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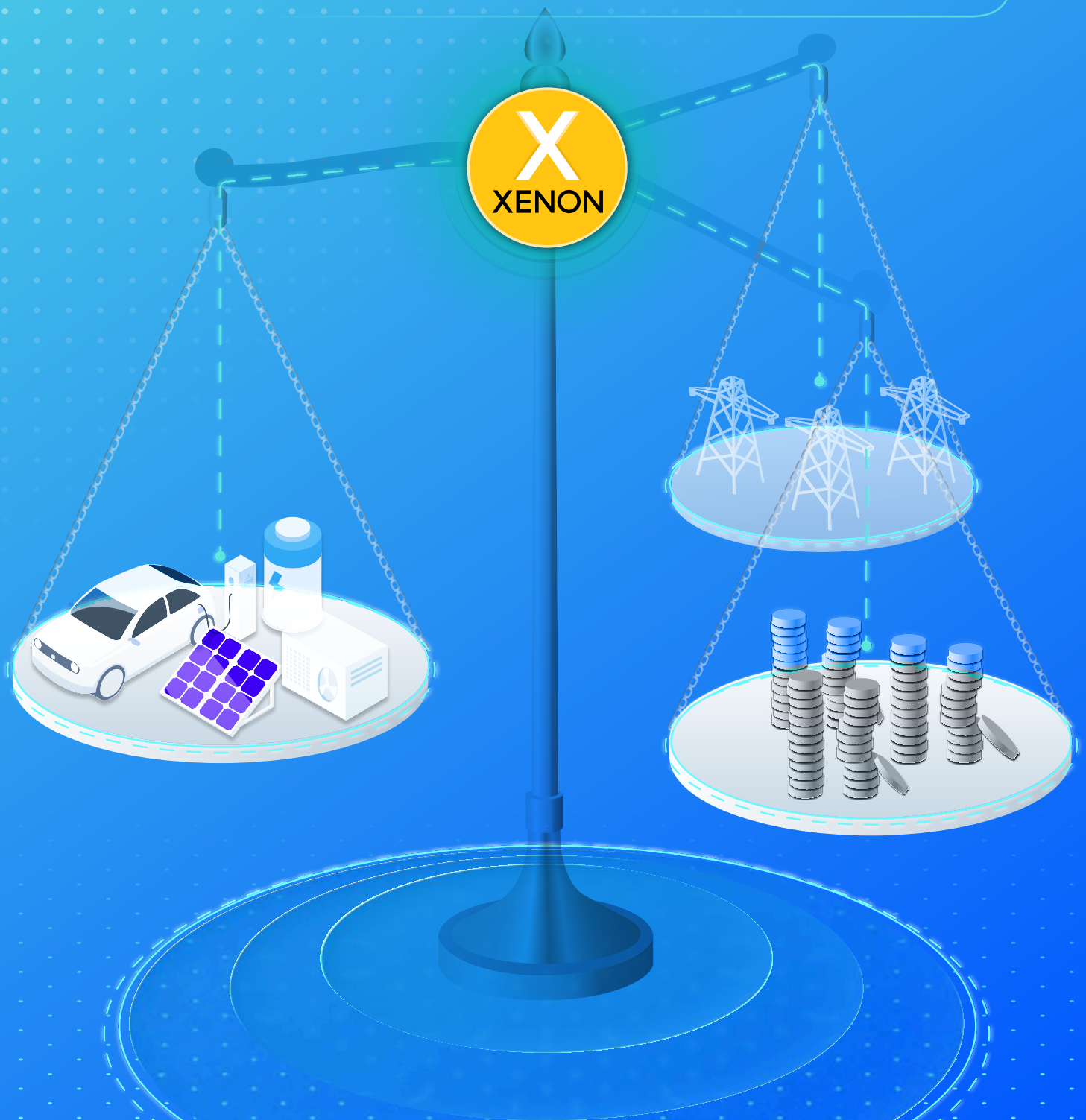
Flexibility Report 2025



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Leveraging small-scale flexibility in Europe

A comprehensive analysis of implicit and explicit flexibility services in Europe and how they unlock additional value for energy providers, OEMs and end users.

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Executive summary

Flexibility is one of the biggest buzzwords in the energy industry – and for good reason. In this report, we break down what exactly is meant by flexibility (AKA "flex"), the difference between implicit and explicit flex, and how much end consumers can save or generate by participating in demand response programs and making their household energy assets available on flexibility markets.

Flex must match DER growth

Rooftop solar and battery storage are scaling rapidly across Europe, driven by new EU directives and national targets. To manage the increase in renewables, such as Germany's plan for half of its 215 GW solar capacity from rooftops by 2030 and up to 780 GWh of storage EU-wide, leveraging residential flexibility will be essential.

Demand outpaces reality

A recent gridX survey of 300 end users revealed that 74% are interested in lowering their costs or receiving reimbursements via flexibility use cases. But only 18% are already actively participating in energy markets, meaning adoption is too slow. Over half the respondents name a reputable provider as the most important product feature, highlighting trust is king.

Turn §14a into an opportunity

§14a EnWG provides a clear path to lower grid charges by making devices controllable. Adding a HEMS minimizes loss of comfort and maximizes end user control. Enabling Module 3, which leverages time-variable grid fees, notably increases annual savings – up to €750 per household.

Potential in Dutch imbalance

With high PV adoption, rising EVs and electrified heating, the Dutch grid faces growing imbalance and congestion. By 2035, 28 TWh of shiftable demand could help stabilize the system. The imbalance market rewards households that support grid balance in real time, with potential earnings around €2.90 per day.

More volatility = greater savings

A gridX analysis found that a Danish household equipped with a rooftop PV, battery, dynamic tariffs and an advanced HEMS could cut annual energy costs in 2024 by up to 58%. As energy prices become far more volatile, the savings potential grows even further – by 2040, the same household could save an additional 13% by simply optimizing according to dynamic tariffs.

Challenges to overcome

Fragmented standards, constantly changing regulation and varying OEM interfaces make it difficult to unlock flexibility at scale. The key to overcoming these hurdles lies in a robust HEMS and strong ecosystems – connecting devices seamlessly, ensuring compliance and unlocking the full value of flexibility for customers, providers and the grid.

Glossary

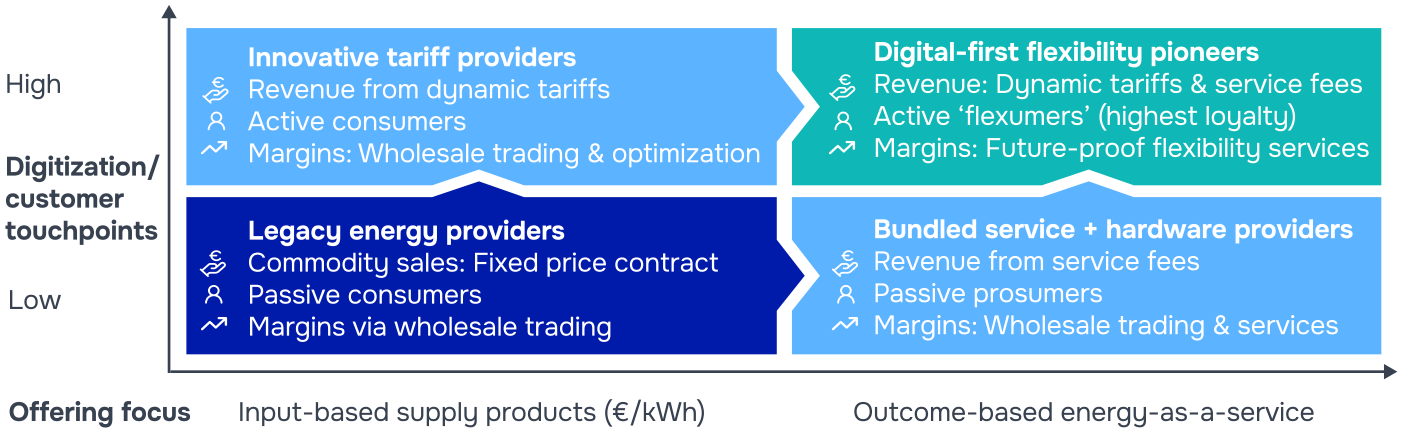
BESS - Battery energy storage system
DER - Distributed energy resources
DSR - Demand side response
DSO - Distribution system operator
EMS - Energy management system
(B)EV - (Battery) Electric vehicle
GCP - Grid connection point
HEMS - Home energy management system
iMSys - Intelligent measuring systems
OEM - Original equipment manufacturer
PV - Photovoltaic
ToU - Time of use
TSO - Transmission system operator
VPP - Virtual power plant

Flexibility is the new currency for future-proof revenue and loyal customers

Margins improve with bundled hardware, customer-first services and digitized supply

The days of commodity sales in energy are over. To deal with squeezing margins due to complex regulation and increased competition from innovative new players, traditional utilities and energy providers must switch to service- and solution-based models. By offering value-added services like smart home integration and participation in energy markets, energy providers capture service value from increased comfort, cost-efficiency and reliability.

From products to solutions: Utilities' evolving business models



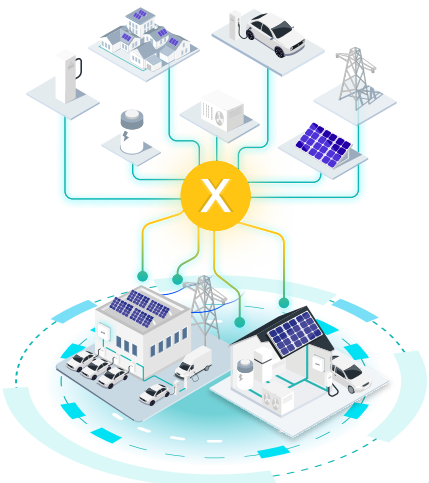
Innovation improves margins in three key ways:

- **Outcome-based revenue**: Recurring flat fees cover optimization services, resulting in predictable cash flows, while dynamic tariffs give utilities more data-driven insights for improved procurement and trading. End users benefit from lower costs based on grid-friendly consumption.
- **Digital scaling**: Once digital platforms are built, each additional customer has a low marginal cost, resulting in higher contribution to margins.
- **Cross-selling potential**: A customer who starts with one asset and basic optimization can more easily be sold additional features or devices later on, compounding margins.

The winners will be those who pivot the fastest, from selling kilowatt hours to value-added solutions.

