

Unlocking the flexibility potential of heat pumps

Introduction

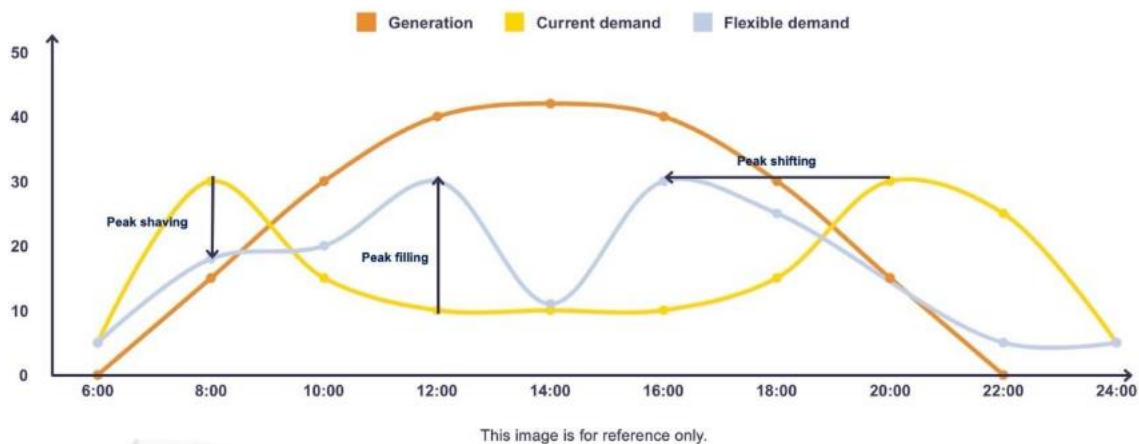
The transition to carbon neutrality calls for radical changes in managing and planning energy systems. As the uptake of renewables grows, energy generation becomes more intermittent and, therefore, price volatility increases. At the same time, renewable technologies already allow for self-consumption and for consumers to become active players in the energy system, both individually and collectively.

However, transitioning to a more decentralised energy system running on renewables requires shifting the paradigm from fossil-based energy systems where energy generation follows consumption patterns to energy systems where consumption adapts to energy generation patterns. This brings both new opportunities and challenges. Firstly, demand-side flexibility is key to shifting energy consumption when renewable power generation is abundant and therefore cheaper for consumers, provided they are offered the possibility to opt for time-differentiated and dynamic energy contracts, and they are exposed to cost-reflective network tariffs. Secondly, demand-side flexibility contributes to a more efficient management of the electricity system; for example, it reduces the costs linked to curtailment of renewable energy generation and the need for costly fossil-based backup generation capacity, while also reducing grid congestion and thereby enhancing grid stability. Flexible consumers must be able to participate in all electricity markets, including the provision of ancillary services. Thirdly, unlocking demand-side flexibility is essential for cost-effective grid expansion, since power networks are designed to accommodate peak demand. Importantly, consumers shall be incentivised rather than mandated to be flexible and the safe operation of energy smart appliances shall always be guaranteed.

What is heat pump flexibility?

Demand-side flexibility is the ability of electricity consumers (demand-side) to respond to external signals such as electricity prices and adapt their consumption patterns accordingly thanks to flexible assets such as heat pumps. Technically speaking, this means that the heat pump can adapt its operation either by heating or cooling more slowly (peak shaving), more quickly (valley filling), or shifting its activity off-peak (peak shifting), also working alongside building automation, zoning systems, smart thermostats and home energy management systems (HEMS) that can optimize comfort and energy use. In all cases, heat pump flexibility should be voluntary, enabled through transparent market-based signals, and always operate within user-defined comfort settings and safety limits.

