

Policy Brief

# A Diamond in the Rough:

How Energy Consumption Data Can Boost Artificial  
Intelligence Startups and Accelerate the Green Transition



By David Osimo and Anna Pizzamiglio



### **About the EDDIE consortium**

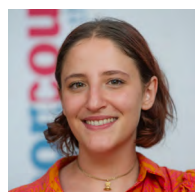
This policy brief builds on the research carried out for the European Distributed Data Infrastructure for Energy (EDDIE), an 18-partner consortium co-financed by the European Union. EDDIE introduces a decentralised, distributed, open-source data space, in alignment with the efforts of the EU smart grids task force, the implementing acts on interoperability and other European initiatives. It has received co-funding by the European Union's Horizon Europe programme under grant agreement No. 101069510. For more, visit <https://eddie.energy/>.

## Policy Brief

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### About the authors

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The views expressed in this policy brief are those of the authors alone and do not necessarily represent the view of the members of the European Distributed Data Infrastructure for Energy (EDDIE) consortium, the companies featured in the study (Flexidao, Ento and UtilityAPI), the European Commission or any of their associates.

Over the last months, the European green deal has been under attack. Hard right-wing parties that have fared well in the 2024 elections accuse it of jeopardising the competitiveness of European industry and adding costs for businesses and citizens alike. On top of that, the war in Ukraine has had a tangible impact on energy prices, energy security and inflation. This sets the stage for a heated, zero-sum political debate, pitting advocates of state intervention and protectionism against proponents of the free market, isolationism against enlargement, competitiveness against the green transition. These tensions were addressed by President Von der Leyen in her address to parliament when she reiterated that Europe “sticks to the targets of the European Green Deal with pragmatism, technology-neutrality and innovation.”

But when we step aside from ideological debates, it is possible to identify policy priorities that can deliver results for the green transition without conducting to ideological confrontations. One such priority is improved access to energy consumption data.

Already today, energy consumption data are crucial to many energy system needs and policy objectives: ensuring the safe and secure operation of the energy system, create a single energy market across borders, managing distributed energy resources (DERs) and integrating green energy, certifying that energy is genuinely green, increasing energy efficiency and growing a thriving cleantech sector. Needless to say, their importance will drastically increase

with the use of artificial intelligence (AI), which is expected to bring radical improvements to energy efficiency and massive business opportunities.

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***‘Energy consumption data are crucial to many energy system needs and policy objectives’***

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Accordingly, the European Commission has proposed several forward-looking regulatory interventions designed to make it easy for

consumers to access and share energy data with third parties. It has launched a wide range of initiatives to make this right effective and actionable for such third-party service providers, such as the European Distributed Data Infrastructure for Energy (EDDIE), the consortium that promotes cross-border data interoperability and supports this policy brief. As the new Commission comes into effect, this policy brief argues that Europe should complement its pioneering effort on regulating data access and data sharing with a similar effort on the demand side of energy data, promoting data reuse by businesses and favouring the emergence of new technologies, such as AI applications and machine learning use cases, supporting the net zero objective. Energy consumption data reuse should become a priority not only in energy policy, but also in Europe’s cleantech and innovation agenda. On the one hand, EU industrial policy is focusing on the manufacturing of clean technologies through the Net Zero Industry Act, on the security of supply of critical raw materials in the Critical Raw Materials Act and on the protection against potential future energy price shocks via the electricity market design reform. Simultaneously, due attention should also be paid to data analytics and machine learning, which are expected to drive a thriving cleantech ecosystem in Europe and deliver on the green deal, as shown by the case studies included in the paper. To achieve this goal, the paper identifies a set of policy recommendations:

- Increase the focus on user experience when developing standards for data and consent management

- Cultivate the ecosystem of cleantech startups using consumption data
- Reinforce data stewardship to foster scalable reuse
- Clarify GDPR with regard to legal basis for data sharing and processes for consent management
- Remove barriers to the single market to allow cleantech startups to scale across Europe

## What are Energy Consumption Data and Why Do They Matter?

The energy supply chain produces many sorts of data, all of which are helpful and important. Policy analysis typically draws on aggregated data from sources like the International Energy Agency (IEA) or Eurostat, focusing on national or regional energy production and consumption. Traditionally, these data have been gathered and estimated based on the information coming from, among others, energy suppliers, transmission and distribution system operators.

However, the advent of smart meters and the Internet of Things (IoT) makes orders of magnitude more data available, such as energy consumption of individual households, or energy storage of in-house batteries. The decentralisation of the digital revolution and the electrification of the economy have led to a proportional growth of metering points on energy.

As in many other areas of the data economy, more granular and timely data is not only a matter of greater precision; it paves the way for entirely new products, services and business models. Consider, for instance, how the availability of granular data on consumer preferences has transformed the advertising and media landscape.

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***‘More granular data is not just about greater precision; it paves the way for entirely new products’***

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To be clear, granular energy data sharing does not necessarily mean real-time sharing, where information about a consumer switching on a washing machine would be immediately forwarded to a third party. However, even with near real-time and more granular data – with data points typically gathered every 15 or 30 minutes – the implications can be huge. For example, a recent study showed that using hourly consumption data instead of weekly or annual can make the difference between zero-emission hydrogen and hydrogen that emits more than traditional fossil fuels.<sup>1</sup>

Such a trove of energy consumption data can make a significant difference when it comes to several policy goals.

They support further integration of the single market for energy. Near real-time data help in balancing supply and demand over a wider geographical area across borders, in optimising the use of generation assets, and in reducing the overall cost of electricity. They play a key

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<sup>1</sup> See Wilson Ricks, Qingyu Xu, and Jesse D Jenkins, “Minimizing Emissions from Grid-Based Hydrogen Production in the United States,” *Environmental Research Letters*, 18.1 (2023), 014025.

role in ensuring grid stability by forecasting demand and managing the flow of electricity across borders to prevent overloads and outages.

They help integrate green energy and to make use of demand side response. Integrating a high share of intermittent renewable energy sources, like solar and wind, into the electricity grid requires sophisticated grid management techniques. Access to more granular consumption data allows grid operators to balance supply and demand more effectively, enhancing grid stability and efficiency. Operators can determine the best times to store excess electricity produced from renewables and the optimal times to release it back into the grid, thus mitigating the variability of renewable energy sources. In addition, the sharing of energy consumption data facilitates the integration of distributed energy resources, such as solar panels and battery storage, into demand response programmes. These resources can be managed to supply energy during peak times.

Consumers can share their consumption data with specialised services that can recommend solutions and pricing models that best match their consumption behaviour. For instance, based on a consumer's energy use patterns, specific renewable energy solutions like rooftop solar panels or participation in community solar projects might be recommended. This level of transparency in terms of consumption can drive behavioural changes, leading not only to greener choices and savings for consumers, but also lower production costs for companies – a fundamental component of competitiveness.

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***'Access to energy data, if done correctly, has the potential to enable the creation of a thriving cleantech market'***

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Last but not least, access to energy data, if done correctly, has the potential to enable the creation of a thriving cleantech market – just as the revised Payment Services Directive (PSD2) revolutionised the fintech market. There

are many energy startups that can use consumers' consumption data to deliver innovative services. AI, in particular, is expected to drive substantial energy efficiency gains throughout the economy, potentially creating a market worth over €100 billion by 2030. It is crucial that Europe is well positioned in this industry too.<sup>2</sup> The following case studies dig deeper into these opportunities and related challenges.

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<sup>2</sup> For the PSD2 directive, see Directive (EU) 2015/2366 of the European Parliament and of the Council of 25 November 2015 on payment services in the internal market, amending Directives 2002/65/EC, 2009/110/EC and 2013/36/EU and Regulation (EU) No 1093/2010, and repealing Directive 2007/64/EC. For estimates on AI in renewable energy market, see Precedence Research, Artificial Intelligence (AI) in Renewable Energy Market Size and Companies, October 2023.