It all starts by integrating devices into one flexible system

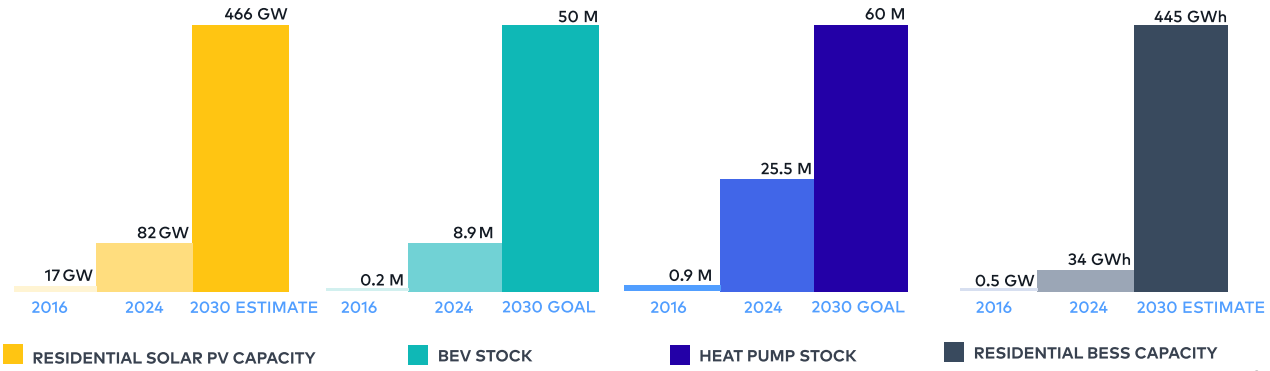
1. Integrate energy assets into one smart energy management system.
2. Aggregate and disaggregate the flexibility of small-scale assets.
3. Trade the flexibility on energy markets.
4. Tap into new revenue streams and stabilize a more renewable-energy-filled grid, while also empowering your customers and saving them money.



Read on to learn how implicit and explicit flexibility services work and why they will be the key to enabling the energy transition.

Small-scale flexibility is here – now its value must be captured

In the EU, DERs are on the rise and the trend is set to continue



Sources: 1-9

Europe's Energy Performance of Buildings Directive, which requires all new buildings to be "solar-ready" and mandates gradual installation of solar panels on existing public buildings from 2027, will boost residential uptake in the EU. Germany aims for roughly half of its 215 GW solar by 2030 target to be rooftop installations, reflecting the EU-wide push for residential deployment.[2]

Residential battery storage capacity in Europe grew 68-fold from 2016 to 2024. SolarPower Europe estimates that to meet its renewable energy targets, the EU will need up to 780 GWh of battery energy storage systems (BESS) by 2030.[8] If residential PV maintains its share of 57% of all capacity, this equates to around 445 GWh, a further 13-fold increase.[6]

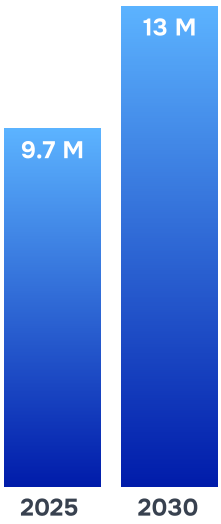
Heat pumps and electric vehicles are experiencing similarly stark growth curves to replace oil and gas and meet emissions reduction targets. Enerdata predicts a fleet of 50 million electric cars in the EU by 2030, one-fifth of the total fleet.[5] The REPowerEU plan states 60 million heat pumps should be in operation by 2030, requiring 5 to 6 million installations per year to close the current gap.[9]

With more DERs comes more flexibility potential and need

ADDRESSABLE MARKET SIZE FOR VPPS IN EUROPE: RESIDENTIAL AND C&I (€)

The total flexibility value potential in the residential and commercial and industry (C&I) sectors is currently at €9.7 billion. Virtual power plants (VPPs) typically capture around 10% of traded flexibility value, making their current addressable market value just under €1 billion. By the end of the decade, this is expected to rise by 34%.

Source: 10



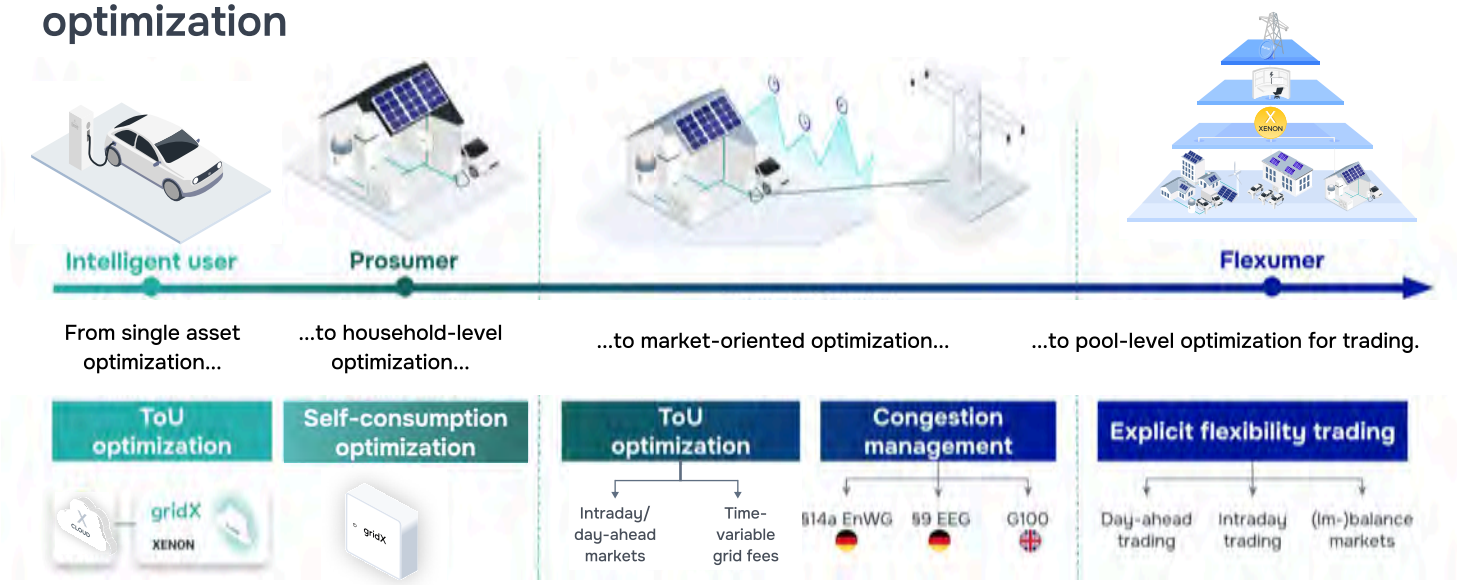
DAILY ENERGY FLEXIBILITY NEEDS IN EUROPE (TWH)

From 2025, about 220 TWh of daily flexibility will be needed each year to ensure a stable energy system. This need will reach 450 TWh per year by 2030, an increase of 205% in five years. This highlights the importance of flexibility solutions that respond to the unpredictable nature of renewable energy production and consumption patterns.

Source: 8

HEMS is the foundation of flex use cases

From cost savings to market influence: The path of energy optimization



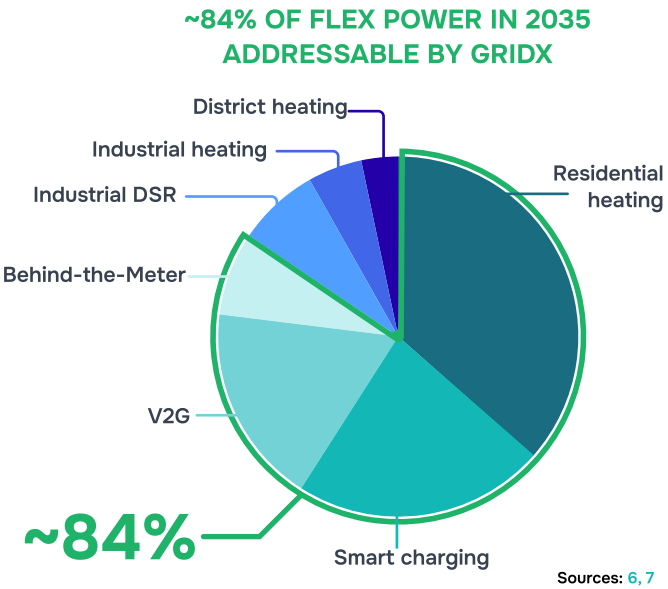
Energy flexibility is a strategic progression and a home energy management system (HEMS) is the engine driving it forward. The lowest entry-point to flex is via single-asset time-of-use (ToU) optimization to reduce household costs, evolving into system-level self-sufficiency by coordinating multiple assets that produce, store and consume energy, and extends to market-oriented strategies that align with intraday and day-ahead markets and grid congestion.

At its most advanced, a HEMS aggregates flexibility to be traded across markets, in combination with other use cases – self-consumption optimization, ToU optimization and regulatory compliance – to transform latent capacity into revenue generation, while also contributing to grid stability and guaranteeing user comfort. This evolution unlocks increasing value at each stage, from direct cost savings to systemic benefits, and positions stakeholders at the forefront of the energy transition. Those who advance along this path gain both economic advantage and strategic influence.

Unlocking flexibility potential starts with smart energy management

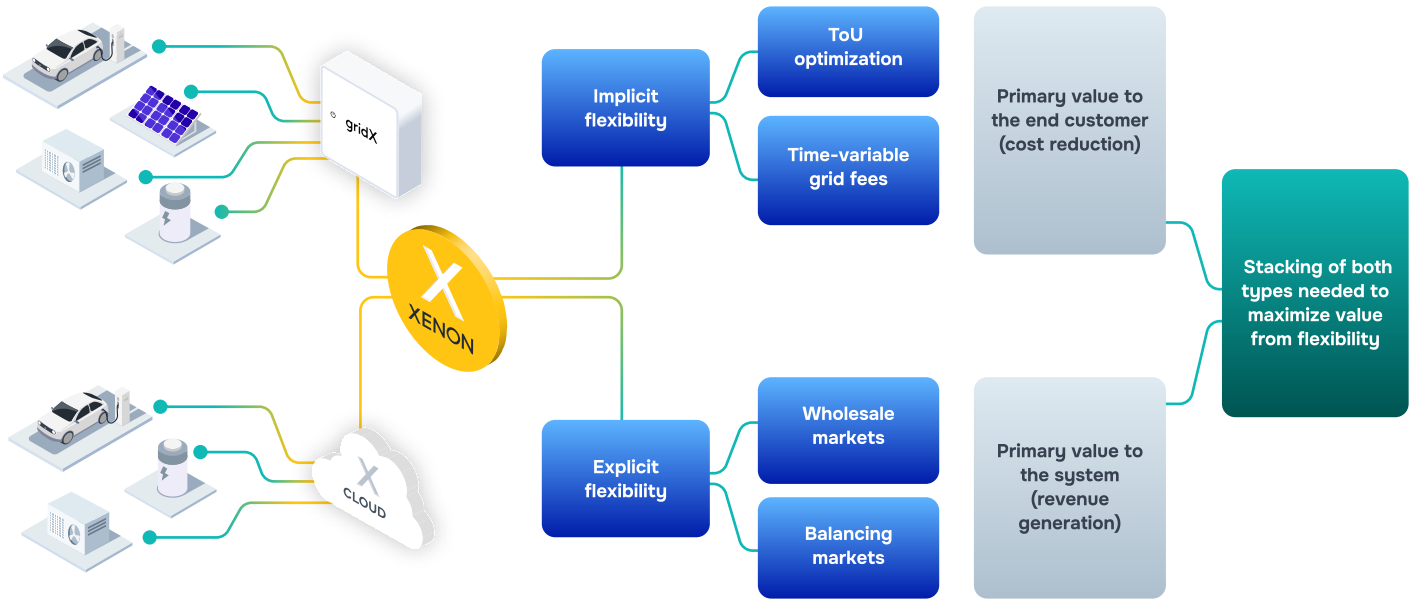
HEMS is the key to unlocking ~84% of flex power potential by 2035. By connecting and controlling distributed energy resources (DERs) – from EVs to heat pumps – HEMS enables cost-effective optimization, constraint management and grid stability.