Types of heat pump flexibility



In an increasingly decarbonised and decentralised energy system, demand-side flexibility plays a key role and benefits both consumers and the energy system as a whole. For consumers, with the right incentives in place, flexibility offers the opportunity to generate significant cost savings by shifting consumption when renewable electricity is more abundant and power prices cheaper¹. This is increasingly relevant because renewable power generation is intermittent and often does not align with consumption patterns. Solar power follows the seasonal sun path, peaking in the middle of the day and with low or no production in the early morning and late evening, when people are typically at home and use most of their daily electricity. On the other hand, wind power is generally abundant during the night, when consumption is at its lowest. Heat pumps can help close these gaps by shifting part of their electricity use while staying within comfort settings.

Importantly, unlocking demand-side flexibility can benefit all consumers, both flexible and inflexible, by switching to a cheaper marginal power source. In fact, wholesale electricity prices are determined by the last power source needed to meet demand, where power generators (sources) are ranked from the cheapest marginal price (typically renewables) to the most expensive (gas- and coal-fired power plants). Shifting consumption when renewable generation is more abundant (and electricity is cheaper) reduces peak loads and the operating hours of the more expensive fossil power generators. Hence, flexible consumers benefit from lower wholesale prices because they use cheap electricity during off-peak hours, but also inflexible consumers can benefit from lower wholesale prices because demand-side flexibility flattens the demand curve and displaces costlier generation resources.

Furthermore, demand-side flexibility addresses several challenges and costs associated with the transition to a decarbonised and electrified energy system. These include increasing hours of negative electricity prices; curtailment costs during excessive renewable power generation; the continuation of fossil-powered electricity generation to meet peak demand; rising investments into grid upgrades; growing costs for balancing the grid. Exploiting the flexibility potential of decentralised energy resources

¹ BEUC, 2024: [Assessment of consumer risks and benefits of heat pumps with and without dynamic price contracts](#)

like heat pumps is cost-effective and their deployment should be accelerated, since it reduces the need for investing in utility-scale assets to provide the same services².

Main barriers to deploying heat pump flexibility

- **Regulatory barriers:** Over the last few years, the European Union has been working on a comprehensive regulatory framework on demand-side flexibility, starting from the revision of the Electricity Market Design in 2019. However, there are still significant gaps and delays in the implementation at national level, for example on the roll out of smart meters, the availability of dynamic energy contracts, or the lack of incentive schemes explicitly supporting the deployment of smart heat pumps.
- **Market barriers:** The key challenge for a faster deployment of heat pump demand-side flexibility remains the availability of sufficient economic incentives for consumers to react to price signals that reflect the different price of generating electricity during the day as well as the cost of dispatching that electricity and the related system constraints, notably through time-differentiated and dynamic energy contracts, cost-reflective network tariffs, and the participation to energy and ancillary service markets. While the picture varies significantly across Member States, the uptake of flexible contracts remains overall limited³ and network tariffs largely do not integrate time-of-use elements yet.
- **Technical barriers:** Unlocking the full flexibility potential of heat pumps will require hardware and software upgrades that need being based on harmonized rules, both at legal and normative levels. The time required by the heat pump industry to implement these upgrades should be properly taken into account by EU and national policymakers. Since cost increases can be foreseen for heat pumps, financial support schemes to at least partially offset the initial investment by end-users should be created, or existing ones should be reinforced with that goal in mind. At the same time, it is critical that heat pumps are allowed but not mandated to respond to grid signals to ensure thermal comfort and preserve the integrity and longevity of the equipment.

Three steps to unlock heat pump flexibility

1. Streamline product requirements for flexible assets and avoid national fragmentation

Reducing the administrative burden on heat pump manufacturers is key to lowering upfront costs for consumers, which constitutes one of the main barriers to a faster uptake of heat pumps. Heat pumps are increasingly subject to overlapping and uncoordinated regulatory requirements — from Ecodesign and the Grid Connection Codes to the Cyber Resilience Act and the Data Act — each with distinct conformity assessment processes, documentation obligations, and implementation timelines.

