IMPACT GRID TARIFF METHODOLOGY (WALLONIA)

Launched in January 2026, this optional grid tariff applies different rates across four daily time slots. Grid charges are five times higher between 5 p.m. and 10 p.m. than between 1 a.m. and 7 a.m. and 11 a.m. and 5 p.m. This methodology aims to shift consumption to off-peak hours (high solar production and night-time). If consumers have a minimum of

flexibility in their consumption, they can reduce their distribution costs by around 14% (up to €280/year for an average household), but this requires a smart meter. The objective is to activate the potential of Walloon consumers for implicit demand-side flexibility (see page 13).

NATIONAL ENABLING FRAMEWORK FOR BATTERIES (BULGARIA)

Bulgaria's energy storage sector is undergoing a rapid and structural transformation thanks to a package of enabling measures:

- » There is no double charging for grid use during charging and discharging cycles.
- » To get a permit often take less than 12 months thanks to streamlined permitting procedures
- » Market rules allow batteries operators to actively participate in wholesale electricity markets to provide flexibility services to the transmission grid operator
- » Public financial support is granted storage systems, under certain conditions⁵⁴

⁵⁴ <https://www.schoenherr.eu/content/bulgaria-accelerating-the-energy-transition-through-renewables-storage-and-next-generation-nuclear>



EU & NATIONAL STRATEGIES AND SUPPORT FOR FOSSIL-FREE FLEXIBILITY

- 11. EU regulation should standardise the exchange of flexibility-related data between all parties (customers, equipment manufacturers, aggregators, network operators, etc.) to enable optimised and smooth demand-side flexibility.**
- 12. Member states and regulators should revise the remuneration rules for grid operators to incentivise them to acquire demand-side flexibility.**

UNITED KINGDOM

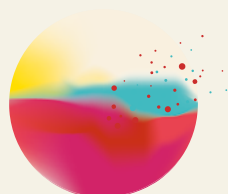
Ofgem, the British regulator has encouraged local flexibility markets by changing the rules on capping DSOs' revenues. The cap no longer depends solely on CAPEX (the value of cables), but also on OPEX (the cost of managing the grid). In other words,

purchasing flexibility is as economically attractive to DSOs as a traditional grid extension. Consequently, the main DSOs are actively procuring flexibility through commercial offers.

GIVE MICROGRIDS THE CAPACITY TO DELIVER THEIR BENEFITS

The EU regulation should:

- 13. Provide legal clarity to microgrids developers by authorising island mode (under clear and transparent conditions), hybrid generation, and renewable/storage combinations in all EU member States.**
- 14. Recognise integrated microgrids as a market player by granting standardised access to flexibility and ancillary service markets and by establishing predictable remuneration for services provided to DSOs and TSOs.** This will allow microgrids to fully deliver their benefits to the energy system and build stronger business models for microgrids.
- 15. Ensure common rules at EU level for grid codes and interconnection standards that simplify and modularise technical, safety, and compliance requirements for microgrids.** As a first step, the EU legislation could ensure that regulatory sandboxes are foreseen by national regulations until the common rules are fully operational.



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