It all starts with local asset connectivity. From there, energy flows are optimized and smart use cases like ToU optimization, self consumption and flexibility trading can be layered in, with a local gateway as the key to making it all work seamlessly.



Sources: 6, 7

Implicit and explicit flex: The two pillars of flexibility



Implicit flexibility uses price signals to shift when energy is consumed, produced or stored.[13] It directly benefits customers by lowering bills, improving self sufficiency and easing strain on the grid.

Explicit flexibility turns those same controllable assets into market resources, providing dispatchable capacity for wholesale, balancing and reserve markets. This generates revenue that can be shared across the value chain while improving grid stability.[14]

Each type targets different value streams – one at the household level and the other at the system level. When stacked, they work together: customers see greater savings, businesses tap into new earnings and the grid operates more reliably. This stacked flexibility then transforms compliance into a strategic advantage for all players.

By aligning each flexibility type with its strongest value stream, stakeholders can target specific benefits while contributing to overall system efficiency. This clarity makes it easier to design business models that maximize both savings and stability.[14]

Where flexibility creates value

Benefit	Stakeholder	Flex use case
Lower energy costs, increase control	End customer	Dynamic tariff optimization and making their flexibility available for trading
Relieve grid congestion & avoid costly upgrades	Grid operator	Congestion management, demand side response, time-variable grid fees
Generate future-proof revenue	Aggregators, OEMs, utilities	Trading aggregated flexibility on wholesale markets
Stabilize renewable energy systems	The entire value chain	All flexibility applications, which better balance intermittent supply with flexible demand

Sources: 15–17

The backbone of grid reliability

Congestion management – also called constraint management – integrates grid operator signals in real time to reduce demand peaks, which threaten to overload the grid or curtail renewable generation when production exceeds demand. It is achieved by forcing consumption shifts to periods of lower demand to maintain grid stability via financial mechanisms, but also via mandatory measures for which participants receive remuneration. This coordination involves integrating signals from in front of the meter to accordingly adjust energy flows behind the meter, intelligently controlling heavy consumption devices like batteries, EV chargers and heat pumps to keep both local and system limits in check.

With intelligent solutions, this creates a win-win-win for actors across the value chain.

Business impact across the value chain

Smart constraint management turns grid-friendly behavior from a burden into a market lever

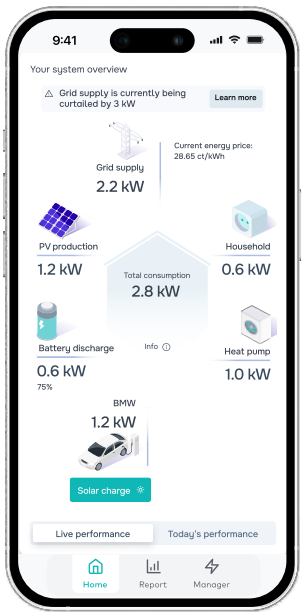
Stakeholder	Key benefit
Consumers	Receive financial compensation for making energy assets grid-friendly, e.g. cut a German household's annual energy costs by up to €750 with §14a.[18]
OEMs	Strengthen their position in a crowded field by ensuring devices are controllable and remain compliant, now and in the future.
Installers	Meet customer demand for integrated HEMS packages that combine controllability with visible energy savings, moving beyond hardware fittings.
Suppliers	Unlock new revenue streams and enhance customer loyalty, while also ensuring regulatory compliance.
Grid operators	Guarantee a more balanced, stable grid and increase transparency of consumption behavior – avoiding costly infrastructure investments or, at least, shifting demand into the future.

The importance of combining congestion management with HEMS

Congestion management isn't just about compliance and reduced costs. When combined with a smart energy management system (EMS), users also enjoy greater transparency and control over their energy consumption.

With a HEMS, users can be notified about consumption restrictions via push notifications in an app, as well as compensate for restrictions with local storage or solar production. Most importantly, they can combine the savings generated by congestion management with other use cases, such as self-consumption optimization and dynamic tariff optimization.

In short, annoying restrictions can be transformed into tangible, sustainable contributions.



Grid-friendly behavior via §14a EnWG

§14a EnWG (Energy Industry Act) creates a direct path to reduced grid charges when devices are controllable. Paired with a HEMS, Modules 1 and 2 ensure these savings flow automatically by managing PV, batteries, wallboxes and heat pumps in line with grid requirements. This provides a steady financial benefit before even tapping into time-variable tariffs. With Module 3, plus time-variable grid fees, savings are even greater.

Three modules to suit different needs

Annual end-user savings with Module 1

Module 1 offers a simple flat-rate reduction in grid fees and is suited to households with smaller or fewer energy-consuming devices.

Annual end-user savings with Module 2

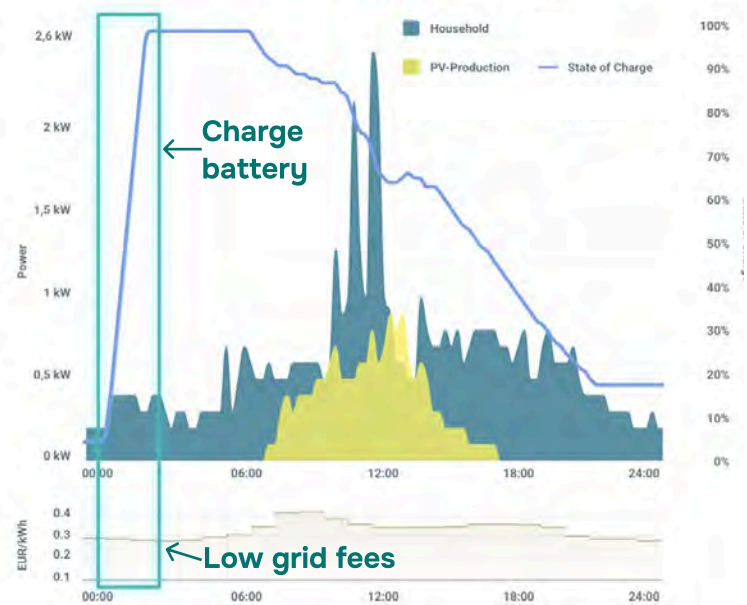
Homes with heavier consumption loads, particularly heat pumps, benefit more from Module 2, which involves a 60% reduction in grid fees, provided a separate metering point is used for controllable consumption devices.

Annual end-user savings with Module 3 (+1)

Module 3 can be added on top of Module 1 and involves time-variable grid fees. These were made available from April 1, 2025 and leverage grid fees or network charges that cover costs associated with electricity transmission and fluctuate according to grid utilization. They are a game-changer in cost reduction, incentivizing a much more responsive and balanced energy system.

Sources: 18-20

BATTERY CHARGING WHEN GRID FEES ARE LOW



Increase savings by an additional 200% with time-variable grid fees in Germany

Dynamic grid fees turn batteries into active cost reducers. Charging during low-price periods can, for example, deliver daily savings nearly three times higher than with static fees.

SAVINGS WITHOUT TIME-VARIABLE GRID FEES:

0.45€/day

Charging the battery with static grid fees of 8.45 ct/kWh (Avacon grid fees 2024) during the night hours

SAVINGS WITH TIME-VARIABLE GRID FEES:

1.35€/day

Charging the battery with ~5.75 kWh for 1.5 hours with the lower grid fees would save an additional 0.635€.
23:00 - 05:00 1.08 ct/kWh
05:00 - 23:00 10.79 ct/kWh

Meeting §9 EEG while maximizing system value

§9 EEG sets the technical requirements that PV systems must meet to receive remuneration. Systems larger than 25 kW must be remotely controllable and provide real-time feed-in data to the grid operator or direct marketer. Smaller systems (up to 25 kW) must either enable remote control or permanently limit feed-in to 70% of installed capacity. If these requirements are not met, operators risk a reduction or loss of their EEG payments.[21, 22]

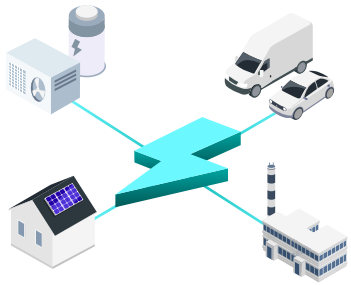
Impact for the market

Reliable compliance with §9 EEG protects subsidies, avoids disconnection and ensures installations remain eligible for advanced energy services. This protects the economics for end customers while enabling OEMs, installers and suppliers to deliver systems that meet regulatory and technical standards.

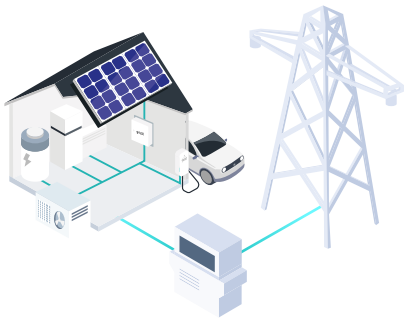
How gridX supports this

gridX ensures every system is compliant with §9 EEG, combining regulatory adherence with functionality for dynamic tariffs and smart optimization. This approach supports both market requirements and customer trust.