# Case Studies

## Enhancing Energy Efficiency and Cost Savings with Artificial Intelligence: The Ento Case

Globally, the buildings sector, which includes energy used for constructing, heating, cooling and lighting homes and businesses, as well as the appliances and equipment installed in them, accounts for over one third of energy consumption and emissions.<sup>3</sup> In the European Union, buildings are responsible for 40% of energy consumption. Around 85% of buildings were built before 2000 and amongst those, 75% have a poor energy performance.<sup>4</sup> Improving the energy efficiency of buildings is therefore key to saving energy, reducing bills for citizens and small enterprises, as well as achieving a zero-emission and fully decarbonised building stock by 2050.

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*‘Energy consumption data is pivotal for achieving energy efficiency’*

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To boost the energy performance of buildings, the European Union has established a legislative framework that includes the revised Energy Performance of Buildings Directive (EU/2024/1275) and the revised Energy Efficiency Directive (EU/2023/1791). However, the positive effects of these recent policies, initiatives, and energy-saving programmes, alongside significant investments in advancing more efficient technologies, are not always immediate; improvements in efficiency and reductions in energy intensity often take years to materialise.

An additional strategy to support the decarbonisation of the buildings sector involves using comprehensive, near real-time energy consumption data to optimise energy use. But how effective is it to leverage data analytics to enhance energy efficiency? What is the underlying logic behind addressing energy inefficiencies through data-driven methods?

The IEA and the European Commission emphasise that energy consumption data is pivotal for achieving energy efficiency and supporting the transition to a sustainable energy system. The IEA highlights that near real-time data allows for better demand forecasts and the optimisation of energy use through connected devices and automated controls, which can significantly enhance energy efficiency and reduce peak loads.<sup>5</sup>

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3 United Nations Environment Programme, “Sustainable Buildings and Construction,” United Nations Environment Programme website. [Online] <https://www.unep.org/topics/cities/buildings-and-construction/sustainable-buildings#:~:text=The%20buildings%20sector%20%E2%80%93%20which%20includes,cent%20of%20energy%20demand%20globally.>

4 European Commission, “Energy Performance of Buildings Directive,” European Commission website, 2024. [Online] [https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive\\_en](https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en).

5 See Jeremy Sung, Monica Troilo, Nicholas Howarth, “Better Energy Efficiency Policy With Digital Tools,” International Energy Agency, 06 August 2021. [Online] <https://www.iea.org/articles/better-energy-efficiency-policy-with-digital-tools> and Pauline Henriot, “Unleashing the benefits of data for energy systems,” International Energy Agency, 12 May 2023. <https://www.iea.org/commentaries/unleashing-the-benefits-of-data-for-energy-systems>.

# How Ento Works and How It Can Help

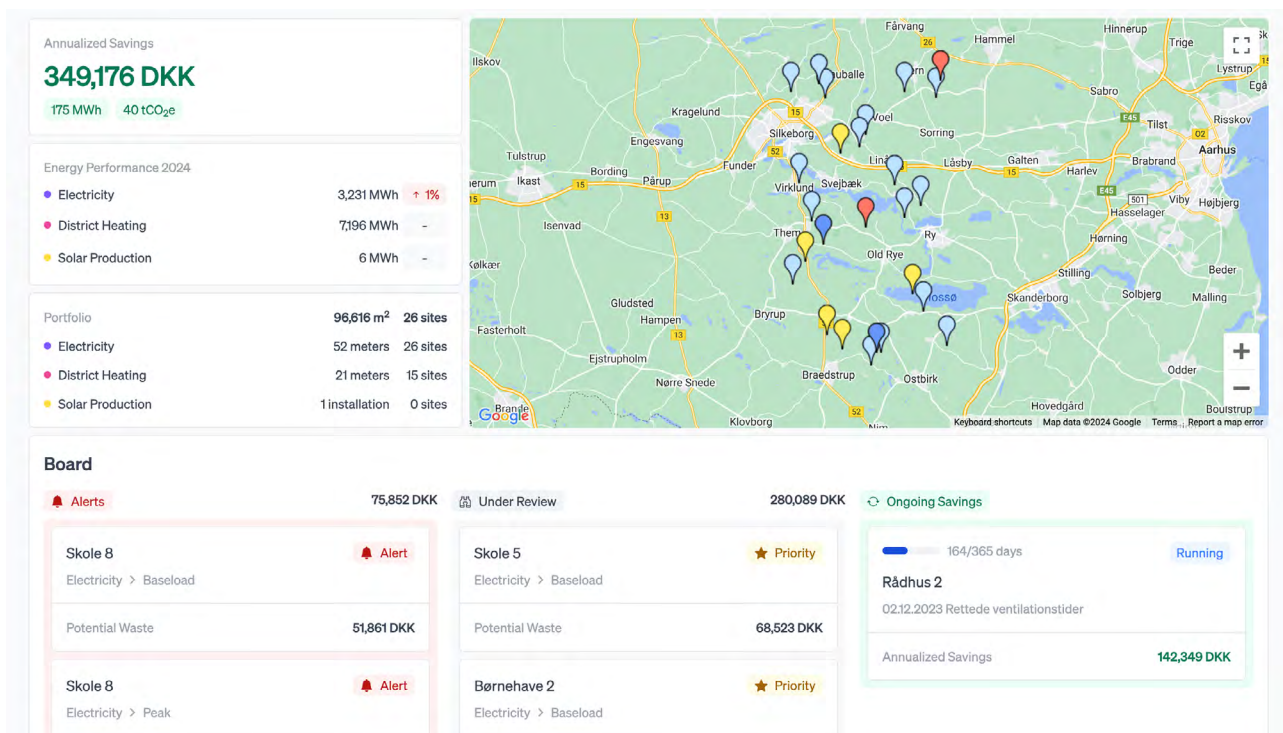
Ento specialises in optimising energy use by leveraging detailed, energy consumption data. Founded by Henrik Bink, Kasper Bjørn Nielsen and Malte Frederiksen, Ento utilises data from around 20,000 buildings in Denmark, representing 10% of the country's total energy consumption. This access allows the company to develop advanced analytics for energy optimisation, specifically targeting large building owners and businesses. It is important to note that Ento's success builds on the smart use of the Danish national energy data hub, DataHub, owned and operated by Energinet, the Danish national transmission system operator for electricity and natural gas.

Ento's approach combines the analysis of granular energy data with predictive analytics to optimise energy use across multiple facilities. By integrating data from various sources, including public datasets like weather and geographical information, Ento provides tailored recommendations for energy savings. Its technology relies on cloud infrastructure, ensuring compliance with the data protection requirements of the General Data Protection Regulation (GDPR).

## Technological Approach

Ento employs a sophisticated technological approach to optimise energy consumption for buildings, integrating advanced algorithms and predictive analytics. At the core of its solution is a set of algorithms designed to understand and analyse a building's energy consumption patterns. This data-driven approach involves collecting detailed energy data from existing utility meters, which is then enriched with additional information such as weather conditions and specific building attributes.

