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WHITE PAPER SERIES

October 2025

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From Passive Consumers to Grid Heroes

Demand-Side Flexibility: The Next Building Block in Europe's Energy Transition

ABSTRACT

As Europe renewable energy surges to 42.5% of electricity generation, creating unprecedented grid instability and €4.2 billion in annual congestion costs, demand flexibility emerges as the game-changing solution. This white paper reveals how intelligent consumption scheduling could deliver €71 billion in annual consumer savings and eliminate 37.5 million tons of CO₂ emissions by 2030—yet 73% of EU households remain trapped in inflexible contracts. From Belgium's remarkable 81% dynamic pricing success to industrial thermal storage breakthroughs, the blueprint for transformation exists, but regulatory barriers and financing gaps threaten to derail Europe's demand-side flexibility ambitions.

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Introduction

With 73% of EU households trapped in fixed-price contracts that ignore grid conditions, demand-side flexibility offers consumers the opportunity to reduce electricity bills by 10-40% through optimized consumption timing. This market transformation could deliver €71 billion in annual savings while enabling Europe to exceed its 55% emission reduction target by 2030. Consumers remain largely unaware of these opportunities due to regulatory fragmentation and limited access to dynamic pricing contracts.

The European Union stands at a critical juncture in its energy transition. Europe races toward its 55% *emission reduction* target by 2030,¹ and climate neutral energy system by 2050. The rapid deployment of renewable energy sources, which reached 42.5% of EU electricity generation in 2025 and must expand to 69% by 2030,² has fundamentally changed the dynamics of the European power systems. Figure 1 presents the renewable electricity generation mix in the EU during Q1 2025, with wind power dominating at 42.5%, followed by hydroelectric (29.2%) and solar (18.1%).

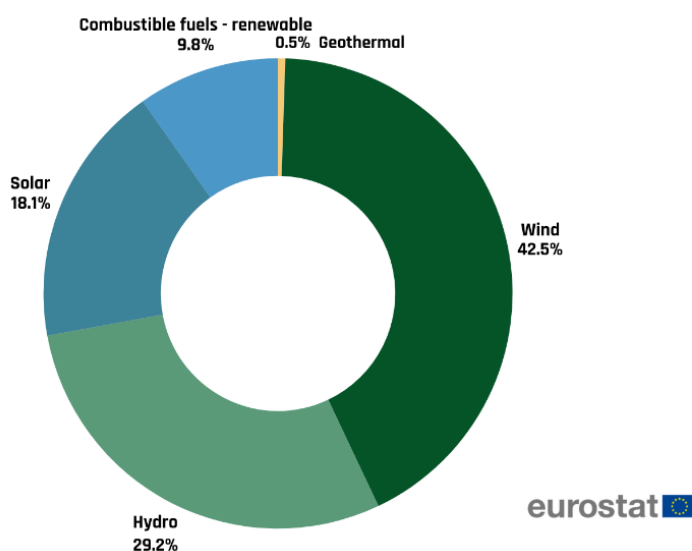


Figure 1. Renewable Energy Generation Sources in the EU in the First Quarter Of 2025.³

Unlike traditional power plants that generate electricity on demand, renewable energy sources can fluctuate by 50% within hours depending on the weather, creating imbalances that current and aging infrastructure cannot efficiently manage.

As Figure 2 shows, emissions intensity has halved since 1990, but this renewable-driven success creates unprecedented grid stability challenges.

¹ European Environment Agency, 2023

² Eurostat, 2025

³ ACER, 2024

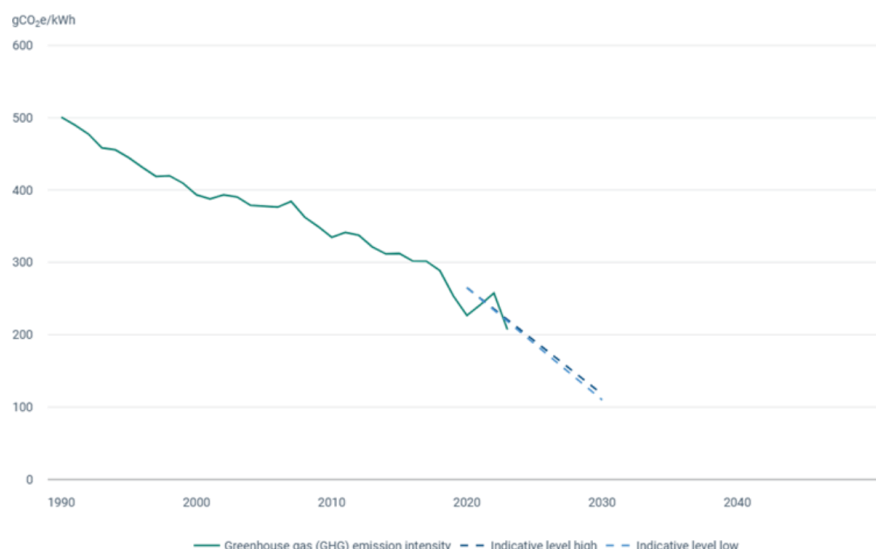


Figure 2. Greenhouse Gas Emission Intensity of Electricity Generation, EU Level. ⁴

What happens when the wind stops blowing across the North Sea just as millions of Europeans return home and switch on their evening lights? The consequences are already visible. Grid congestion, when electricity cannot flow from generation sites to consumption centres due to network limitations and the huge cost of managing grid congestion in the EU was €4.2 billion in 2023.⁵ It's time to reimagine how we consume energy, and this is the promise of demand flexibility.