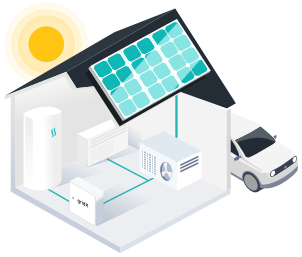
Other key amendments shaping the market: §19 EEG, §51 EEG and §100 EEG



Avoid grid overload



Accelerate smart meter rollout



Incentivize flexibility

Recent updates to EEG's §19, §9, §100 and §51 are designed to strengthen grid stability, integrate more renewables and make flexibility pay. The goals are clear: enable battery feed-in, mandate controllability for new assets, enforce feed-in limits until smart meters are in place and adjust subsidies when negative prices hit.[23, 24]

Systems must now be able to feed energy back under set conditions, communicate with the grid via iMSys + control box, adapt to pricing signals and give customers a way to earn from flexibility. Delivering solutions that align with these rules lets market players tap into new revenue streams while supporting a more reliable, future-ready energy system.[25]

G100: Flexibility through compliance and interoperability

Effective as of May 1st, 2023, G100 is a UK regulation introduced by the Energy Networks Association (ENA). It is designed to manage the rapid growth of electric DERs. It helps maintain grid stability by placing limits on the power output of both large-load and small-scale energy assets.[26]

Customer Limitation Scheme (CLS)

At the heart of G100 is the Customer Limitation Scheme (CLS), which enforces limits on energy import and export for compliant devices. For a small-scale energy asset to be considered "compliant", it must have the following: wireless communication capability and/or extended voltage tolerances, fail safe functionality, basic cybersecurity scheme, increased commissioning requirements for installers and connection processes in accordance with G99 requirements. This allows DSOs to manage network stability during periods of high stress by dynamically controlling DER export and import, an essential capability for regional and household-level flexibility.[27]

Operational states

G100 defines four operational states for devices connected to the grid through the CLS. These states describe how a system should behave depending on whether it's operating normally or facing issues. This ensures safe, resilient and predictable asset behavior across all conditions, which is critical for flexible energy orchestration.

1. **Normal operation**: Export/import remains within configured limits via CLS control.
2. **Occasional excursion**: CLS can handle temporary breaches and return to safe operation.
3. **Failed state**: In the event of CLS malfunction, devices must default to low-power or shutdown mode.
4. **Operation without CLS**: Systems without CLS must operate in low-power or off mode.

Important for installers and OEMs

Compliance to G100 is now a required step during system design and installation. Incorporating CLS and fallback states encourages resilient design that will remain relevant as flexibility markets evolve, and aid in lessening grid congestion.[27]

1. **Assessment**
   Check if your system requires G100 compliance. Use type-tested equipment from the ENA register or provide supporting test documentation.
2. **System design**
   Design the Control/Export Limitation Scheme to keep power flows within the DNO's agreed limits.
3. **Documentation**
   Prepare an operational description and evidence of compliance for submission via the G100 Compliance Report.
4. **Installation and testing**
   Install the system and verify performance, including transitions between states and maintaining limits during faults.
5. **Approval**
   Submit the required forms to the DNO following the ENA G100 Application Guidance (Form B).

Dutch net metering phase out increases flex potential

Beginning January 1, 2027, the Netherlands will officially phase out its long-standing Net Metering Scheme ("salderingsregeling" in Dutch). This transition marks a significant shift in how prosumers engage with the energy market, driving greater self consumption, system flexibility and a fairer, future-proof electricity pricing model.[28]

While net metering successfully encouraged widespread installation of rooftop solar panels, it also led to large amounts of uncontrolled feed-in to the grid, contributing to today's severe congestion issues.[29] At the same time, it incentivized households to practice constraint management by sizing systems to offset demand rather than to integrate with wider grid needs. As a result, few Dutch households have invested in storage or smart energy management solutions. With the upcoming phase-out of net metering, these tools are essential for allowing households to store excess solar, optimize their consumption and play an active role in easing grid strain.[30]

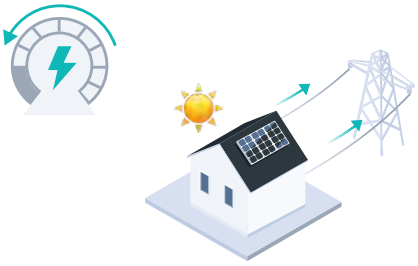
What's behind the phase out?

Alleviating low-voltage grid congestion

With rising PV adoption and uncontrolled feed-in, grids are under pressure. Reducing excess feed-in helps stabilize voltage levels and maintain grid reliability.

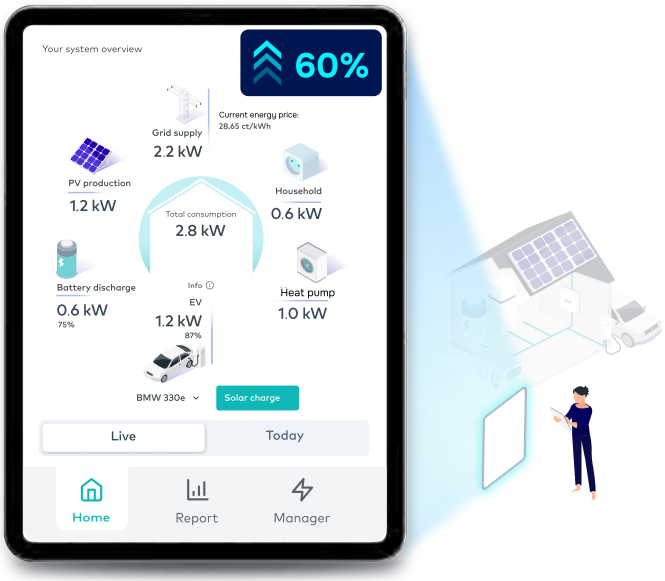
Liberalizing feed-in remuneration

Moving from netting to market-based compensation ensures that feed-in reflects true market conditions and allows for more transparent, dynamic pricing models.[31]



What changes on January 1st, 2027

Prosumers will no longer be able to fully offset the electricity they generate with solar panels against their own consumption. Instead, energy suppliers will determine the compensation for excess electricity fed back into the grid.

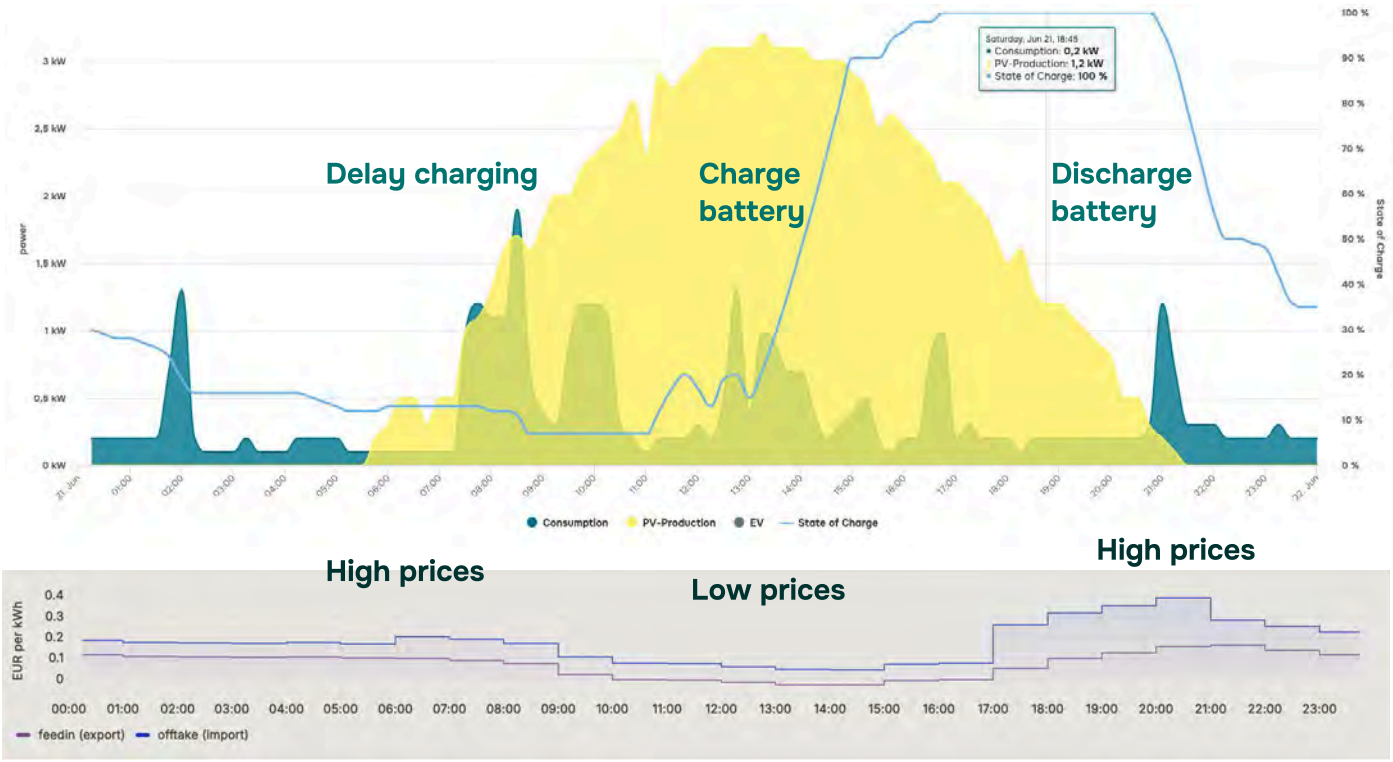


A study by CE Delft and the Netherlands Organization for Applied Scientific Research (TNO) found that, with the end of the net metering scheme, residential PV system owners can still maintain strong financial benefits by increasing their self consumption from 30% to **60%**.[30] Encouraging homeowners to use more of the solar power they generate (rather than feeding it into the grid) promotes energy efficiency and cost savings directly at the source. This can be achieved by adding more assets, such as heat pumps and EVs, and tapping into the flexibility of these assets with the help of an EMS.

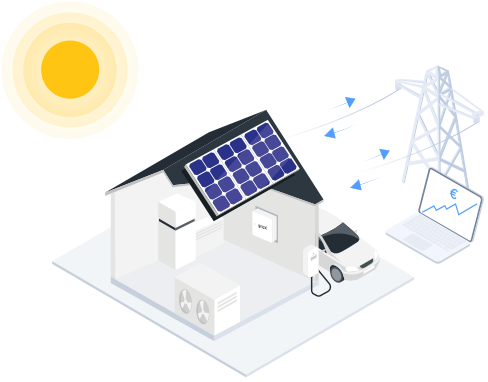
Finding flexibility in ToU tariff optimization

Households across Europe stand to gain a lot by pairing dynamic time-of-use (ToU) tariffs with a smart HEMS. This combination automatically shifts energy use to periods of low prices and taps into stored power, such as from a home battery, when prices peak, which often coincides with grid congestion. The result is significant cost savings and seamless integration of renewables without compromising on comfort, as the HEMS maximizes both household efficiency and grid support. Below, we look at a Danish household's savings via delayed charging on a sunny summer's day.

GRIDX STUDY OF A REAL DANISH HOUSEHOLD'S SAVINGS BY DELAYING BATTERY CHARGING ACCORDING TO PRICES



Charging the battery from solar was delayed from 6 AM until 11 AM. After that, the charging of battery was allowed to ensure that the least amount of energy was being fed into the grid, so as not to cause a strain. During the night, when prices for feed-in are typically at their lowest, the system discharged into the grid to benefit from the positive feed-in prices.