Figure 1. Screenshot of ENTO energy optimisation AI tool





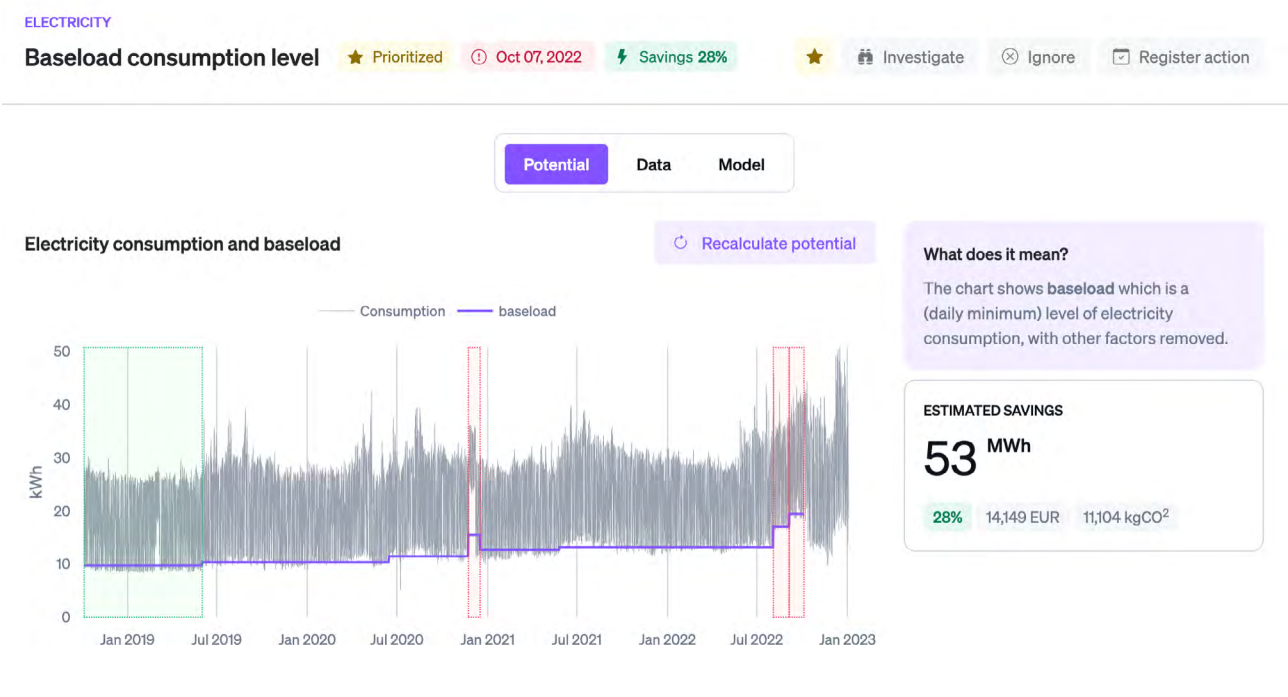
Once the data is gathered, Ento’s system uses predictive analytics and machine learning models to identify the most effective energy optimisation measures. These measures are automatically prioritised based on their potential impact and return on investment (ROI) and the recommendations are presented to building owners or operators. This prioritisation ensures that clients can focus on the most cost-effective and impactful actions first.

After implementing the recommended measures, Ento’s virtual advisor continues to monitor energy consumption to document and confirm the actual savings. This continuous monitoring is crucial, as it provides continuous feedback and allows for adjustments to be made to further optimise energy use. The documented savings and performance data can also be used to support sustainability managers within organisations, providing valuable insights for corporate social responsibility (CSR) reporting and sustainability initiatives.

*‘Ento’s virtual energy advisor assists clients throughout their entire journey towards zero-emission buildings’*

Ento’s virtual energy advisor assists clients throughout their entire journey towards zero-emission buildings. While the initial focus is on the easiest and most efficient solutions, the advisor can also support more comprehensive energy optimisation strategies over time. The company believes that in the near future, virtual energy advisors will become indispensable tools for implementing energy optimisation measures.

**Figure 2. Screenshot of ENTO digital advisor for electricity**



## Impact and Success Stories

Ento's approach has led to significant energy savings and efficiency improvements for its clients. For example, one of the key insights from its data analysis is that approximately 10% of buildings have a suboptimal configuration, leading to unnecessary energy use. By addressing these inefficiencies, Ento helps clients reduce their energy consumption and operational costs. Additionally, its solutions often include recommendations for installing renewable energy systems, further enhancing sustainability.<sup>6</sup>

The company successfully collaborated with one Denmark's largest retail banks, Arbejdernes Landsbank in Kalundborg, to achieve significant energy savings. By leveraging energy consumption data, the bank optimised its energy use and implemented efficiency measures, resulting in annual savings of 67%. This remarkable achievement was made possible through detailed data analysis, which identified inefficiencies and provided actionable insights for improvement.

Municipalities and regions form a significant part of Ento's client base, with around 30% of its customers coming from the public sector. A notable example is the collaboration with the Danish municipality of Hjørring. With 64,000 inhabitants, Hjørring has very ambitious climate goals. By 2030, the municipality wants to reduce its CO<sub>2</sub> emissions by 86% compared to 1990. To reach this objective, the municipality's energy managers are using Ento's AI-based software solution. Having started with 145 sites in December 2022, the municipality successively added more buildings to the platform over time. Today, it manages 152 buildings with an annual electricity consumption of 9,092 MWh with the help of Ento. By harnessing detailed energy consumption data, Ento identified inefficiencies in the municipality's energy systems, including heating and lighting. The implementation of tailored

optimisation strategies led to substantial energy savings, which translated to financial savings of DKK 1 million per year. The municipality's overall energy use decreased significantly, demonstrating the efficacy of real-time data analysis in achieving large-scale energy and cost efficiency for public sector operations.

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***'Such optimisation strategies led to substantial energy and financial savings'***

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Ento's work with these entities demonstrates the potential for large-scale impact through public-private partnerships.

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<sup>6</sup> For a deeper understanding of their specific projects and success stories, refer to the detailed case studies on the Ento website: <https://www.ento.ai/resources/cases>.

## Challenges and EDDIE's Added Value

While Ento's model is highly effective within Denmark, expanding to other European countries presents challenges. Each country has unique regulatory and data access hurdles. For instance, in Spain, accessing energy data requires specific identification numbers and in the United Kingdom, data must be sourced from third-party providers. Despite these challenges, Ento is actively working to integrate data from various sources across Europe, including Italy, where they are developing APIs to streamline data access.

Looking ahead, Ento plans to expand its services to smaller businesses and residential markets. It is also exploring partnerships with utilities to enhance its offering and potentially move towards a business-to-consumer (B2C) model. EDDIE is anticipated to play a significant role in supporting these expansion efforts by providing a common consent-management interface for data sharing across Europe.

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***‘Expanding to other European countries proved difficult because of different regulatory and data access hurdles’***

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# Streamlining Clean Energy Integration: The UtilityAPI Case

The integration of DERs such as solar panels, wind turbines and battery storage systems into the energy grid is critical for the green transition. However, it presents significant challenges. Effective management and optimisation of these resources are essential to ensure grid stability and efficiency. Virtual power plants (VPPs), which aggregate DERs, rely on precise demand response mechanisms and comprehensive site assessments to operate effectively.

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***‘The primary challenge of Virtual Power Plants is managing and integrating data from various sources’***

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The primary challenge in VPP uptake is managing and integrating data from various sources, often in near real-time. This data is crucial for forecasting output, controlling generation capacity, and making informed decisions about contract negotiations and price setting.

Accessing standardised energy data for VPPs is complex and often fraught with interoperability issues. Utility data is typically fragmented across different providers and formats, making it difficult to compile and analyse

effectively. This hampers the efficiency of VPPs and obstructs the broader deployment of clean energy technologies, ultimately slowing down the green transition.

## How UtilityAPI Works and How It Can Help

UtilityAPI is the software US industry leader in providing secure, standardised, authorised access to utility data. Founded in 2014 by Daniel Roesler to fight climate change, the company offers a simple, fast, automated solution for sharing utility customer bills and interval data with explicit customer consent, revocable at any time. Historically, energy efficiency service providers spent dozens of hours compiling and organising customer usage data in order to propose appropriate technology solutions; UtilityAPI’s software collects the data in an instant. This time saving streamlines the sales process for clean energy companies, allowing them to provide clean energy solutions faster and more cheaply. It is estimated that companies using UtilityAPI’s services save almost seven million kilograms of CO<sub>2</sub> emissions every month.