The cost of managing grid congestion in the EU was EUR **4.2 billion in 2023.**



The range of average margins of capacity made available for trade in the day-ahead market was **30-70% in 2023.**



Grid congestion in the EU curtailed over 12 TWh of renewable electricity in 2023, causing additional **4.2 million tons of CO₂ emissions.**

Figure 3. EU Grid Congestion in Focus.

What is demand flexibility?

Demand flexibility revolutionizes how electricity systems operate. Rather than building ever-larger power plants and transmission lines to meet peak demand, it enables consumers to shift, reduce, or modulate their electricity use in response to grid conditions. The European Commission defines it as

⁴ European Environment Agency, 2023

⁵ ACER, 2024

"the ability of a customer to deviate from its normal electricity consumption profile, in response to price signals or market incentives".

This approach transforms passive consumers into active grid participants. Industrial facilities shift energy-intensive processes to off-peak hours. Buildings pre-cool or pre-heat when renewable energy is abundant. Electric vehicles charge when wind farms generate excess power.

The scale of Europe's flexibility challenge demands urgent action. The Joint Research Centre projects that flexibility requirements will more than double by 2030, reaching 24% of total electricity demand.⁶ By 2050, this figure rises to 30%, a sevenfold increase from today's levels. Without this flexibility, Europe cannot integrate the renewable capacity needed to meet climate targets.



Figure 4. 2030 Flexibility requirements.

As shown in Figure 5: Demand-side flexibility maximizes the value of existing generation and grid assets, reducing system costs while enabling consumers to actively engage in energy markets and benefit financially from their participation.

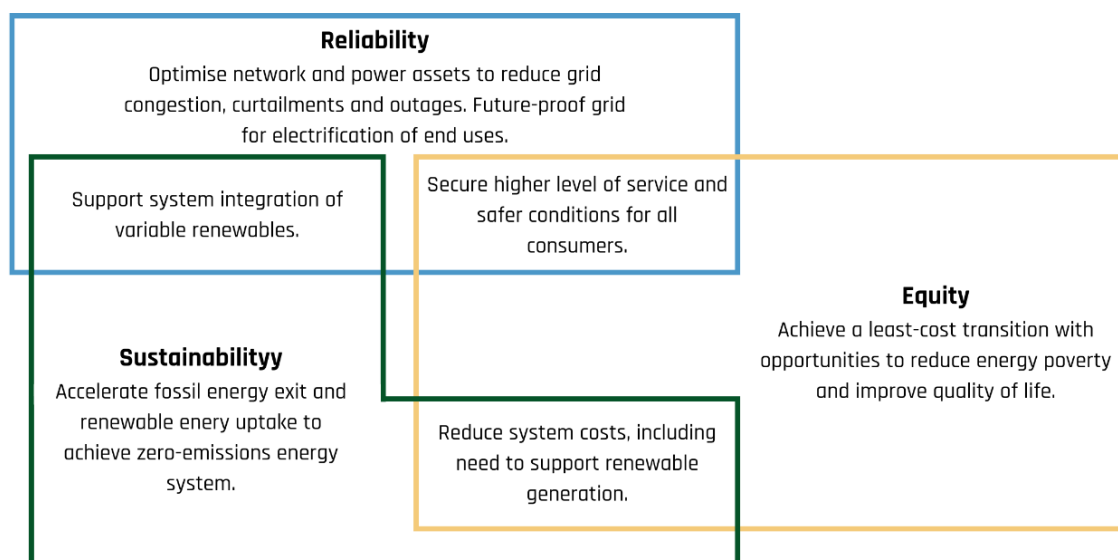


Figure 5. Demand-Side Flexibility Benefits.⁷

⁶ European Commission, 2023

⁷ RAP, 2022

Why do we need demand flexibility?

European electricity consumers across all sectors face mounting pressures from evolving consumption patterns and rising costs that demand flexibility can directly address. With 73% of EU household consumers locked into fixed-price contracts that provide no incentive to adjust consumption patterns, there is massive untapped potential to optimize when and how electricity is used.⁸ The rapid electrification wave is fundamentally transforming demand patterns, with 42 million new residential electrification assets expected by 2030,⁹ creating potential electricity bill savings of 10-40% through optimized consumption timing.¹⁰ Commercial buildings face substantial demand charges that can account for a major portion of monthly electricity bills, with demand flexibility solutions delivering peak demand reductions of 10-40% and total bill savings of 11-27%.¹¹ However, consumers across all sectors currently lack awareness of their flexibility potential and the financial benefits it offers, with limited access to dynamic pricing contracts that would enable them to respond to real-time price signals. As European consumers face continued electrification of transport, heating, and industrial processes, demand flexibility becomes essential not just for managing costs but for enabling active participation in the energy transition.

Quantifying unprecedented benefits

The transformative potential of fully activating demand flexibility across Europe is highlighted in the comprehensive analysis by DNV for smartEn. The study modelled flexibility deployment from buildings, transport, and industry under a scenario achieving 55% greenhouse gas reduction by 2030, comparing outcomes against a baseline without demand-side flexibility.