Maximize solar value with ToU optimization

Without ToU optimization, the battery would have been charged as soon as the sun started shining. Delaying the charge until 11 AM, however, meant the prices were significantly lower, so the household saved money but still fully charged the battery with solar power to store energy that could be consumed later that evening. Combining it with self-consumption optimization also ensures that if power is needed (e.g., the spike at 8:30 AM) the EMS will again limit charging of the battery to use the solar power for household consumption. It then goes full charge to ensure the battery reaches a higher charge by the time the sun sets.

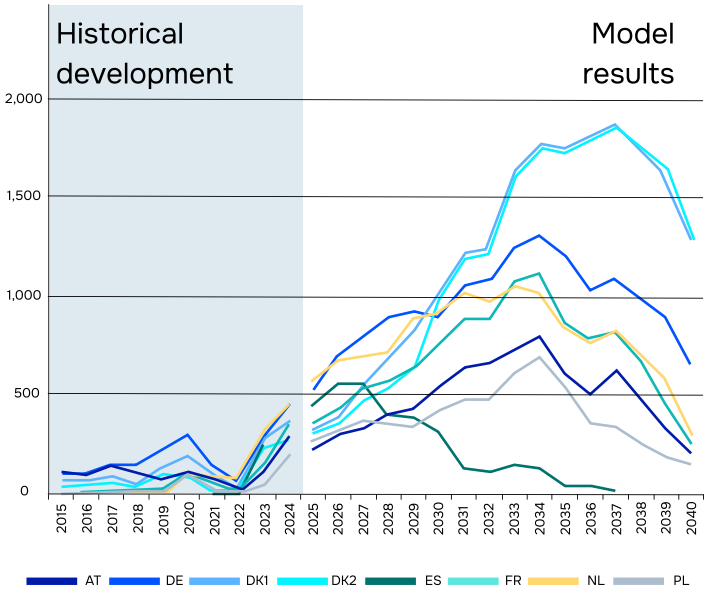
Increased volatility = Increased savings

As the share of renewables in the electricity mix increases, negative wholesale electricity prices are expected to increase in every European market in the coming years, peaking around 2035, before dipping again as demand-side flexibility becomes more widespread. According to Enervis, Germany can expect almost a 200% increase in negative prices by 2035 (largely due to increased solar penetration), while Denmark will likely see a 500% increase (mostly due to increases in offshore wind).[32]

The increase in hours with negative prices will be complemented by a corresponding increase in price peaks during demand periods – due to higher CO_2 prices, rising demand and high project development costs.

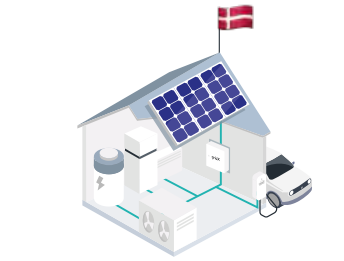
With the right technology that intelligently shifts consumption to lower price periods, these increased fluctuations can be a positive.

NUMBER OF HOURS WITH NEGATIVE PRICES



Source: 32

EXPECTED ANNUAL ENERGY COSTS FOR AN AVERAGE SETUP IN DENMARK WITH MORE VOLATILE ELECTRICITY PRICES IN 2040

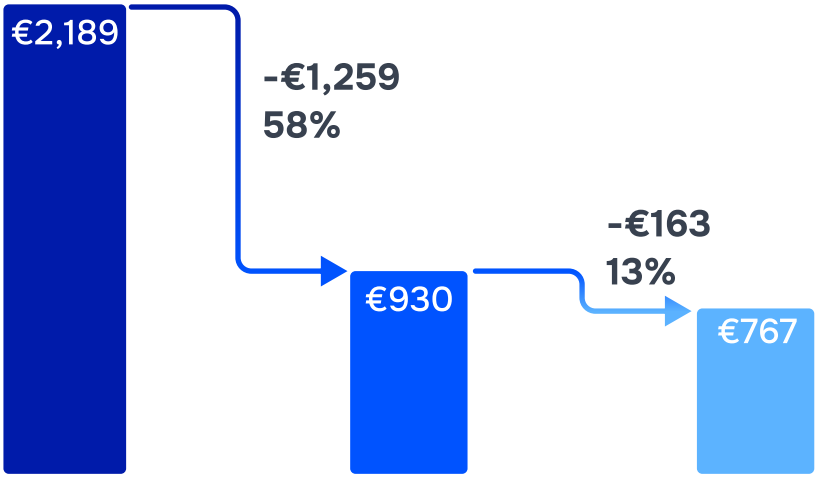


Household consumption: 5,000 kWh

7 kWp

10 kWh

6,500 kWh



2024 prices
Static tariff, no PV, no battery

2024 prices
PV + battery + HEMS + dynamic tariff

Predicted 2040 prices
PV + battery + HEMS + dynamic tariff

Based on expected increases in both wholesale electricity price peaks and troughs (negative hours), our simulations found that users in Denmark with a PV, battery, dynamic tariffs and an advanced HEMS could save an additional €163 per year simply by intelligently shifting consumption in line with more extreme prices. This is on top of the €1,259 savings they can experience today with a smart setup. This is the definition of future-proof: as fluctuations increase, users that invest in a sophisticated HEMS today, will automatically save more in the future, without having to change a thing.

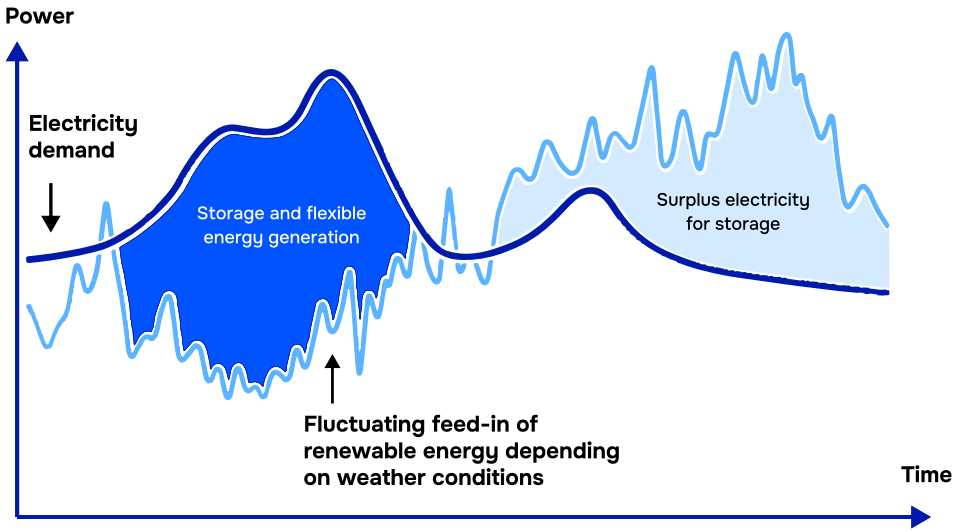
Pool-level optimization for energy trading

Enabled by digital platforms, IoT devices and automated control systems, explicit flexibility services allow for real-time optimization and orchestration of DERs. They provide the grid with the toolset to dynamically match supply and demand, particularly in scenarios of increasing renewable penetration and volatile generation patterns.

Grid stability

With fewer conventional power plants in Europe to provide inertia and frequency control, the grid must rely on DERs to deliver fast, responsive support. A smart EMS enables these assets to respond to frequency deviations, congestion signals or voltage fluctuations in a coordinated manner. This enhances the resilience of the grid and reduces reliance on fossil-based backup solutions, aligning technical needs with climate goals.

HOW FLEX COULD AFFECT FUTURE ENERGY SYSTEMS

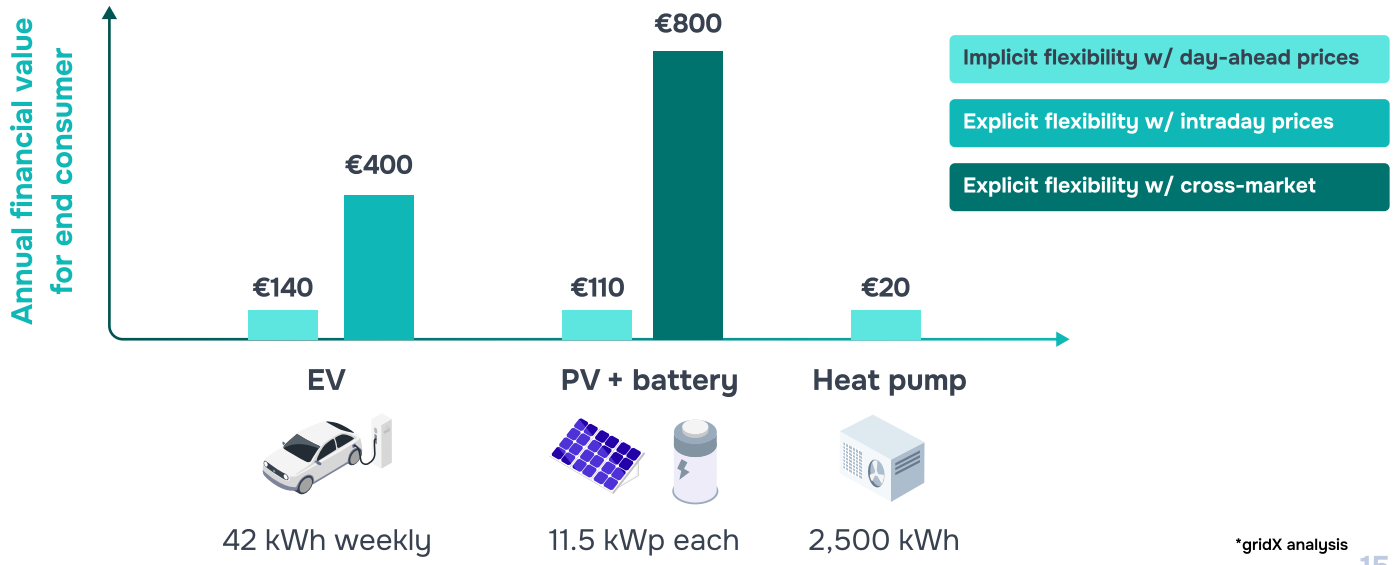


Source: 33

Revenue generation

Companies generate revenue through explicit flexibility by actively participating in energy markets with the help of a smart EMS, which identifies available capacity, aggregates distributed flexibility and automatically responds to market signals to meet demand. This allows energy providers to offer services like load shifting, peak shaving or VPPs. In return, they earn income through capacity payments, activation fees and reduced grid charges.