As a testament to UtilityAPI’s success, in 2022 the company announced Series A funding of \$10 million, led by Aligned Climate Capital. “Data access shouldn’t be a roadblock to clean energy deployment,” said Aligned Climate Capital CEO Peter Davidson. “UtilityAPI solves this challenge by making it quick and easy for clean energy companies and utilities to share data, while still protecting consumer privacy.”<sup>7</sup>

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<sup>7</sup> ESG News, “UtilityAPI Raises \$10 million in Series A Funding Led by Aligned Climate Capital,” *ESG News*, 17 May 2022. [Online] <https://esgnews.com/utilityapi-raises-10-million-in-series-a-funding-led-by-aligned-climate-capital/>.

UtilityAPI focuses on four main areas:

- Site assessment
- Market settlement
- Energy management
- Rebate access

This specific case study focuses on how UtilityAPI supports market settlement.

By facilitating the integration of energy consumption data into VPPs, UtilityAPI ensures accurate demand response and efficient site assessments. This data is critical for matching energy generated by DERs with demand, aiding in market settlement, reducing discrepancies and enhancing stakeholder trust. Standardised data and interoperability enable VPPs to anticipate and respond to energy demand fluctuations more effectively, balancing supply and demand, preventing grid overloads and optimising energy use.

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***‘Such data is critical for matching energy generated by Distributed Energy Resources with demand’***

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### ***Technological Approach***

UtilityAPI utilises various types of granular energy data to enhance its services:

- Interval consumption data from smart meters and monitoring devices provides information on energy use patterns.
- Historical consumption data, collected over time, helps in understanding long-term trends and is crucial for accurate forecasting and planning.
- Generation data about energy produced from renewable sources is essential for matching supply with demand in VPPs.
- Site-specific data includes detailed information about the physical characteristics of a site, such as geographical location, climate conditions, and existing infrastructure, which is vital for site assessments.
- Additionally, demand response signals, including the timing and scale of load reductions or increases, help in managing grid stability and optimising energy distribution.

UtilityAPI uses an advanced technological approach to manage and utilise these different types of energy data. The platform offers several key features:

- **Data standardisation and interoperability:** UtilityAPI standardises energy data from various sources into a consistent format, making it interoperable across different systems and platforms. This ensures that data from multiple utilities and meters can be seamlessly integrated and used for analysis and reporting.

- **Green Button Connect:** UtilityAPI provides a Green Button Connect certified solution, which is an international standard for providing third-party data access to utility customer data. This ensures safe, secure, and standardised data exchange, compliant with industry standards.
- **API integration:** The platform includes a fully documented API that can be integrated into existing software systems, both for internal tools and customer-facing platforms. This allows for automated data retrieval and integration into various applications, facilitating real-time data access and analysis.
- **Performance reporting:** UtilityAPI's platform enables third parties to submit performance data automatically to meet reporting requirements. This feature supports ongoing monitoring and validation of energy consumption and generation data, which is essential for market settlement and regulatory compliance.
- **Data security and privacy:** UtilityAPI ensures that all data exchanges are consent-driven, 100% encrypted, standards-compliant, and fully auditable. This guarantees the privacy and security of customer data, which is crucial for maintaining trust and compliance with regulatory requirements.
- **Flexible licensing and customisation:** The platform offers flexible licensing options and can be customised to meet the specific needs of different users, including utilities, community choice aggregators (CCAs), and utility vendors. This flexibility allows for tailored solutions that can adapt to various market and regulatory environments.

## Impact and Success Stories

The use of interval and meter data from UtilityAPI has demonstrated significant benefits. For VPPs, enhanced grid stability and optimised energy use lead to efficient and reliable operations, while accurate matching of generated energy with demand prevents waste and improves overall energy efficiency. In addition, the platform's ability to provide standardised, Green Button Connect certified data is essential for direct marketing contracts such as Virtual Power Purchase Agreements (VPPAs). VPPAs rely on this data to manage their balancing

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***‘Virtual Power Purchase Agreements rely on this data to validate consumption and generation data’***

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responsibilities, monitor connection points, validate consumption and generation data for settlement, and market Certificates of Origin efficiently.

One notable success story is UtilityAPI's collaboration with various stakeholders in deploying clean energy technologies.

Its platform has enabled more precise and timely decision-making, leading to substantial energy savings and efficiency improvements. By addressing inefficiencies and providing actionable insights, UtilityAPI has helped clients reduce energy consumption and operational costs, further supporting the green transition.

## Lessons from UtilityAPI's Success in the United States

UtilityAPI exemplifies how access to detailed energy consumption data can drive significant improvements in energy efficiency and cost savings. By leveraging real-time data for both demand response in VPPs and conducting accurate site assessments for clean energy technologies, UtilityAPI supports the efficient and effective deployment of clean energy solutions. This not only aids in achieving energy efficiency and grid stability but also promotes the broader adoption of renewable energy sources, contributing to a more sustainable and competitive energy landscape in the United States. As Europe strives for a greener future, companies like UtilityAPI can serve as an example of how to leverage data to achieve sustainability and competitiveness goals.

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***‘UtilityAPI exemplifies how access to detailed energy consumption data can drive significant improvements in energy efficiency and cost savings’***

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# 24/7 Carbon-free Energy Matching and Green Certificates: The Flexidao Case

Within the energy landscape, particularly amongst commercial and industrial energy consumers, the concept of 24/7 carbon-free energy matching (24/7 CFE) and granular carbon accounting is gaining momentum.<sup>8</sup> The United Nations describes 24/7 CFE as ensuring "that every kilowatt-hour of electricity consumption is met with carbon-free electricity sources, every hour of the day, everywhere".

Studies have demonstrated that global adoption of 24/7 CFE practices would accelerate grid decarbonisation, enabling deeper reductions in CO<sub>2</sub> from electricity consumption compared to current energy procurement practices.<sup>9</sup> Increased demand for carbon-free energy sources during periods when wind and solar energy cannot provide supply will drive investment in other generation technologies and battery storage solutions. As a result, more and more

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## ***'Global adoption of 24/7 CFE practices would accelerate grid decarbonisation'***

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companies are establishing sustainability goals based on 24/7 CFE, with initiatives like the Climate Neutral Data Centre Pact, an example of the efforts of large energy buyers to achieve ambitious greenhouse gas reductions.<sup>10</sup>

Despite the clear benefits of 24/7 CFE, several system barriers need to be overcome for its global adoption:

- Achieving 24/7 CFE is a complex challenge due to the intermittent nature of renewable energy sources like solar and wind, which do not generate power consistently throughout the day or year. This variability leads to gaps where demand may exceed the available renewable supply.
- There is a lack of comprehensive tracking tools to match energy consumption precisely with renewable generation. This is mostly due to a lack of access to interval meter data for both production and consumption facilities.
- There is no harmonised regulatory framework to support 24/7 CFE matching. Globally, different regions and countries have varying regulations and standards for energy attribute certificates (EACs), making it difficult to implement a consistent and reliable system.<sup>11</sup> For example, implementation of the European Union's Guarantee of Origin (GO) scheme varies across member states, complicating the standardisation and harmonisation of EACs.<sup>12</sup>

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8 The United Nations, "24/7 Carbon Free Energy Compact," 2022. [Online] [https://www.un.org/sites/un2.un.org/files/2021/10/24-7cfe\\_compact\\_-\\_v2\\_updated.pdf](https://www.un.org/sites/un2.un.org/files/2021/10/24-7cfe_compact_-_v2_updated.pdf).

9 Ibid. 1, and Qingyu Xu, Aneesa Manocha, Neha Patankar and Jesse Jenkins, "System-level Impacts of 24/7 Carbon-free Electricity Procurement," (2021) Zero-carbon Energy Systems Research and Optimization Laboratory, Princeton University, Princeton, NJ.