The results demonstrate benefits across multiple dimensions:

- €71 billion in direct annual savings for consumers through optimized consumption;
- 37.5 million tons (Mt) would be saved in annual GHG emission in EU;
- 15.5 TWh (61%) would be the avoided renewable curtailment;
- €11.1-29.1 billion in avoided grid infrastructure investments through better utilization.¹²



Figure 6. Potential of Demand-Side Flexibility Quantified.¹³

⁸ ACER, 2025

⁹ LCP Delta, 2025

¹⁰ Rocky Mountain Institute, 2015

¹¹ Rocky Mountain Institute, 2015

¹² EATON, 2025

¹³ EATON, 2025

From a commercial and industrial (C&I) lens, monetization pathways align with today's products—capacity and activation payments in system services, plus day-ahead/intraday/real-time arbitrage—consistent with €8 billion C&I capture estimate for 2030 within a €12 billion DSR market.¹⁴

Despite these compelling benefits, demand-side flexibility deployment remains limited by financing constraints and regulatory fragmentation.

The following analysis examines how engineering solutions, policy frameworks, and innovative financing mechanisms can accelerate demand-side flexibility deployment to meet Europe's climate imperatives.

Engineering Side of Demand Flexibility

Technical demand-side flexibility architecture integrates smart meter measurement, AI-driven control algorithms, and automated device responses to transform passive consumers into active grid participants.

The shift from traditional one-way grids to renewable-dominated systems with active participants requires fundamental technical transformation. Traditional grids operated simply: power plants generated, networks distributed, and consumers used. Today's renewable grid demands bidirectional flows, real-time coordination, and distributed intelligence. Demand flexibility operates through three integrated layers working in milliseconds to hours.

¹⁴ McKinsey, 2025

Technical architecture

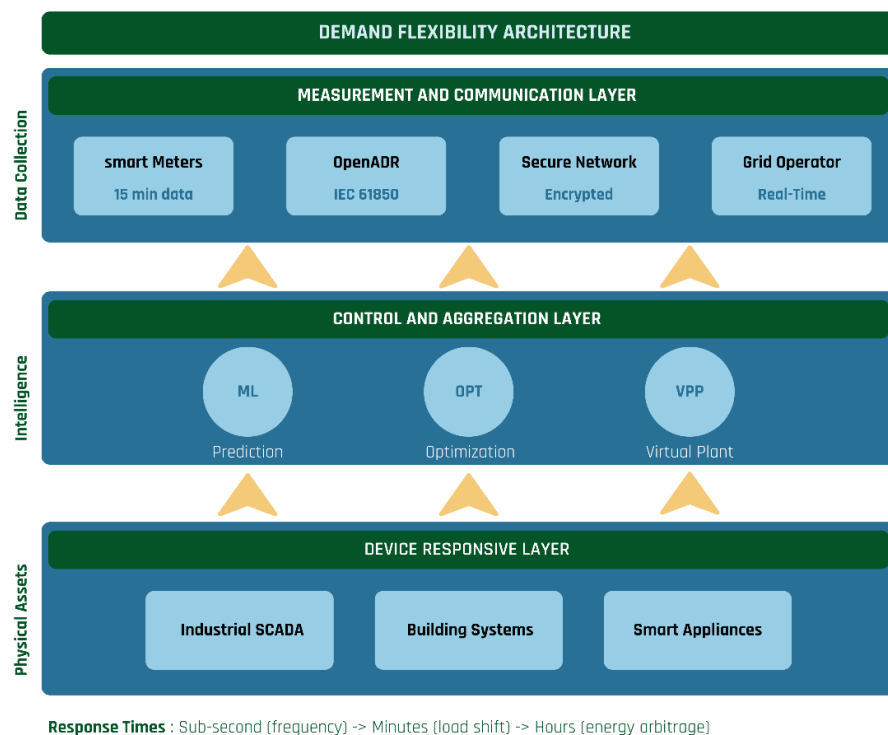


Figure 7. Demand flexibility architecture.

Measurement Layer: Smart meters capture 15-minute consumption data per EU regulations. Secure networks transmit millions of data points to grid operators, providing real-time visibility, which was previously impossible to achieve.

Control Layer: Machine learning algorithms predict flexibility from historical patterns, weather forecasts, and user behaviour. Optimization engines solve problems with 240,000+ variables, creating robust portfolios that deliver even when individual assets fail.

Device Layer: Industrial SCADA (Supervisory Control and Data Acquisition) enables sub-second frequency response. Building systems adjust HVAC (heating, ventilation, and air conditioning) based on price signals. Smart appliances shift consumption autonomously. Each sector requires different control mechanisms but contributes to the same grid stability goal.

Technical innovations driving scale

Four breakthrough technologies enable continental-scale flexibility:

- **Edge computing:** Local controllers respond in milliseconds without central commands, improving resilience.
- **Blockchain settlement:** Smart contracts execute instant payments when verified flexibility meets conditions.
- **Digital twins:** Virtual replicas simulate impacts before dispatch, preventing overloads.
- **IEEE 2030.5 standards:** Common protocols enable plug-and-play integration across vendors.