GRIDX'S XENON WITH SELF-CONSUMPTION OPTIMIZATION AND STATIC TARIFFS VS. A HEMS WITH DIFFERENT TYPES OF FLEXIBILITY OPTIMIZATION (IN GERMANY)*



*gridX analysis

Germany's flexibility opportunity is real and growing

Germany's intraday markets offer huge earning potential for utilities and HEMS providers. In 2023, the intraday continuous 60-minute product saw an average spread of €906.73, compared to just €97.88 in day-ahead markets. On extreme days, spreads topped €5,000 and even hit €10,000 – prime opportunities for anyone able to react in near real time.[38]

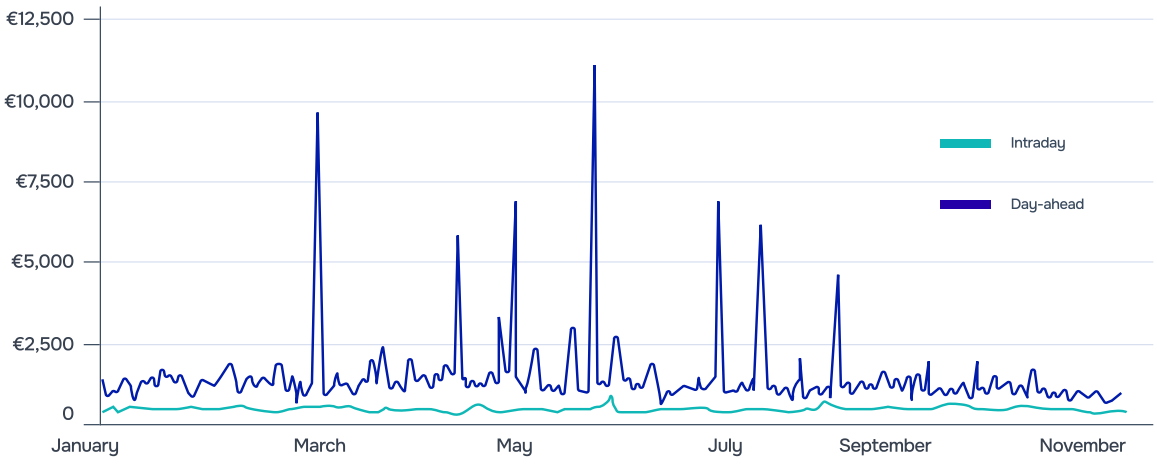
Expected shiftable demand in Germany by 2035

100 TWh

Source: 11, 12

By aggregating flexible assets like EVs, batteries and heat pumps, providers can act as VPPs – buying when prices drop and selling or curbing demand when they spike. A fleet of just 1,000 EVs can already create a profitable intraday trading position.[34, 35, 38]

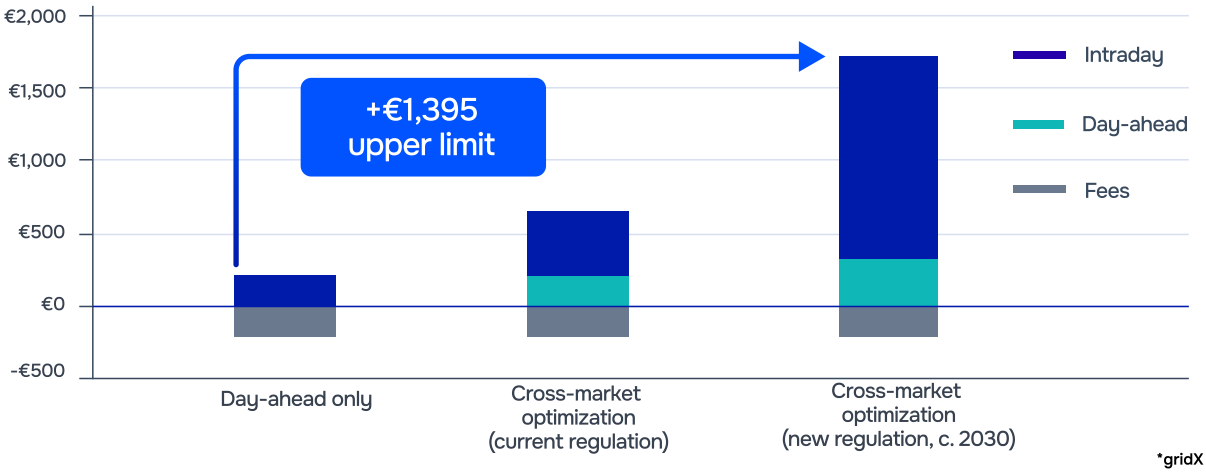
INTRADAY VS. DAY-AHEAD PRICE COMPARISON (2023, GERMANY)



Source: 36

While the slow smart meter rollout and limited real-time data remain hurdles, Germany's 2030 target of 80% renewables will only increase volatility. Investing now in tech, aggregation capability and forecasting tools means capturing this revenue instead of leaving it on the table.[37]

ANNUAL INTRADAY REVENUE POTENTIAL WITH HOME BATTERIES*



*gridX analysis

The UK: A rising leader in energy flexibility

The UK's energy system is undergoing a rapid transformation toward renewables and electrification, making flexibility a cornerstone of its Net Zero journey. While Brexit has reinforced the importance of domestic solutions – by reducing integration with the EU's Internal Energy Market – the true driver of flexibility is the shift to a renewables-heavy, electrified grid.[39]

Expected shiftable demand in the UK by 2035

80 TWh

Source: 11, 12

Great potential and challenges from rising wind and solar

As a leader in offshore wind and with fast-growing solar capacity, the UK faces the challenge of balancing intermittent generation with rising electricity demand from EVs, heat pumps and electrified heating. Regional imbalances add to the strain: renewable generation is concentrated in Scotland, while demand is highest in the South.[40]

Flexibility assets, such as storage, demand response, interconnectors and flexible generation, are therefore essential to maintain system stability. The UK's independence from EU frameworks may even accelerate innovation and decision-making in this area.

Day-ahead market optimization

Reforms are making participation in flexibility markets easier than ever. Ofgem's proposed "one-stop" registration simplifies access for aggregators and asset owners, lowering barriers to entry and enabling better rates for customers. In addition to driving more flexible energy use, it could contribute between £30bn to £70bn in savings by reducing the need to build costly infrastructure. With rising numbers of EVs and home batteries, it promotes asset owners responding increasingly to intraday price signals, creating new value streams while supporting grid stability.[41]

Demand response at scale

Consumer participation is also accelerating. Nearly 2 million households and businesses joined Britain's Demand Flexibility Service in winter 2024–25 (up 0.3 million from the previous year). By shifting consumption away from peak times, these participants saved enough energy to power 12.7 million homes for an hour, showcasing the scale and impact of demand-side flexibility.[42] Since 2022, over 1.6 million consumers took advantage of paid opportunities to shift their consumption from peak hours through energy suppliers.[43] Heat pumps and smart appliances are also being designed to respond automatically to price signals or grid needs.

Looking ahead, the combination of market reforms, engaged consumers and rapidly growing flexible assets positions the UK as one of Europe's most dynamic markets for flexibility.

Imbalance optimization in the Netherlands

The Netherlands is grappling with growing energy imbalance, driven by rapid renewable integration and surging electricity demand. In a country of just over 18 million, there are 8.4 million private households.[44, 45] Of these, 3.7 million are prosumers with at least one flexible DER. The high uptake of decentralized assets is straining the grid, with 2.55 GW of new residential solar

Expected shiftable demand in the Netherlands by 2035

28 TWh

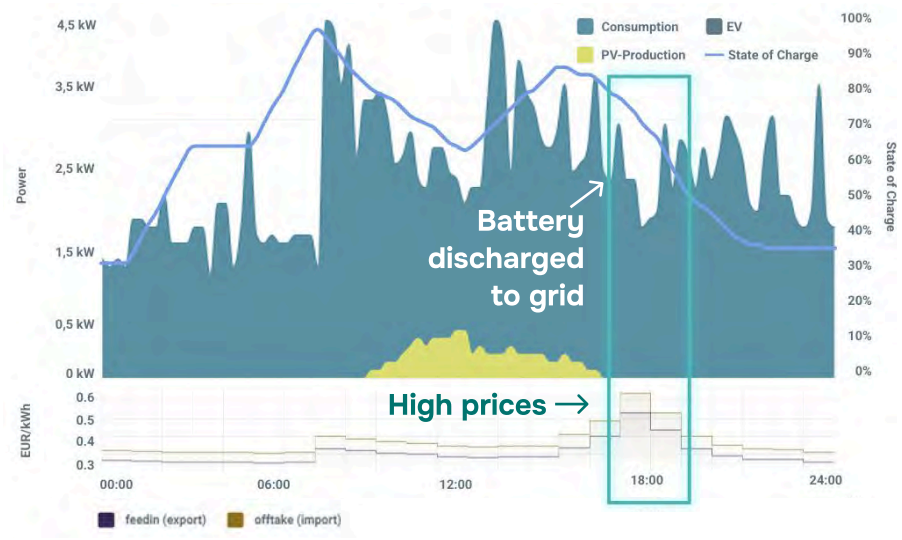
Source: 11, 12

Earn money by optimizing according to the Dutch imbalance market

The imbalance market is the real-time tool the Dutch transmission system operator uses to keep supply and demand in balance. When forecasts don't match reality, like unexpected drops in wind or spikes in demand, flexible assets are activated to restore balance. Participants are rewarded for helping, while those causing imbalances pay charges.

EARNINGS FROM DISCHARGING INTO THE GRID WHEN PRICES ARE HIGH

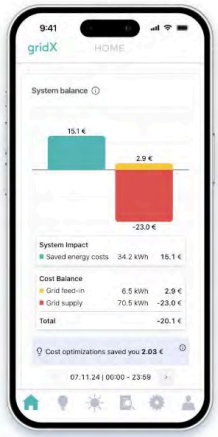
THE EMS LOGIC



END-USER EARNINGS

2.90€/day

Discharging unused battery capacity into the grid during high export prices would earn an additional €2.90 that day.



A smart HEMS turns this challenge into an opportunity by leveraging energy flexibility. By automatically shifting consumption, storing excess solar generation or selling energy back at optimal times, a HEMS helps maintain grid balance while allowing end customers to profit from market volatility (as in the image above). In this way, every Dutch household can not only reduce their energy bill but also play an active role in stabilizing the country's energy system.

> "Behind every energy-flexible home is a complex web of players working in harmony – all coordinated to deliver effortless flexibility. By working with partners such as gridX, Essent simplifies that ecosystem so the end customer reaps the benefits – saving money by lowering the energy costs, making money by charging/discharging bonuses and promoting greater sustainability – without even noticing the heavy lifting happening behind the scenes."