² SmartEn, 2022: [Demand-side flexibility: quantification of the benefits in the EU](#)

³ LCP Delta, SmartEn, 2026: [2025 Market Monitor for Demand Side Flexibility](#)

Furthermore, additional obligations are also established at national level in some Member States. The cumulative effect is one of regulatory overload that increases costs, slows product development cycles, and undermines EU's deployment targets for heat pump deployment. The emerging regulatory framework on flexible assets, and heat pumps specifically, shall therefore be streamlined.

1.1. Ensure coordination across different regulatory instruments

Connected heat pumps are now subject to a triple layer of EU digital compliance: Ecodesign for energy performance; the Cyber Resilience Act (Regulation (EU) 2024/2847) for cybersecurity; and the Data Act (Regulation (EU) 2023/2854) for user data access and third-party sharing. Each framework establishes distinct and uncoordinated conformity assessment processes, documentation obligations, and ongoing requirements.

Recommendation 1: EHPA calls on the EU to ensure coordinated timelines and requirements across different horizontal and product-specific regulatory instruments to minimise the burden on heat pump manufacturers and production costs.

1.2. Avoid national fragmentation to preserve the Single Market

Some Member States and close trade partner countries are also taking action on digitalisation of the energy sector and energy smart appliances, contributing to regulatory uncertainty and market fragmentation. Since 2023, Germany accepts SG-Ready certification for heat pumps to be eligible for the federal funding for efficient buildings (BEG) — yet this label is explicitly scoped to Germany, Austria, and Switzerland, with no recognition at EU level; importantly, from July 2027, SG-Ready will no longer be eligible and heat pumps will need a digital interface compliant with the Code of Conduct for Energy Smart Appliances (CoC ESA). Furthermore, the Energy Industry Act (EnWG), effective as of January 2024, mandates technical controllability by system operators for heat pumps above 4.2 kW, with the EEBUS and KNX protocols promoted as de facto standards. The Netherlands is simultaneously developing its own framework and selected three standards (EEBus, S2 and Matter), based on a national survey with manufacturers of heat pumps, PV panels, electric vehicles, batteries, and energy management systems (EMS). France relies on tariff-based implicit flexibility, requiring no device-level connectivity standard at all. Outside the EU, the UK is defining smart functional requirements for heat pumps under the Energy Smart Appliances Regulations 2026.

A manufacturer active across these markets must therefore monitor and comply with different national regulations and approaches, each requiring distinct hardware adaptations and separate national compliance steps. This directly contradicts the Single Market principle that a product compliant in one Member State should be freely placed on the market in all.

Recommendation 2: EHPA calls on the EU to ensure that technical standards and connectivity requirements for flexible heat pumps are agreed at EU level and that Member States are not permitted to introduce additional or divergent national standards that go beyond the EU framework. The CoC ESA provides a technology-neutral and market-based mechanism to progressively align national energy smart appliance schemes with a common EU baseline and should be leveraged for this purpose.

2. Drive down electricity bills for flexible consumers

Demand-side flexibility must generate cost savings for consumers to become widely deployed and produce systemic benefits too. However, barriers are still in place and prevent consumers from fully exploiting their flexibility potential, particularly residential consumers.

2.1. Complete the roll out of smart meters

Smart meters can measure electricity consumed and fed into the grid more accurately and provide data on actual time of use. Therefore, they are a key enabler to monitor and reward demand-side flexibility from assets like heat pumps.

The 2019 recast of the Electricity Directive introduced dedicated provisions on smart metering systems (articles 19 and 20). However, their rollout is not complete yet. As of 2024, seven Member States reported a coverage lower than 80% in 2024 and five did not provide data, including large countries like Germany (2% in both households and industry) and Poland (36% in households and 65% in industry)⁴. To accelerate the rollout, in July 2026, the Commission presented a proposal to revise the Electricity Regulation that would introduce a binding deployment target of at least 50% of all final consumers covered by smart meters by 2030 and 75% by 2033.