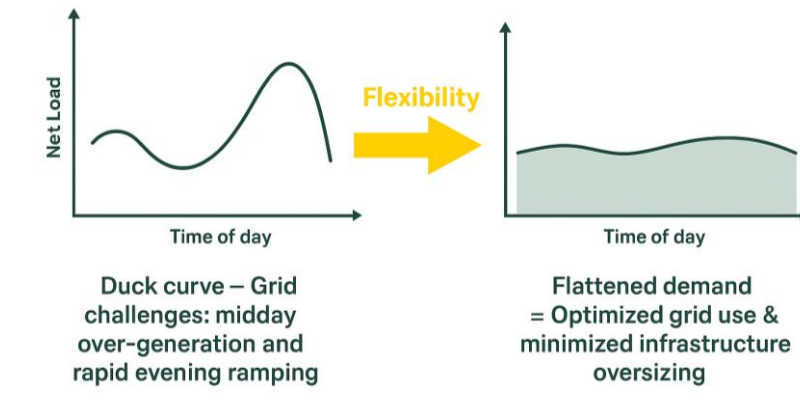
Grid impact metrics

Figure 8. Flexibility: Grid Impact Metrics.

Visualization demonstrates how flexibility transforms shifted demand peaks into smooth, manageable loads, eliminating waste while maximizing renewable integration and grid efficiency. The engineering transformation is complete: flexibility converts electricity from rigid commodity to responsive system, enabling the renewable future through orchestrated intelligence.

Decarbonization with flexibility

Demand flexibility has the potential to eliminate 37 million tons of CO₂ annually by 2030, equivalent to removing 8 million combustion-engine cars from the streets, through three mechanisms:¹⁵

- consuming renewable energy when produced prevents clean electricity waste;
- displacing inefficient fossil fuels-powered peaker plants that emit 40-60% more CO₂ per MWh;
- enabling sector coupling where renewable electricity directly replaces fossil fuels in heating and industry.

The European Commission's Clean Energy Package identifies flexibility as a "cornerstone technology" for the 55% emission reduction target, transforming consumers from passive emitters into active decarbonization agents.¹⁶

¹⁵ ENTSO-E Report, 2024

¹⁶ ENTSO-E, 2025

Legislative Applications – What Works and What Requires Further Improvements

While the European Union has established comprehensive legal foundations for demand-side flexibility, significant implementation failures across Member States prevent the full realisation of this potential, with only Belgium achieving remarkable success at 81% household dynamic contract uptake.

The market-ready technology, which transforms customers into decarbonization agents is not the only factor required for the success of demand-side flexibility. The legislative landscape for demand flexibility in the European Union presents a complex picture of ambitious frameworks hampered by inconsistent implementation. While the EU has established comprehensive legal foundations, significant barriers persist at the national level, preventing the full realization of demand flexibility's potential.

The cornerstone of EU demand flexibility legislation rests on the Clean Energy Package, particularly the recast Electricity Directive (2019/944) and Electricity Regulation (2019/943). These instruments mandate Member States to establish regulatory frameworks for active customers, market participants engaged in aggregation, and energy communities.¹⁷ The upcoming Demand Response Network Code promises to further clarify legal frameworks on aggregation models and establish requirements for baseline validation methods.¹⁸

Despite robust legislative foundations, recent monitoring reveals major implementation failures:¹⁹

- **Undefined Market Actors** - Multiple Member States have failed to implement roles and responsibilities into national legislation. Independent aggregators remain undefined in national rules across significant portions of the EU, creating uncertainty that discourages investment and innovation.²⁰
- **Market Access Barriers** - Many distributed energy resources remain legally prohibited from accessing energy markets due to restrictive regulations. Electric vehicles cannot participate in electricity markets absent clear regulatory definitions for energy storage. Current regulations in some EU regions prevent customers from adjusting energy usage in response to price signals.²¹ Market analysis confirms these regulatory challenges, showing that "market access is improving across most countries, but there remains significant work to do in five of the seven countries studied."^{22 23}
- **Pricing Mechanism Failures** - A staggering 73% of household consumers across the EU remain on fixed price contracts, insulated from price variations that would incentivize demand response, as depicted on Figure 9 below.²⁴ Fixed electricity price contracts

¹⁷ ACER, 2025

¹⁸ ACER, 2025

¹⁹ ACER, 2025

²⁰ ACER, 2025

²¹ ACER, 2025

²² These seven countries are: Belgium, France, Germany, Great Britain, Italy, Netherland, and Spain

²³ LCP Delta, 2025

²⁴ ACER, 2025

bundled into single sums obscure time-of-use signals and remove incentives for flexible consumption.