Roel de Krom
Head of Customer Flex
essent

Survey says: Adoption breeds acceptance

300 respondents

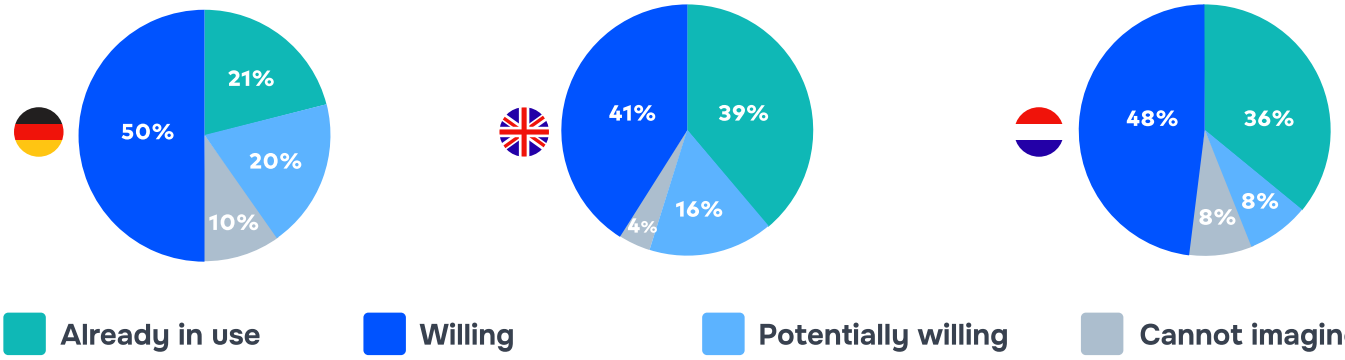
1/3 1/3 1/3

33% 41% 25%

59% have an EMS
38% have a variable tariff

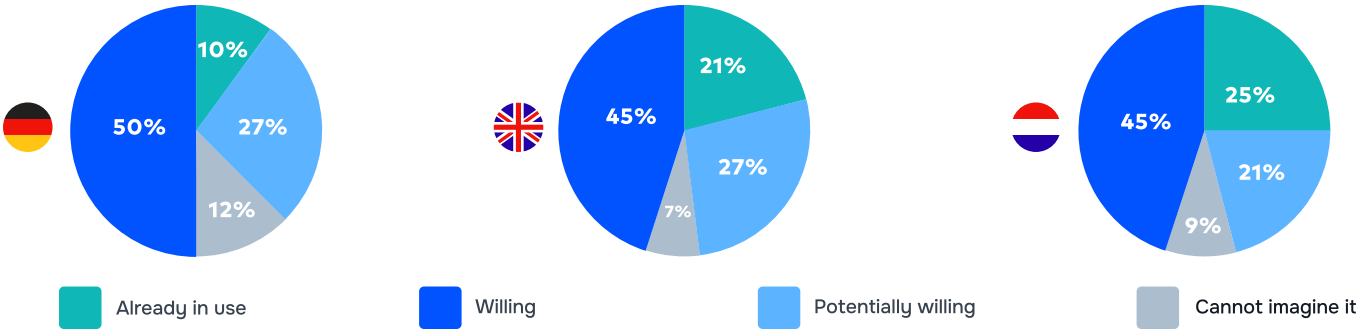
59% (very) interested and knowledgable

Willingness to cost-optimize their electricity usage (implicit)



Of the three countries surveyed, the UK has the highest share of respondents who already leverage implicit flexibility services (39%), and the lowest share of people who can't imagine using these services (4%) – showing that as market penetration increases, customer resistance declines. Confirming this, Germany has the lowest share of respondents who already cost-optimize their electricity usage (21%) and the highest share who can't imagine employing these strategies (10%). The fact that half of German respondents are willing to use these smart energy solutions shows that customer readiness is outpacing the rollout. The Netherlands has the highest combined share of respondents who are already using or willing to use implicit flexibility services.

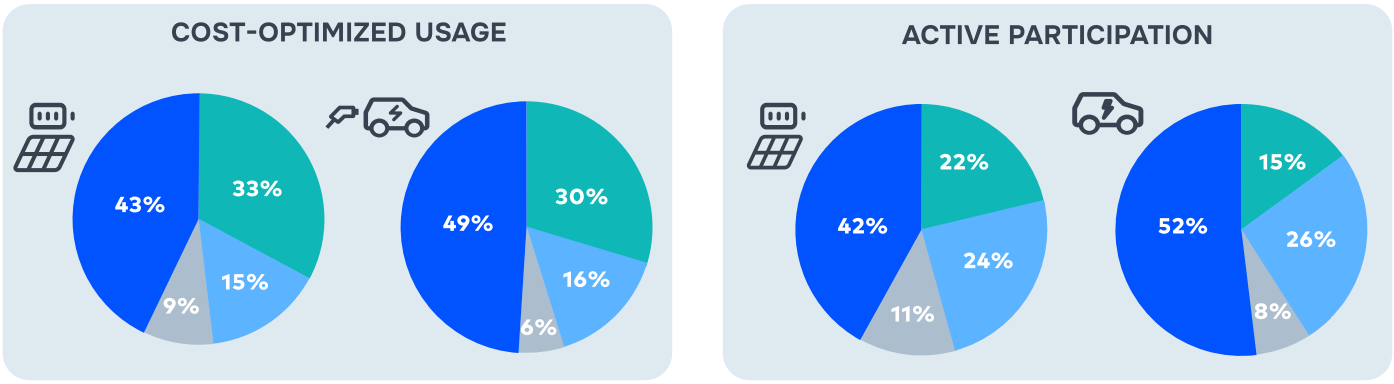
Willingness to actively participate in the energy market (explicit)



Generally, the share of respondents who cannot imagine using explicit flexibility services, or who are only potentially willing, is larger than for implicit flexibility services, likely reflecting higher skepticism towards the concept. Germany has a notably smaller share of respondents who are already using these solutions, while the Netherlands takes the lead in adoption. Once again, broader adoption (21% in the UK and 25% in the Netherlands) correlates to decreased customer aversion (7% and 9% who cannot imagine it, respectively). Germany once again has more polarized views with the highest share of willing participants, but also the highest share who cannot imagine it, likely reflecting lower familiarity.

PV owners currently more flexible while EV owners want to be

Willingness to participate in flexibility services according to energy asset



The survey shows that PV and battery owners have a higher tendency to already be participating in flexibility services, yet EV and charger owners show a higher willingness to take part. This shows the high potential of EV-only energy management use cases as an entry point, and the ability to later upsell users with additional assets to increase the attractiveness of flexibility use cases.

Barriers, benefits and features of flexibility services

TOP THREE CONCERNS (MULTIPLE ANSWERS POSSIBLE)

1. I don't want to give up control
2. The potential savings/value seem too small
3. I haven't fully understood the concept

TOP THREE REASONS FOR FLEX USE CASES (MULTIPLE ANSWERS POSSIBLE)

1. Reduce costs/receive reimbursement
2. Contribute to the energy transition
3. Retaining control over my devices

TOP THREE MOST IMPORTANT PRODUCT FEATURES (MULTIPLE ANSWERS POSSIBLE)

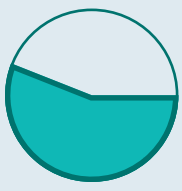
1. A credible and reputable provider
3. A low effort for setup and management
3. A user interface for easy overview and control

End users want savings, trust and control

The main reason for taking part in flexibility services is, unsurprisingly, money: both cost savings and revenue generation. But it isn't purely transactional, as over a quarter of users find flexible usage generally interesting, regardless of savings.

27%
Find flexible usage generally interesting, regardless of savings

56%
of EV drivers are fine with permanently connecting their car to a charger



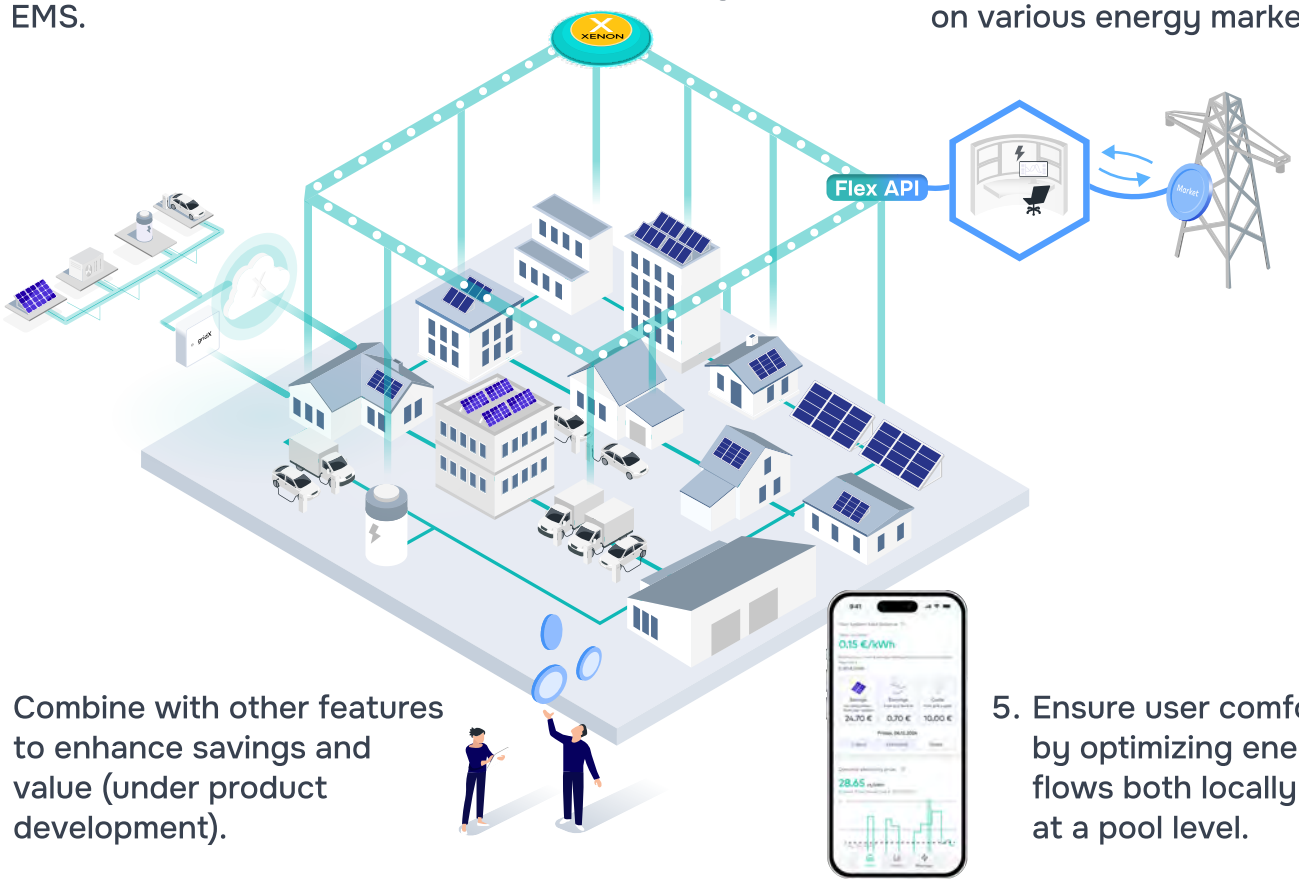
Users also don't want to give up control or lose comfort (e.g. cold water or an uncharged car), although the majority of EV drivers don't view permanently connecting their car to a charger as negative. This shows the importance of a smart EMS that takes different factors and priorities into account.