10 The Climate Neutral Data Centre Pact is a pledge of industry players and trade association of cloud infrastructure services and data centres in Europe to achieve climate neutrality by 2030. Website: <https://www.climateutraldatacentre.net/>.

11 The production, trade/distribution and consumption of renewable energy can be electronically documented and tracked with Energy Attribute Certificates (EACs). With these certificates, companies can claim the environmental benefit of renewable energy production for their own electricity consumption. EACs do not represent the electricity itself (they are usually unbundled from the production), but are contractual instruments to convey information about the produced electricity such as the type of power plant (e.g., hydropower plant, wind power plant, solar plant), the actual power plant where the renewable electricity was produced (e.g., the name of the plant, location) and the actual amount of electricity produced (unit is one megawatt hour (MWh) of renewable electricity).

12 A Guarantee of Origin (GO) is an energy certificate defined in article 19 of the European Directive 2018/2001/EC (previously in article 15 of the European Directive 2009/28/EC). A GO certifies attributes of electricity, gas (including hydrogen), heating and cooling, especially coming from renewable sources, and provides information to energy customers on the source of their energy. Guarantees of Origin are the only defined instruments evidencing the origin of electricity generated from renewable energy sources.



## How Flexidao Works and How It Can Help

Flexidao, a cleantech startup founded in 2017 and based in Amsterdam and Barcelona, provides data and digital solutions to help energy buyers track, monitor and manage their clean energy portfolios effectively and efficiently. Its platform can be used to monitor energy consumption on an hourly basis, ensuring that the electricity consumed is matched with renewable generation. Flexidao's technology supports organisations in achieving genuine carbon neutrality by ensuring reliable and verifiable carbon-free energy operations, whilst also helping them overcome operational challenges like data collection and consolidation.

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***‘This combination of data, verification and analytical tools provides a solution for 24/7 CFE certification’***

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Flexidao has secured significant funding to support its mission. In July 2022, the company raised \$6.5 million in a Series A funding round led by SET Ventures, with participation from Google, the Microsoft Climate Innovation Fund, and existing investor EIT InnoEnergy. This funding will drive the rapid scaling of Flexidao’s platform across the United States and Europe. Both Google and Microsoft are not only investors but also customers of Flexidao, using the technology to support their targets of 100% 24/7 carbon-free electricity by 2030.

Flexidao’s customer base includes other large companies like Vodafone, Iron Mountain Data Centers, Dutch Rail, and many more. Since 2017, Flexidao has been enhancing its data collection capabilities as an eligible party in different regions and integrating into different types of data sources (datahubs, DSOs, Data Aggregators, Suppliers, BRP, etc.), mainly within European and US markets. Additionally, it has collaborated with several major energy firms, such as Iberdrola and Acciona, to guarantee the renewable origin of green hydrogen<sup>13</sup>. The company’s innovative approach has earned it recognition, including being listed in the top 100 of the Startup Energy Transition (SET).

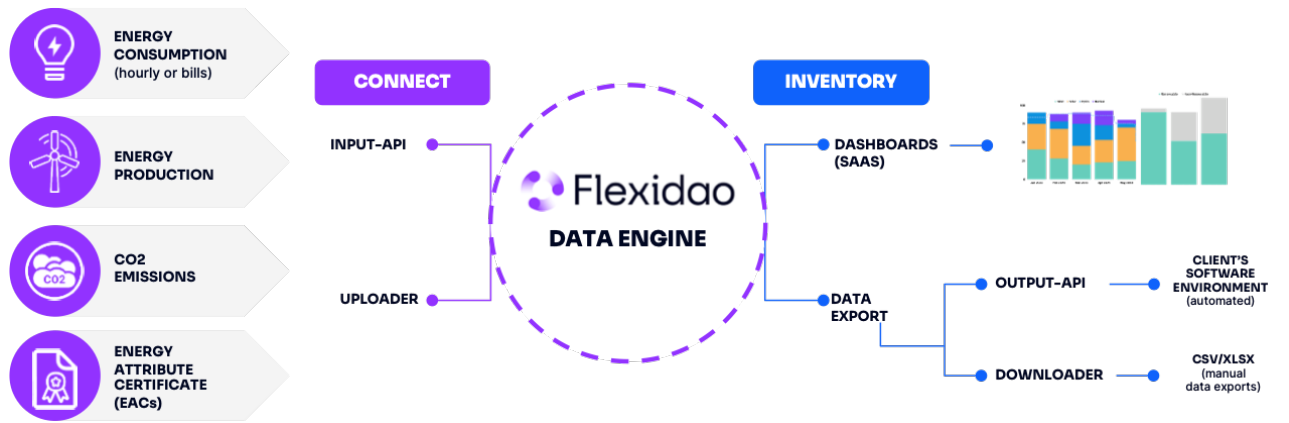
### **Technological Approach**

Flexidao’s technological approach integrates smart metre data, advanced technology and data analytics. By connecting with smart metres, Flexidao's platform gathers detailed data on energy consumption and generation. This data is processed to create an immutable record of energy transactions, ensuring data integrity and transparency. The platform also provides tools for analysing and visualising energy data, helping businesses understand and optimise their energy use patterns. This combination of data, verification and analytical tools provides a comprehensive solution for achieving 24/7 CFE certification.

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<sup>13</sup> Giacomo Bravaccini, “Green Hydrogen: How to Guarantee its Renewable Origin,” *Flexidao Blog*, 02 February 2023. [Online] <https://www.flexidao.com/resources/green-hydrogen-how-to-guarantee-its-renewable-origin>.

**Figure 3. Scheme of how Flexidao works**



Flexidao works with various datasets, including interval and billing data for both consumption and production, EAC-related data (i.e., cancellations and available balances), and CO<sub>2</sub>-related data (i.e., average emissions, marginal emissions, residual mix).

Sources for these data include:

- Consumption meter data: direct integrations, Distribution System Operators (DSOs)/ utilities, centralised models, decentralised models, and sometimes suppliers.
- Production meter data: direct integration with suppliers/schedulers, centralised and decentralised models with production data available, and in some regions, open-source solutions.
- EACs: suppliers, direct integration with registries.
- CO<sub>2</sub> data: typically obtained from third-party providers or public datasets, such as the residual mix published annually by the Association of Issuing Bodies (AIB).

Flexidao’s software solution is its CFE Inventory Tool, a centralised platform for electricity contract and certificate data management. The software supports data collection and management services, either automated or manual, for energy consumption, production, and emissions on an hourly or monthly basis. It also provides easy-to-understand visualisations and quick data exports.