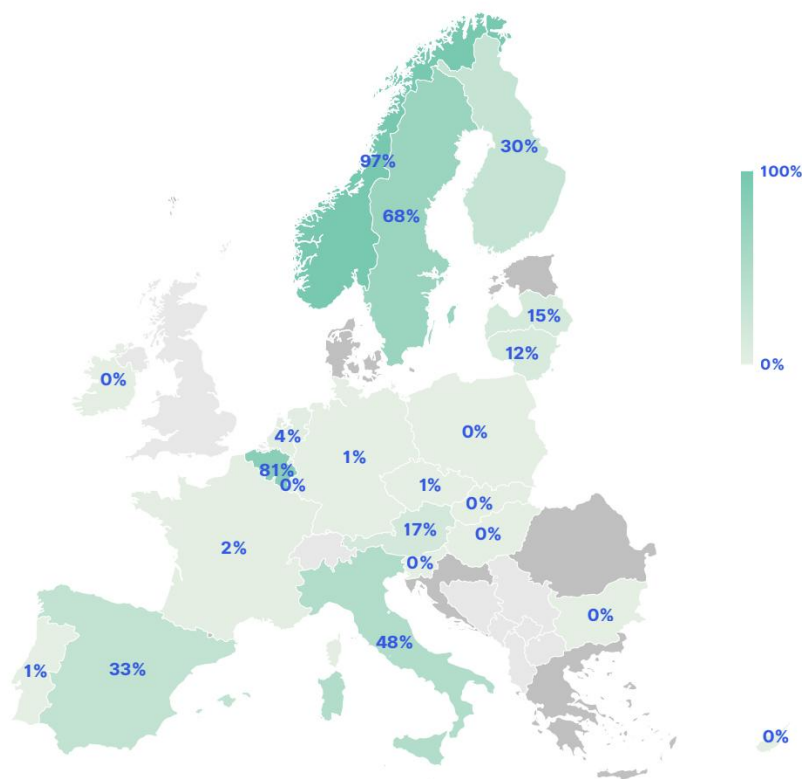


Figure 9. Percentage of Households with Dynamic Contract Uptake.²⁵

What Works: Success Stories and Best Practices

In spite of the limitations of the demand flexibility implementation on an EU-level, there are a few success stories, which ought to be treated as precedent and trailblazer examples for other European countries on the path of integrating the demand-side flexibility into the green energy transition, these are:

- Dynamic Pricing Leadership** - Belgium demonstrates remarkable success within the EU framework, achieving 81% household dynamic contract uptake, while Norway, as an EEA member with greater regulatory autonomy, has reached 97% household and 90% non-household uptake.²⁶ These examples illustrate different pathways to demand flexibility success, with Belgium proving that high adoption rates are achievable within EU legislative constraints. Belgium implemented comprehensive consumer awareness campaigns while working within EU consumer protection requirements, showing how Member States can "strengthen national measures to raise consumer awareness and mobilise flexibility" effectively.²⁷ While Norway's 97% achievement is impressive, its

²⁵ ACER, 2024

²⁶ ACER, 2025

²⁷ ACER, 2025

status as an EEA member rather than EU Member State provides greater regulatory flexibility in energy policy design.²⁸ As such Norway has been able to achieve near-complete smart meter rollout due to its centralized mandatory approach, unified technical standards, and minimal consumer resistance. Norway's success illustrates the potential for demand flexibility but could be challenging to be directly replicated by EU Member States bound by different regulatory frameworks and implementation requirements, the voluntary nature of the approach to the smart meter rollout, and the politicized debate on smart meters.²⁹

- Market Transformation Evidence** - Commercial data reveals rapid transformation in demand flexibility markets. Smart energy retail is experiencing explosive growth at 25%+ CAGR, with the shift from traditional to integrated smart energy retail currently at 6% of customers but projected to grow by a factor of at least three through 2030.³⁰ Demand-side flexibility capacity is growing at 38% CAGR, expanding from 20 GW in 2024 to a projected 100 GW by 2030, with growth "at an inflection point".³¹

Why is it then, that the success story of Belgium is not widespread, across the other 26 Member States? While there are plenty of reasons that are largely country specific, there are a few that overarch the EU, as depicted in the below Figure 10.