Recommendation 3: EHPA calls on the EU and the Member States to accelerate the roll out of smart meters as a critical enabler of demand-side flexibility and supports the Commission's legislative proposal⁵ to set mandatory targets for Member States to reach minimum coverage thresholds.

2.2. Offer attractive time-differentiated and dynamic energy contracts

According to the Electricity Directive, consumers shall be given the opportunity to opt for fixed-term, fixed-price electricity supply contracts and dynamic electricity price contracts (article 11) and have access to independent and transparent tools to compare offers from energy suppliers (article 14).

However, fixed-price, fixed-term and regulated energy contracts still dominate in most Member States. While these contracts can temporarily shield consumers against price spikes and volatility in the short-term, they provide little to no incentive to adjust consumption based on marginal electricity prices, reducing consumption when electricity is scarce and prices high and vice versa⁶. Also, it must be stressed that the marginal cost of generating electricity must be recovered and therefore it will ultimately be reflected in final electricity bills either through time-differentiated prices or when fixed-price contracts are renegotiated.

Moreover, perpetuating inflexible consumption generates additional costs that are borne by consumers, for example in the form of hedging costs included in fixed-price contracts, or by taxpayers when regulated contracts are kept artificially low to mitigate social impacts, such as during the 2022 energy

⁴ ACER, 2025: [Electricity country sheets - Monitoring Data 2024](#)

⁵ European Commission, 2026: [COM/2026/600 final](#)

⁶ ACER, 2025: [Rewarding flexibility: How retail markets can empower electricity consumers and improve affordability](#)

crisis. Safeguards against price spikes are key to ensuring social fairness, but they shall be targeted at vulnerable consumers, and they should always be designed to preserve the incentive to reduce consumption when electricity is scarce and marginal costs high.

Since the share of renewable power generation will only increase to achieve EU's decarbonisation targets, energy contracts must also evolve to pass-on the benefits of lower wholesale prices to consumers. Importantly, demand-side flexibility benefits all consumers since reducing peak consumption can change the marginal source in the merit order and lower electricity costs for inflexible consumers too.

Recommendation 4: EHPA calls on the EU and the Member States to ensure that consumers are offered attractive time-differentiated and dynamic energy contracts, including targeted social safeguards to protect vulnerable consumers from excessive price spikes.

2.3. Transition to future-proof network tariffs

As a result of the increasing decarbonisation and electrification of the energy system, electricity bills will see the energy component shrink and the share of network costs rise. Despite the investments needed to expand and modernise the grid, accelerating the electrification of demand and unlocking the full potential of demand-side flexibility can stabilise grid charges and their impact on consumer bills. Therefore, predictable time-of-use network tariffs will become increasingly more important to incentivise flexibility, complementing wholesale price signals.

Traditionally, network tariffs for small-scale consumers (residential and commercial) have been mainly volumetric (in €/kWh) in most EU Member States, often with a flat price throughout the day⁷. However, these tariffs fail to capture the costs and needs of the evolving electricity grid with more intermittent and variable patterns driven by flexible consumers and distributed resources.

Network charges shall be carefully designed to ensure optimal grid utilisation together with cost recovery, while avoiding unintended disincentives for electrification of heating and cooling via heat pumps.

Recommendation 5: EHPA calls on Member States to increase the weight of capacity-based and predictable time-of-use elements in the design of network charges to promote a cost-effective use and development of the grid by leveraging flexible assets like heat pumps, as recommended by the European Commission⁸ and ACER⁹.

3. Reward heat pumps for providing system services

The deployment of flexible assets such as heat pumps opens the possibility for consumers to become active participants of the energy system. This means participating in the management of the electricity system, either directly or through an aggregator, and being rewarded for providing services such as grid balancing, congestion management, or resource adequacy.

⁷ SmartEn, 2025: [A Roadmap for Cost-Reflective Electricity Network Tariffs in the EU](#)

⁸ European Commission, 2025: [C/2025/4010](#)

⁹ ACER, 2025: [Getting the signals right: Electricity network tariff methodologies in Europe](#)

However, the decision to contribute and to what extent shall remain a prerogative of the heat pump user. This is not in contrast with the fact that the energy system will need an increasing number of end-users that are able and willing to provide more flexibility to the energy system.