***‘The software provides easy-to-understand visualisations and quick data exports’***

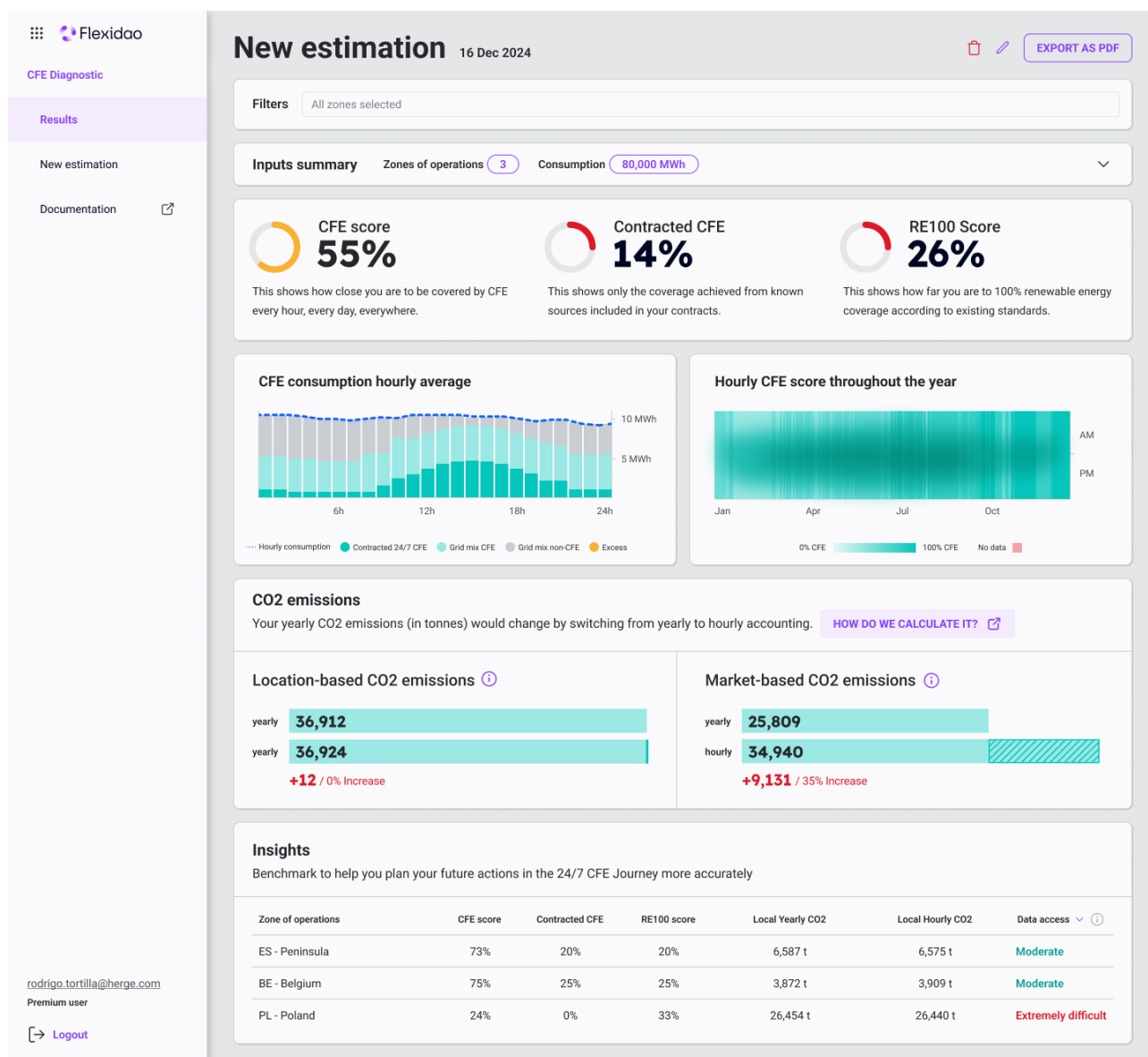
Flexidao’s platform also offers granular Scope 2 monitoring and inventory management tools, which help businesses manage their EAC

portfolios, ensuring that volumes received from contracts match the expected volumes based on meter and invoice data.

Lastly, Flexidao provides advanced intelligence for carbon-aware energy procurement, allowing businesses to match production and consumption data according to EnergyTag’s guidelines and compare the performance of 24/7 CFE contracts against current annual reporting standards.<sup>14</sup> Flexidao’s tools also provide insights into the status of the grids on an hourly basis, enabling businesses to adjust their loads and identify gaps in their procurement strategy. This level of granularity and accuracy in data management and reporting is crucial for businesses aiming to achieve 24/7 CFE certification.

*‘Flexidao provides advanced intelligence for carbon-aware energy procurement’*

**Figure 4. Screenshot of Flexidao CFE platform**



<sup>14</sup> EnergyTag is a non-profit organisation that sets a voluntary standard for hourly matching and Granular Certificates. It does not, however, issue or sell Granular Certificates or perform any demonstration tracking projects, nor does it develop dedicated software. Website: <https://energytag.org/>.

## Impact and Success Stories

### Google Case Study

Google has set an ambitious goal of operating on 24/7 CFE globally by 2030. To achieve this, the company plans to scale the use of Time-based Energy Attribute Certificates (T-EACs or Granular Certificates) across its global carbon-free energy portfolio. T-EACs enable the validation of clean energy generation and trading on an hourly basis.

Google faced the challenge of gathering and retiring EAC and hourly meter data across its global portfolio into one platform to generate T-EACs. Neither the energy data nor the integration mechanism were standardised, making the collection process tedious.

Flexidao collaborated with Google to automate the data collection: they collected hourly emission factors and used Flexidao's dashboards to display relevant charts and KPIs for decision-making and reporting, including an inventory of renewable energy contracts, associated energy certificates, and emissions.

Flexidao and Google piloted 24/7 CFE tracking in Denmark, Ireland and the Netherlands in 2021. Building on the success of the pilot, the collaboration is expanding to fully digitise and automate hourly tracking and incorporate T-EACs across Google's global carbon-free energy portfolio.

## Challenges and EDDIE's Added Value

Data collection and integration are complex and vary significantly across regions. Flexidao has been gathering data from different regions, utilising diverse data sources such as data hubs, DSOs, data aggregators, suppliers, and Balancing Responsible Parties (BRPs). However, each region presents unique complexities, including different standards and protocols for data exchange, such as EDIFACT, XML, and JSON, and varying formats like power values in kW versus energy values in kWh.

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***‘Another significant challenge is obtaining customer consent and authorisation for data access’***

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Another significant challenge is obtaining customer consent and authorisation for data access. In some regions, online authorisation via portals suffices, while others require signed authorisation letters, further complicating and delaying data access. The lack of

standardisation and the need to adapt to various protocols and infrastructure requirements demands significant investment in time and resources from energy service providers, making the integration process both costly and labour intensive.

EDDIE will offer substantial value in addressing these challenges. It aims to provide a decentralised platform for accessing meter data from multiple regions. This will streamline the integration process by reducing the need for individual integrations and extensive testing as well as simplifying the maintenance of existing integrations and potential changes at the data sources. By standardising data formats, EDDIE will make data management and utilisation easier for energy service providers, allowing them to focus on optimising their services rather than on the technicalities of data integration. Furthermore, EDDIE will reduce integration efforts by offering predefined requirements for data retrieval from various region connectors, thereby streamlining the process for eligible parties. Its support for automated data collection processes will enhance the efficiency and timeliness of data access, addressing the resource constraints faced by service providers. EDDIE will also enhance the user experience by providing clear guidelines and procedures for customer authorisation, making the consent process more accessible and efficient.

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***‘By standardising data formats, EDDIE will make data management and utilisation easier for energy service providers’***

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# Policy Recommendations: How to Accelerate the Transition from Regulation to Innovation

In the last 10 years, European data policy has aimed to provide newcomers and third-party data reusers with access to data to promote competition among data holders: this was the case for analytics startups and civil society using open government data in directive 37/2013 on the reuse of public sector information as well as for fintech providers using account data held by banks as per directive 2015/2366 on payment services. The rationale is that such competition drives efficiency and allows output to shift from established firms to new entrants. As Isobel Schnabel, an executive board member of the European Central Bank, recently pointed out in a landmark speech, productivity increases mainly occur when output moves from less productive to more productive firms. As she puts it, “If these [more productive] firms were empowered to scale up, aggregate productivity growth could rise significantly”.<sup>15</sup>

This is also one of the underlying objectives of the Energy Efficiency Directive and the new Implementing Regulation: to ensure that existing and new third parties develop innovative services based on energy consumption data that foster growth and sustainability, just like the payment services directive aims to boost fintech growth.