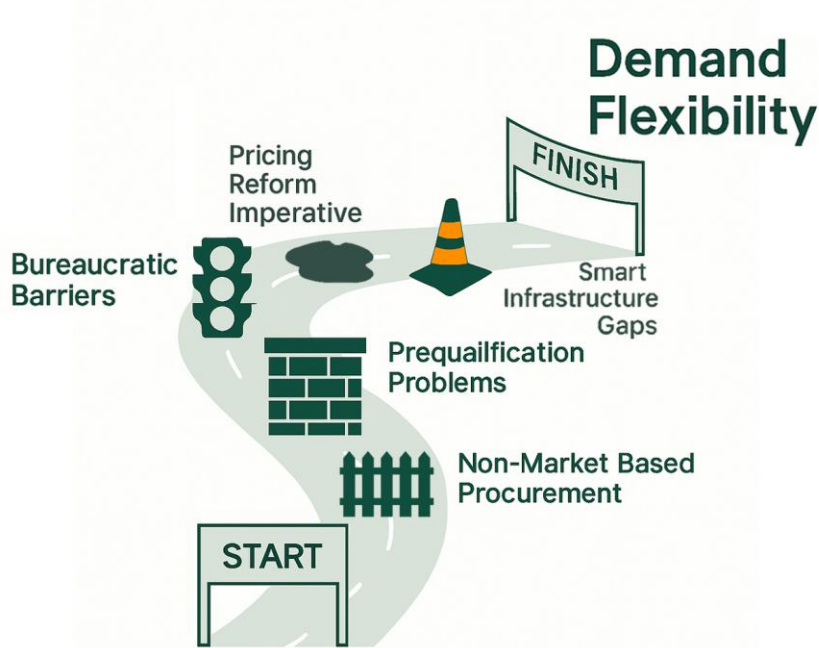


Figure 10. Steps for Successful Demand Flexibility Adoption.³²

²⁸ Sareen S., 2020

²⁹ Sareen S., 2020

³⁰ LCP Delta, 2025

³¹ LCP Delta, 2025

³² ACER-CEER, 2024

- **Bureaucratic Barriers** - Administrative burdens disproportionately affect smaller actors and new entrants. Lengthy procedures for acquiring licenses and approvals delay market entry, while discriminatory requirements favour established players over innovative technologies.³³
- **Prequalification Problems** - Large minimum eligible capacities exclude smaller providers from balancing services. Unit-level prequalification requirements prove particularly restrictive for aggregators managing large numbers of small assets, creating inefficiencies that undermine distributed resources' value proposition.³⁴
- **Non-Market-Based Procurement** - Several Member States rely on non-market-based procurement for frequency containment reserves, with inconsistent remuneration structures. This creates unpredictable market environments that deter investment in flexible resources.
- **Smart Infrastructure Gaps** - The EU's legislative framework recognizes smart metering as essential infrastructure, yet implementation remains inconsistent. Many countries lag in deployment and fail to establish supporting ICT services necessary for third-party access to real-time consumption data. Without comprehensive data platforms enabling authorized aggregators and energy service companies to access near-real-time consumption data, smart meters become expensive infrastructure with limited functionality. One fitting example is Germany, where rollout of smart meters remains at below 10% of all households – some of the lowest in the EU, comparable to only Czechia and Hungary.³⁵
- **The Pricing Reform Imperative** - Current market conditions create optimal opportunities for flexibility deployment, with 70% of days in 2024 showing electricity price variations over 50 €/MWh.³⁶ However, regulatory frameworks fail to capture this value. International experience shows demand flexibility can save 10-15% of potential grid costs in residential sectors, with customers reducing electric bills by 10-40% using existing technologies.³⁷ Market evidence supports this potential, with leading energy retailers following an "execute-engage-empower-collaborate framework" that integrates electrification, smart energy retail, and demand-side flexibility as increasingly intertwined value chains.³⁸

Legislative Improvement Recommendations

Not to dwell on what has been the reason for the approach to demand flexibility that fails to meet the needs of a just energy transition, there are a few legislative steps that can be applied to ensure that energy efficiency is taken on to the next level by maximizing the opportunities offered by demand flexibility across the Old Continent. These recommendations are the following:

- **Immediate Actions Required** - Member States must implement primary legislation aligning with Electricity Directive requirements and the upcoming Network Code

³³ ACER, 2025

³⁴ ACER, 2025

³⁵ ACER, 2025

³⁶ ACER, 2025

³⁷ Rocky Mountain Institute, 2015

³⁸ LCP Delta, 2025

provisions.³⁹ This includes establishing clear definitions for active customers, independent aggregators, and energy communities, complemented by detailed operational procedures.

- **Market Access Reform** - Regulatory frameworks must guarantee equal access for all distributed energy resources to wholesale electricity markets, including 15-minute product implementation. Administrative procedures should be consolidated through one-stop-shop approaches, with financial obligations scaled to participant size.
- **Pricing Mechanism Transformation** - National regulatory authorities should strengthen price signals through substantial peak-to-off-peak shifting incentives, while suppliers must expand time-differentiated contract offerings.⁴⁰ Net metering schemes that distort cost allocation require abolition.

The EU's legislative framework demonstrates remarkable ambition but suffers from substantial implementation gaps.⁴¹ Success requires moving beyond fragmented approaches toward comprehensive strategies recognizing demand flexibility as essential infrastructure for decarbonization. Legislative frameworks must evolve to support this transformation, ensuring regulatory barriers become enablers of innovation rather than obstacles to progress. The path forward demands coordinated action among all stakeholders to bridge the gap between legislative intent and practical implementation.

Success Stories – Residential & Industrial

Real-world demand flexibility includes Fortum's thermal batteries storing renewable energy for 13,000 Finnish homes and Octopus Energy revolutionising demand-side flexibility market in the UK and beyond.

While there are industries and processes whereby demand-side flexibility bears much higher potential costs than the benefits that come with the flexibility, among others glass production, pharmaceutical manufacturing or food sterilization. Majority of industry can benefit from demand-side flexibility without the equipment damage, safety hazards, regulatory violations, or product loss. Among many of these processes, the following can be highlighted:

- the highly energy heavy cement manufacturing plants can benefit from up to 16.9% energy consumption owing to demand-side flexibility choices;⁴²
- in aluminium smelting, application of variable voltage smelting pots allows for up to 20.7% energy consumption reduction by turning on and off the various pots, as the electricity prices change;⁴³
- drying and dying of textiles is shiftable in time, in line with electricity prices;
- refrigeration systems can pre-cool/freewheel for hours, shifting load without spoilage;
- recycling plant operations can take place during off-peak hours.

³⁹ ACER, 2025

⁴⁰ ACER, 2025

⁴¹ ACER, 2025

⁴² Golmohamadi H, 2022

⁴³ Golmohamadi H, 2022

Listing just a few of the industrial areas highlights the breadth of possibilities of the demand-side flexibility, and underlines that it is a crucial piece in the puzzle that is the green energy transition. To better understand what sort of projects, need to be scaled, a few of already implemented demand-side success stories are reviewed below.