3.1. Prioritise non-discriminatory and market-based procurement of grid services

Although heat pumps are high inertia systems designed primarily to maintain comfort through smooth and stable operation, they can still provide grid services through voluntary, transparent, and market-based flexibility. Building-level control systems can also enhance the flexibility potential by coordinating thermal zones, occupancy patterns and comfort requirements. Such services should be incentivised and procured through market-based mechanisms rather than emergency grid-support measures.

The proposal for a Network Code on Demand-Response, including the related targeted amendments to other Network Codes, aims to establish common rules on demand-response, facilitate the market-based procurement of local services, and ensure that resources and service providers have access to electricity markets in a non-discriminatory way.

Recommendation 6: EHPA calls for the swift adoption and implementation of the Network Code on Demand Response to enable resources like heat pumps, building and smart control systems to participate in electricity markets based on transparent, non-discriminatory, market-based procurement of local services.

3.2. Quantify and integrate heat pump flexibility potential into grid planning

The European Commission estimates that 584 billion will be needed for grid modernisation and expansion by 2030. Unlocking demand-side flexibility can significantly optimise and reduce investment needs and minimise the impact on final electricity bills. Furthermore, the Electricity Market Design requires Member States to perform an assessment of their flexibility needs, including the potential of non-fossil flexibility resources such as demand response and energy storage to fulfil these needs (article 19c).

A robust assessment of the electrical consumption and flexibility potential of the heat pump stock is critical for planning cost-effective grid upgrades. Heat pumps are not always operating at their highest capacity so the electrical power demand must be considered, not its nominal thermal capacity. The amount of active power modulation, its rate of change and available thermal storage capacities (duration of flexibility provision) need to be considered to quantify the flexibility potential, as well as the contribution of HVAC zoning and home energy management systems (HEMS). Furthermore, the efficiency of a heat pump may increase over time if the energy efficiency of the building is further upgraded to align with the Energy Performance of Buildings Directive (EPBD).

Recommendation 7: EHPA calls on the European Commission and the Member States to timely deliver Flexibility Needs Assessment reports (due by July 2026), as required by the Electricity Regulation, and to work on a robust assessment of the demand-side flexibility potential of the heat pump stock based on installed and forecasted capacity.

3.3. Promote non-fossil flexibility support schemes

The Electricity Regulation explicitly requires Member States to adapt capacity mechanisms to enable the participation of non-fossil flexibility such as storage and demand-response (art. 19g).

The costs of capacity mechanisms have followed an upward trend over the last years and are expected to continue growing. Following the Clean Energy Package, the Electricity Regulation set an emission limit of 550 gCO₂/kWh from July 2025, which de facto excludes technologies like coal and oil. Nonetheless, capacity mechanisms are still dominated by fossil fuels, with gas being the biggest beneficiary and less than 30% of payments going to low-emission technologies¹⁰.

Recommendation 8: EHPA calls on the Member States to promote non-fossil flexibility support schemes when designing capacity mechanisms, to avoid lock-in effects and strengthen the business case for deploying demand-side flexibility.

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The European Heat Pump Association (EHPA) represents the European heat pump sector. Our over 200 members include heat pump and component manufacturers, research institutes, universities, testing labs and energy agencies.

EHPA advocates, communicates and provides policy, technical and economic expertise to European, national and local authorities, and to our members.

We organise high level events and manage or partner in multiple projects.

We work to shape EU policy that allows the heat pump sector to flourish, and to become the number one heating and cooling choice by 2030. Heat pumps will be a central part of a renewable, sustainable and smart energy system in a future decarbonised Europe.

¹⁰ ACER, 2025: [ACER 2025 Security of EU electricity supply Monitoring Report](#)