However, more than 10 years have passed since the directive on the reuse of public sector information, one of the first acts to promote open data, and lessons were learnt. As the 2018 strategy of the Open Data Charter underlined, a “publish with purpose” approach can deliver more than “publish and they will come.”<sup>16</sup> Access to data is just the first step. Data reuse is costly and difficult, because data is sticky, as a recent paper points out. Effective data reuse and the free flow of data require continuous efforts to overcome obstacles. Reusers are not rushing to access data and develop new services, and consumers are not rushing to demand access to data, or even less to share it with third parties. A flourishing data economy

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***‘A flourishing data economy does not naturally emerge from legally mandated data sharing’***

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does not naturally emerge from legally mandated data sharing; it is an ecosystem that needs to be cultivated by lowering barriers and promoting incentives for adoption.<sup>17</sup>

This is especially true in the energy sector, which is traditionally dominated by large semi-public players with little competition and where consumers are not accustomed to shopping around

for innovative services. At the same time, recent policy discussions around competitiveness and the green transition have highlighted the importance and urgency of growing a successful European cleantech industry. The opportunity is greater than ever, but so too are the challenges.

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<sup>15</sup> Isobel Schnabel, “From Laggard to Leader? Closing the Euro Area’s Technology Gap,” 2024.

<sup>16</sup> Open Data Charter, Publishing with Purpose (Open Data Charter, 2018).

<sup>17</sup> For the sticky data argument in the scientific realm, see Laia Pujol Priego and Jonathan Wareham, “The Stickiness of Scientific Data,” 2020. See also the recent evaluation of the revised payment services directive: VVA and CEPS, *A study on the application and impact of Directive (EU) 2015/2366 on Payment Services (PSD2)* (Luxembourg: Publications Office of the European Union, 2023).

Europe needs to accelerate the transition from a pioneering set of regulations establishing the legal right to access and share data to a flourishing ecosystem with high data reuse, new services and strong consumer demand. The European Commission is making significant strides in the right direction by defining the right to access and share energy data and promoting stakeholder collaboration to define standards and protocols. But for data sharing to succeed, market forces need to be harnessed and great data-driven services need to scale.

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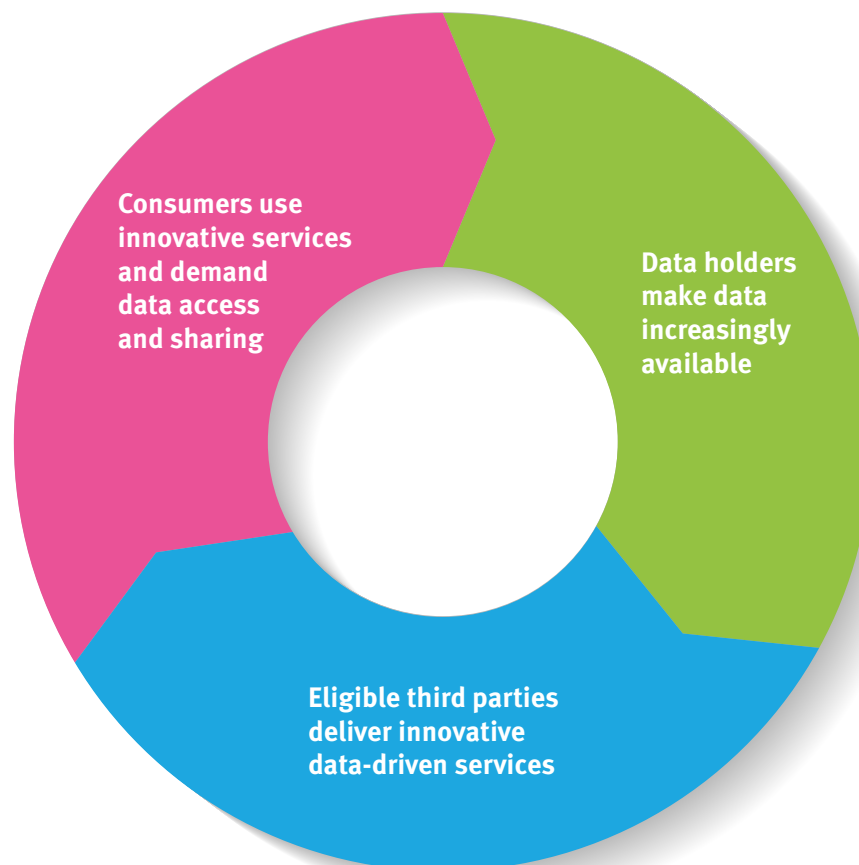
***‘For data sharing to succeed, market forces need to be harnessed and great data-driven services need to scale’***

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Regulation can only take Europe so far. Enforcement and implementation are always challenging, as the payment services directive shows. Ensuring that data are shared effectively, consistently and timely, that they are of high quality, that the procedures are not too cumbersome for third parties and consumers alike, is a task that cannot be met by enforcement alone.

What needs to happen is for the demand side to have a stronger role, where third parties deliver innovative services based on these data and consumers actively seek access to and share data with third parties. This is crucial to creating a cycle where data become increasingly available, third parties deliver innovative services based on these data, and consumers drive the demand for data access and third-party sharing. Achieving this virtuous, seamless cycle requires ongoing effort on all fronts, and in particular in the following set of recommendations.

**Figure 5. The future virtuous cycle for energy data**



## Increase the Focus on User Experience

User experience is crucial for adoption at scale of data driven energy services and data sharing practices. This might seem like a marginal aspect, related to the convenience of users, but it is a critical issue that can determine the success or failure of new products and services. Cumbersome or inconsistent consent management processes substantially lower opt-in rates. Any friction encountered by users during the data-sharing process becomes an insurmountable obstacle to achieving sufficient critical mass at scale. A small ambiguity or technical difficulty can be the reason consumers give up, especially when the value of any new service is still being assessed. What is needed are plug-and-play, one-click options for consumers.

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***‘What is needed are plug-and-play, one-click options for consumers’***

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One of the most challenging areas is the management of consent and the authentication of consumers to give their consent. A lesson learnt from the implementation of PSD2 is the insufficient prioritisation of user

experience. Strong customer authentication (SCA) and consent management in particular have proven to be an obstacle to user experience and have slowed uptake.

Consistent user experience must be built into the implementation process, including involving design experts in the implementation process of the regulation. Europe arguably leads in energy data portability, but lags behind Australia, the United Kingdom and the United States in terms of user experience. For instance, Australia’s Consumer Data Standards initiative includes user interface standards for managing consent. In the United States, the whole policy initiative is called “Green Button,” referring to a standard one-click way to download one’s own energy data.<sup>18</sup> These initiatives are not yet perfect and without challenges, but they represent a much more developed attempt to make design an integral part of consumer policy and simplify consent management. Europe should look at these examples, and learn what worked and what did not, to ensure that user experience is prioritised and streamlined into policy design.

## Cultivate the Ecosystem

User-centricity is not only a consumer concern; it should also apply to companies in the ecosystem. A flourishing data economy requires buy-in from companies investing in innovative products and services as well as from venture capitalists investing in innovative startups. Startups need to be involved in the process and appropriate incentives must be put in place. There should be a strong link between innovation and regulation activities and community-building exercises, so that the voice of startups is heard in the regulatory process. Innovation-focused activities, such as dedicated innovation programmes, public procurement of innovation, hackathons, and awareness-raising activities, should also be launched to encourage data reuse by startups. The best example of this remains Open Banking Limited,

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<sup>18</sup> To be clear, this is not to say that such initiatives are more successful. For instance, the Green Button proved to be challenging to implement. But they reveal a welcome emphasis on user experience which is often less visible in European initiatives. See also Chrysoula Mitta, Charlotte van Ooijen and David Osimo. *User-Centricity: What It Means, How It Works, Why It’s Needed: How Relentless Focus on End-Users Raises Adoption and Delivers Better Services to Citizens* (Brussels: The Lisbon Council, 2021).



the implementation entity for open banking in the United Kingdom, which includes dedicated information for innovators, inspiring case studies, developer support, hackathons and challenges, and regular reporting on the sector. Crucially, such initiatives should be led by high-profile industry players and entrepreneurs who can amplify the voice of startups.