Octopus energy: monetizing flexibility

Octopus Energy revolutionized the retail electricity market by transforming traditional fixed tariffs into dynamic flexibility products, proving that residential consumers can be profitable demand-side response participants.

Their flagship "Agile Octopus" tariff exposes customers to half-hourly wholesale prices, sometimes going negative when renewable generation exceeds demand. The flexibility mechanism: their IT platform Kraken automatically optimizes consumption for 1.8 million UK customers, shifting loads like EV charging and heat pumps to cheapest periods. Customers can reduce the cost by charging their EV by up to 70%, saving €830 through smart charging.⁴⁴ More than 300 thousand customer devices are managed globally, creating 1.9GW of flexible capacity to help balance grids and make better use of renewable energy.⁴⁵ The business model captures value across the entire flexibility chain. Octopus aggregates small residential loads into meaningful grid resources, selling flexibility services to grid operators while passing savings to customers.

Octopus's German expansion brings this flexibility model to Europe's largest market. This expansion arrives at a critical moment, because, as discussed above, Germany is one of the slowest EU Member states in terms of smart meter deployment. This infrastructure gap has historically blocked demand-side flexibility development. Octopus's entry, combined with Germany's 2025 mandatory smart meter rollout, has the potential to catalyse a more rapid implementation of this much needed technology.

Fortum Finland: District heating flexibility through massive thermal storage

Fortum transformed district heating from rigid baseload consumption into Europe's largest demand flexibility resource through thermal storage and power-to-heat technologies across the Nordic region.

In Espoo, Finland, Fortum is revolutionizing district heating by building an innovative electric-powered heat production facility. The €26 million project combines a 50MW electric boiler with an 800MWh thermal battery capable of storing heat for 13,000 homes' daily consumption, becoming operational in 2025-2026.⁴⁶

The system exploits time-variable electricity pricing, storing heat when renewable electricity is abundant and cheap, then discharging during peak demand periods. AI optimization coordinates this flexibility across Finland, Baltic countries, Poland, and Norway, responding to real-time grid signals. The two-way district heating network even purchases waste heat from customers, creating distributed flexibility resources.

The Fortum example shows how demand flexibility isn't just about reducing consumption during peaks, it's also about creating intelligent systems that can increase consumption when beneficial, store energy across time periods, and deliver services when needed while supporting grid stability.

⁴⁴ World Economic Forum, 2025

⁴⁵ Octopus Energy, 2025

⁴⁶ Fortum, 2024

2030 Vision: Demand Flexibility as Decarbonization Catalyst

Europe stands at a pivotal moment where demand flexibility capacity must undergo unprecedented five-fold growth by 2030 to unlock massive decarbonization potential while overcoming significant behavioural barriers to consumer adoption.

The above are just a few examples on where Europe finds itself today, it is standing at a critical juncture where demand flexibility will become indispensable for achieving ambitious decarbonization targets. By 2030, demand-side flexibility capacity is projected to experience unprecedented growth, expanding from 20GW in 2024 to approximately 100GW, a remarkable five-fold increase representing a 38% CAGR.⁴⁷ This dramatic scaling reflects the urgent need to manage increasing power market volatility as renewable energy penetration continues to accelerate, with volatility trending upwards as generation often exceeds demand during peak renewable production periods.⁴⁸

The decarbonization potential of widespread demand flexibility deployment is substantial. Comprehensive modelling by DNV demonstrates that full activation of flexibility from buildings, electric vehicles, and industry could deliver 37.5 million tons of annual greenhouse gas emissions savings by 2030, representing a 8% reduction that would help the EU exceed its 55% emissions reduction target.⁴⁹ This would be achieved through 397TWh of upward flexibility and 340.5TWh of downward flexibility, generating €4.6 billion in savings through reduced generation costs while avoiding 15.5TWh of renewable energy curtailment.⁵⁰ The system-wide benefits extend beyond emissions reduction, with consumers potentially saving €71 billion annually on electricity consumption while enabling €11.1-29.1 billion in avoided distribution grid investments.⁵¹

However, realizing this potential requires addressing significant behavioural limitations and social acceptance challenges that threaten to constrain deployment. Research identifies three primary behavioural barriers: lack of awareness about flexibility benefits, insufficient skills to process energy-related information, and status-quo bias driven by transaction costs and psychological inertia.⁵² Current customer segmentation reveals that while 9% of consumers are highly engaged "Leaders" and 30% are willing "Followers," 61% remain either cautious or indifferent to energy transition participation.⁵³ Overcoming these barriers necessitates comprehensive awareness campaigns tailored to different customer segments, transparent communication to build trust, and default opt-out mechanisms that reduce decision-making friction while maintaining consumer protection.⁵⁴

⁴⁷ LCP Delta, 2025

⁴⁸ ACER, 2025

⁴⁹ smartEn & DNV, 2022

⁵⁰ smartEn & DNV, 2022

⁵¹ smartEn & DNV, 2022

⁵² Florence School of Regulation, 2023

⁵³ LCP Delta, 2025

⁵⁴ ACER, 2025

Financing Gap of Demand Flexibility

Private capital, traditionally focused on large-scale energy infrastructure such as wind farms or solar parks, often struggles to assess the value and risk of demand flexibility solutions. These projects typically rely on aggregating thousands of distributed, small-scale assets with variable participation rates, operating within fragmented regulatory environments. This complexity challenges conventional infrastructure financing models.