Users prioritize low effort, underscoring the importance of seamless installation and automated management. Finally, not everyone will be trusted to control energy devices. Users will ultimately opt for a credible provider that delivers advanced features, high security and quality service.

Unlock flexibility with XENON

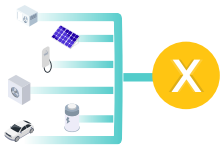
Residential flexibility holds enormous potential to operate the future energy system more sustainably, cost-effectively and reliably, and it all starts with a smart EMS. In fact, 84% of flexible power sources in 2035 will be addressable by XENON. Here's how you can benefit:

1. Integrate and control DERs (via cloud or local gateway) in one smart EMS.
2. Aggregate (and disaggregate) asset flexibility.
3. Interface with trading platforms via our Flex API to make flexibility available on various energy markets.



4. Combine with other features to enhance savings and value (under product development).
5. Ensure user comfort by optimizing energy flows both locally and at a pool level.

How does gridX make this possible?



With XENON Flex, gridX is able to act as an **aggregator** and provide grid balancing services and congestion management, as well as imbalance, day-ahead and intraday optimization for residential and e-mobility use cases.

Like most things in life, in energy "it takes a village" to make meaningful change. Delivering true energy flexibility requires the combined expertise of technology providers, market innovators, utilities and asset owners – each playing a vital role in shaping a smarter, more resilient energy system.

Cloud-to-cloud optimization as a low entry-point to flex

Cloud-to-cloud optimization presents a particularly fast and cost-efficient way to introduce flexibility offerings to end customers and quickly lock-in loyalty by generating revenue for them. By enabling direct cloud integrations with assets – without the need for additional on-site hardware – this approach reduces installation costs, simplifies logistics and lowers the barrier to entry.

gridX and E.ON have already installed thousands of cloud-to-cloud systems in the field that leverage the flexibility of electric vehicles.

"We are at a crucial turning point in electric vehicle adoption: systems must be implemented now to ensure EVs become an energy asset rather than a burden. The most cost-efficient solution is to make the energy from EVs available for trading via cloud-to-cloud optimization. This creates a win-win-win: EV drivers are compensated while their charging needs are secured; grid stability increases through added flexibility; and E.ON unlocks new revenue streams by leveraging customers' flexible assets.

XENON Flex from gridX enables this by pooling EV flexibility and connecting it to E.ON's trading arm. Pilot tests have already demonstrated the technology's vast potential, marking the first step toward a clean, stable energy system that benefits all."

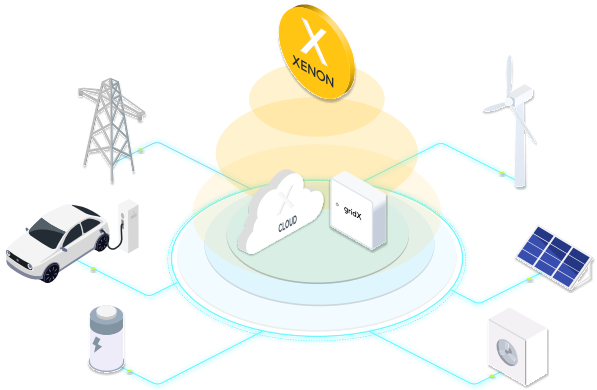
Jens Puknat
Head of E.ON Smart Control/iONA

e·on

Single-asset use cases as an entry point to upselling later

Cloud-to-cloud solutions are particularly effective for single-asset use cases, such as EVs, where integration can be rolled out quickly and at scale. Energy providers can test new flexibility services with minimal upfront investment, accelerate customer acquisition and expand their portfolios without the operational complexity of hardware deployment.

At the same time, this model enables easier scaling. Thousands of assets can be onboarded in weeks rather than months, supporting rapid growth in flexibility services across markets.



There are, however, trade offs to consider. Cloud-only setups offer slower reaction times compared to local control, and regulatory requirements in some markets still necessitate additional hardware. This makes cloud-to-cloud optimization an ideal entry point for utilities wishing to lock-in customers and then later advance their offering to include a local gateway for more sophisticated use cases.

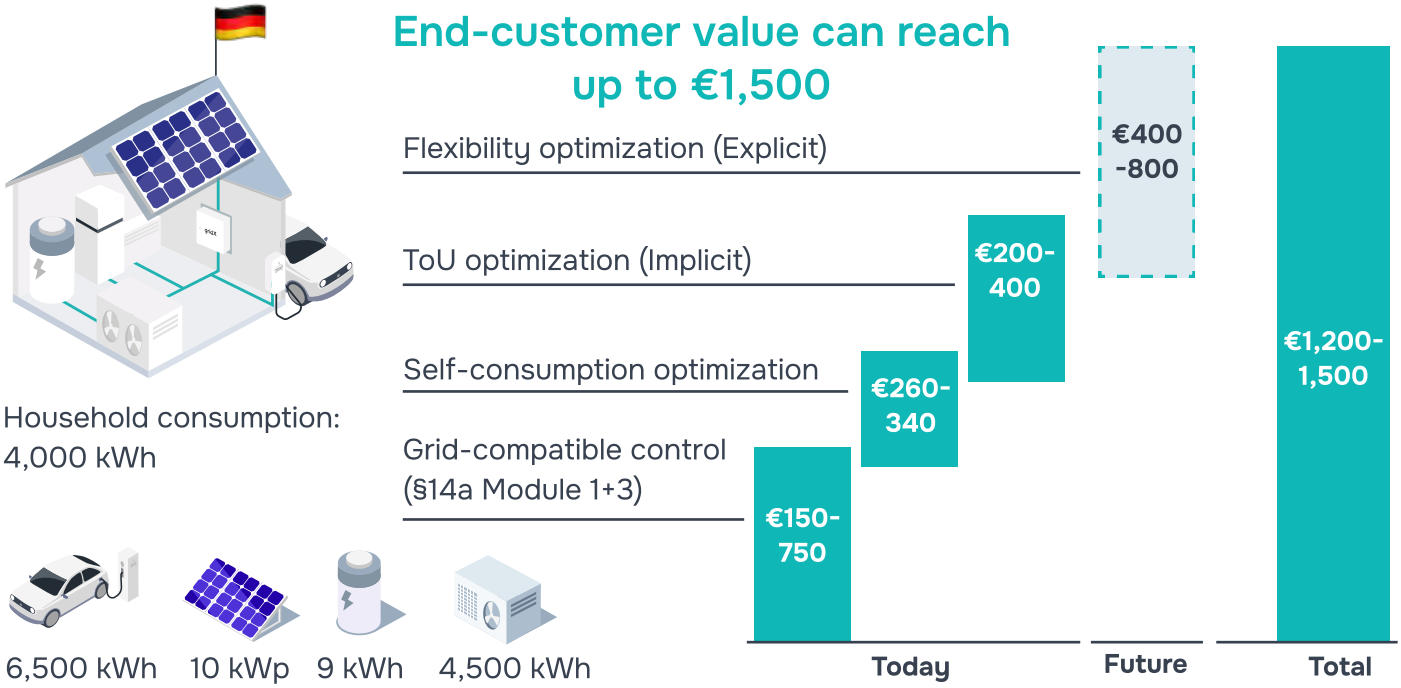
Maximizing savings by stacking value pools

Accessing the full savings potential for end customers revolves around value stacking, which is only possible with the addition of a local gateway. With the right energy management strategy, households can save money and actively support grid stability without ever compromising on comfort. With an advanced HEMS, everything happens automatically and in the background. Customers don't have to change their routines or lift a finger; the HEMS seamlessly manages when and how energy is used, ensuring they reap the benefits without even noticing.

Stacking value pools can save up to €1,500/year

- **ToU optimization** shifts consumption to cheaper hours.
- **Self-sufficiency optimization** increases the use of locally generated solar power.
- **Grid-compatible control**, such as that required under §14a EnWG, enables participation in flexibility schemes that help stabilize the energy system.

Stacking different value pools is the key to maximize financial value for end consumers



End customers benefit without compromising on comfort

Value stacking not only maximizes financial benefits for the end user, but also creates a win-win for the entire energy ecosystem. It ensures efficient use of DERs, improves grid stability and supports the broader integration of renewable energy – making every connected home an active contributor to the energy transition.

Turn complexity into opportunity

True flexibility starts with control. Yet across Europe, technical inconsistencies and fragmented standards continue to slowdown/block seamless device integration. gridX tackles these challenges head-on with real-world insight, rigorous testing and close collaboration with OEMs to ensure reliable, scalable control across all assets.

The challenges

- Constantly changing regulation adds complexity, and policy shifts make flexibility a must, e.g. §9 EEG, §34 MsbG and §19 EEG.
- Consumers are ready for flexibility services and willing to participate in energy markets to save (or make) money, but they don't want to lose control and they want a trusted provider.
- New markets gradually open up to encourage flexibility opportunities, but expansion into new markets remains challenging.
- The entry to flexibility solutions is high, requiring significant investments in time and money.
- Flexibility use cases are just one puzzle piece of a smart energy solution - users still want to be self-sufficient and need to be grid-compliant.

The gridX solution

- Stay compliant and on top of regulation with an adaptable and future-ready EMS that reduces development overhead.
- Build trust and reduce churn with transparent energy solutions that empower your customers to view trading activity and actively manage their consumption.
- Stay agile and roll out efficiently with a modular EMS proven in over 15 countries that can be adapted to local requirements.
- Start with a cloud-to-cloud solution to test user adoption and then grow and upsell as acceptance increases.
- Stack value and don't lose any opportunities: self-consumption optimization, dynamic tariff optimization, grid-compliant control and explicit flexibility services will soon be available in combination on XENON.

> "Our survey and increasing field experience confirm the trends in today's energy market: flexibility services are rapidly evolving from an innovation to a core component of any energy management solution. gridX is uniquely positioned to support B2B customers with the full spectrum of solutions covering connectivity, energy management and flexibility, and a range of go-to-market strategies. From a simple cloud-to-cloud approach for optimizing electric vehicles, to a gateway-plus-cloud approach for multi-asset households that want to combine grid-compliant control and flexibility use cases – this diversity ensures energy providers can maximize value for every end user."

Tim Steinmetz
Managing Director
gridX

gridX

The energy management system powering our flexible energy future.

About us

57+

Supported OEMs

Integrate energy devices from over 57 different manufacturers.

~180,000

Assets connected

An EMS built for future-proof scalability and adaptability.

99.95%

Guaranteed uptime

Industry-leading security and availability.

200+

Talented team members

Passionate and knowledgeable experts who Get. Shit. Done.

XENON: Your EMS for guaranteed success.

Want to become a gridX partner?
Scan the QR code to learn more or get in touch!

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