The European Commission is working towards this, and in early autumn will officially establish a Smart Energy Expert Group, whose mission is to accelerate the digitalisation of the energy system and contribute to the smart energy transition. The expert group should do so with a focus on smart energy solutions and services that are beneficial to consumers and the system as a whole. Another approach explored by the European Commission is to encourage ecosystem creation through research and innovation programmes, such as Horizon Europe and Digital Europe. EDDIE is a prime example of such collaboration. However, because of the bureaucratic complexity of these initiatives and the inherent time limitations of startups, participation is often difficult for these companies. To foster innovation, a proactive effort towards startups is essential, including design consultation processes that make it easier for them to participate. The participation of startups should be a KPI for any initiatives, and expert groups dominated by established companies and incumbents should be treated in the same way we treat “manels” (i.e., all-male panels) in conferences.

When it comes to innovation funding programmes, they should be designed to lower entry barriers for startups and other energy service providers. The percentage of startup involvement should be clearly reported in the KPIs of the programme. Specifically, any energy-related work programme should include, and actively strive to engage, entities defined as an “eligible party” in the implementing regulation 2023/1162, i.e., “suppliers, transmission and distribution system operators, delegated operators and other third parties, aggregators, energy service companies, renewable energy communities, citizen energy communities and balancing service providers, as far as they offer energy-related services to final customers.”<sup>19</sup>

## Reinforce Data Stewardship

Data reuse is challenging. Even in the best-case scenarios, when data are accessible, differences between data providers and countries remain, and data quality needs to be monitored. Continuous data stewardship and active data curation will likely be necessary to ensure high-quality, easily reusable data, especially for new machine-learning applications. There are already many intermediary initiatives to make data available at scale, and in some cases, commercial data curation solutions are available. But it is likely that, especially for cross-country datasets, data curation activities will not be financially sustainable. Data spaces, therefore, remain crucial to ensure high-quality and interoperable data.

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***‘Continuous data stewardship and active data curation will likely be necessary to ensure high-quality, easily reusable data’***

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<sup>19</sup> See European Commission, Implementing Regulation (EU) 2023/1162 of 6 June 2023 on interoperability requirements and non-discriminatory and transparent procedures for access to metering and consumption data (Text with EEA relevance).

Moreover, reinforcing data stewardship involves the development and implementation of effective data governance models for data exchange. The Smart Energy Expert Group discussed above will be tasked with: providing assistance and framing recommendations that promote connectivity, interoperability and seamless exchange of data between different actors along the energy value chain, while respecting data sovereignty, privacy and data protection; developing a governance structure for facilitating data exchanges within the energy sector; and promoting interoperability and data exchanges with other sectors.

## Clarify GDPR

Consent remains the cornerstone of energy data sharing, and rightly so. Consent requirements for energy are less strict than those of the PSD2, potentially making processes more straightforward and avoiding the adoption bottlenecks seen with PSD2. However, consent management remains a challenge in ensuring data portability and data sharing at scale.

Given the high social value of energy consumption data, which can be used to address both climate change and energy poverty, it should be possible to launch a dedicated “data4good” initiative facilitating data access for public interest purposes. It might even be worth exploring the radical possibility of moving from opt-in to opt-out for consumer energy data sharing. If energy data are crucial to fight climate change, the sharing of data based not on

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***‘The sharing of data based not on consent but on another legal basis, such as public interest, could be considered’***

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consent but on another legal basis, such as public interest, could be considered. The review of the General Data Protection Regulation (GDPR) could be an opportunity to identify new instruments to facilitate data sharing. At the very least, the European Data Protection Board should provide clarifications on simple, compliant ways to share energy data.

## Remove Barriers to the Single Market

As in many other domains, procedures and formats for energy data vary between member states. Startups have to learn and adapt to each country’s data access protocols, often struggling to access the data they need to provide services across borders. Different bureaucratic requirements make it difficult for startups to scale their businesses, a critical factor in reducing the green premium and fostering growth within Europe’s cleantech sector. Cleantech startups face the double challenge of an immature and fragmented market. Once again, the single market remains a goal more than an achievement for cleantech businesses seeking to expand internationally. The Ento example illustrates the difficulty of accessing data across borders and the cumbersome processes involved.

As reiterated by the Letta report, the independent and high-level report on the future of the single market commissioned to the former Italian prime minister by the European Council for the 30<sup>th</sup> anniversary of the establishment of the single market, a sustained effort is needed to remove barriers.<sup>20</sup> The requirements and processes to access data must be the same across member states.

The political guidelines of the new Commission and the Letta report go as far as supporting a 28<sup>th</sup> regime for innovative startups, a new legal status that will allow for single, harmonised rules. But until such a radical step is taken, the response lies in the daily work of initiatives such as SOLVIT or the Single Market Enforcement Task Force<sup>21,22</sup>. These are doing crucial work that should be much better recognised and prioritised.

For instance, a company such as Ento should be able to rely on EU services to address bottlenecks, but at the moment, very few companies use SOLVIT and other similar services for business. Much can be done to improve the delivery and adoption of such services. Setting usage targets and publishing usage data would be effective steps towards increasing their impact.

The overall message should be clear: supporting innovative companies is at the heart of the green transition and European competitiveness. The European Commission should become their visible ally in addressing any bottleneck they find. More than one million SMEs in Europe export their goods or services, and many others are trying to do so but are being discouraged by the obstacles. European services should provide information and support at scale to hundreds of thousands of businesses every year. This work is crucial, even if it lacks the visibility of a 28<sup>th</sup> regime. As Agatha Christie aptly said, “it's a rotten job, but somebody's got to do it.”

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***‘Supporting innovative companies is at the heart of the green transition and European competitiveness’***

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20 See Enrico Letta, “Much More Than a Market: Speed, Security, Solidarity: Empowering the Single Market to deliver a sustainable future and prosperity for all EU Citizens,” European Council (2024).

21 SOLVIT is an alternative dispute resolution mechanism in the European Union for European Union citizens and businesses, to settle cross-border issues such as recognition of professional qualifications, residence permits, social security, employment rights, market access for products or services, etc. With a Solvit Centre in every Member State as well as in Norway, Iceland and Liechtenstein, Solvit is a mechanism for resolving disputes concerning misapplication of Internal Market rules by public authorities. It is based on cooperation between the national Solvit Centres. The network aims at resolving disputes without the use of formal legal proceedings. Its use is voluntary and does not exclude the possibility of referring the case to court later.

22 The Single Market Enforcement Task Force (SMET) was set up by the Action plan for better implementation and enforcement of single market rules adopted in March 2020 as part of the European industrial strategy. As a high-level forum where the Commission and EU countries work together, SMET is best placed to identify how to deal with barriers, jointly devise and implement solutions, ensure a consistent approach and act rapidly.

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# Acknowledgements

The authors would like to thank Vincent Berrutto, Henrik Brink, Eloi Fàbrega Ferrer, Nate Kinsey, Eloise Moench, Michael Murray, Paula Pinho and Stavros Stamatoukos, for taking the time to meet and share their knowledge and experience. From the EDDIE consortium, special thanks go to Besiana Balla, Georg Hartner, Sofia Nicolai and Laurent Schmitt for their insightful comments. All errors of fact or judgement are the authors' sole responsibility.

## About EDDIE

EDDIE introduces a decentralised, distributed, open-source Data Space, in alignment with the efforts of the EU smart grids task force on implementing acts on interoperability and other European initiatives. The European Distributed Data Infrastructure for Energy (EDDIE) significantly reduces data integration costs, allowing energy service companies to operate and compete seamlessly in a unified European market. Additionally, an Administrative Interface for In-house Data Access (AIIDA) ensures secure and reliable access to valuable real-time data based on customer consent.

This project has received co-funding by the European Union's Horizon Europe under grant agreement No. 101069510.

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