While the broader European demand-side management market reached €18.9 billion in 2024 and is projected to grow to €54.6 billion by 2034,⁵⁵ demand response remains a relatively small segment. This is the paradox of demand flexibility, while it offers superior cost-effectiveness compared to traditional grid reinforcements, it continues to face financing constraints that limit its growth.

Barriers to private capital deployment

While infrastructure finance and asset-backed private credit have grown significantly across Europe,⁵⁶ investors in these asset classes have shown limited appetite for demand flexibility investments. The sector faces financing challenges compared to conventional energy infrastructure such as solar panels or wind turbines with more predictable revenue streams. Demand flexibility assets depend on aggregating numerous small-scale resources with variable participation rates, making it difficult for financial institutions to assess risks using traditional models.

A new class of investment opportunities is beginning to emerge, built on technology, aggregation, and smarter regulation.

Market-based solutions and investment opportunities

One solution worth highlighting is the Energy Service Companies (ESCOs) performance-based financing: installing smart technologies at no upfront cost to consumers in exchange for a share of the generated savings. These models align incentives across stakeholders and lower the entry barrier for households and SMEs alike. At the same time, initiatives such as SmartEn's demand flexibility monitoring are creating transparency, comparability, and standardization, all prerequisites for scalable institutional investment.

Demand flexibility enables deferred grid investments, CO₂ reductions, and cost savings for customers. With the right tools, demand flexibility can become a mainstream infrastructure asset, fit for ESG mandates and sustainable portfolios.

The more financing will demand flexibility projects receive, the stronger will be the investment case for demand flexibility's role in the decarbonization of Europe's energy system. For this to be made possible, there is a need to bridge the financing gap, by scaling proven technologies to unlock not only grid stability, but also a new era of consumer-driven climate impact.

Solas Capital specializes in debt financing of energy efficiency and decentralized renewable energy projects. Solas aims to broaden its project portfolio to connect demand-side flexibility initiatives with institutional investors pursuing climate-aligned returns.

⁵⁵ Research and Market, 2025

⁵⁶ Funds Europe, 2025

About Sebastian Carneiro

Sebastian Carneiro is the Chief Executive Officer and Co-founder of Solas Capital AG, a specialised investment advisory firm that pioneers financing solutions for decentralised energy efficiency and behind-the-meter assets across Europe. Sebastian has over 15 years of experience in project finance, including his previous role as Director at Europe's largest private energy efficiency fund. As a CFA Charterholder and engineer by trade, Sebastian is driven by developing innovative investment solutions that accelerate the deployment of green assets and make the energy transition a reality.

About Julia Sokołowska

Julia Sokołowska is an Investment Analyst at Solas Capital AG, where she manages a range of investment activities. She completed her MA in International Development with a Specialization in Sustainable Finance at the Geneva Graduate Institute; she also holds a BA in Environmental Studies and International Relations from Wellesley College in the USA. She brings experience in sustainability and climate change governance in the IGO and NGO sectors. Julia is a CAIA Charterholder.

About Marie Kubitza

Marie Kubitza is an engineer working at Solas Capital AG. She holds a dual academic background, having completed an engineering degree specialized in Renewable Energies, alongside a master's in international finance from Nova School of Business and Economics. Her interdisciplinary profile reflects her commitment to accelerating the energy transition through scalable, data-driven approaches.

About Solas Capital

At Solas Capital we provide specialised financing solutions for demand-side energy projects, bridging the gap between institutional investors and high-impact energy efficiency projects. Unlike traditional renewable energy investments focusing on supply, we specialise in reducing energy demand at scale—an often-overlooked but equally important pillar to reach Net-Zero.

We prioritise the building sector—responsible for 40% of Europe's energy consumption—and industrial efficiency, providing capital to project developers to offer zero upfront cost solutions. Our team of experts structures funding solutions for distributed energy transition projects across Europe, delivering cost savings while reducing fossil fuel dependence.

Our asset-backed private credit strategy offers investors fixed-income like returns from EU Taxonomy eligible assets while accelerating Europe's transition to a carbon-neutral economy. We firmly believe that the best energy is the energy we don't use.

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Disclaimer

This white paper is a marketing document which intends only to provide a general overview of investment strategies of energy efficiency and distributed renewable energy investments. This document is not intended to be, nor should it be construed or used as an offer to sell, or a solicitation of any offer to buy any securities, which offer may only be made at the time a qualified offeree receives a confidential final private placement memorandum describing the offering (the "issue document"). In the event of any conflict between information contained herein and information contained in the issue document, the information in the issue document will control and supersede the information contained herein. The information herein is not intended to provide, and should not be relied upon for accounting, legal or tax advice or investment recommendations. You should make an independent investigation of the information described herein, including consulting your tax, legal, accounting or other advisors about the matters discussed herein. Some figures may refer to the past or simulated past performance and past performance is not a reliable indicator of future results. Some figures maybe forecasts only and forecasts are not a reliable indicator of future performance. The information provided in this document have not been independently verified. The information contained herein is provided for informational purposes only, is not complete, and does not contain certain material information about Solas Capital and the presented investment strategies, including important disclosures and risk factors associated with the strategies. There can be no guarantee that the presented investment objectives or results -comparable or not to past performance -will be achieved.

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