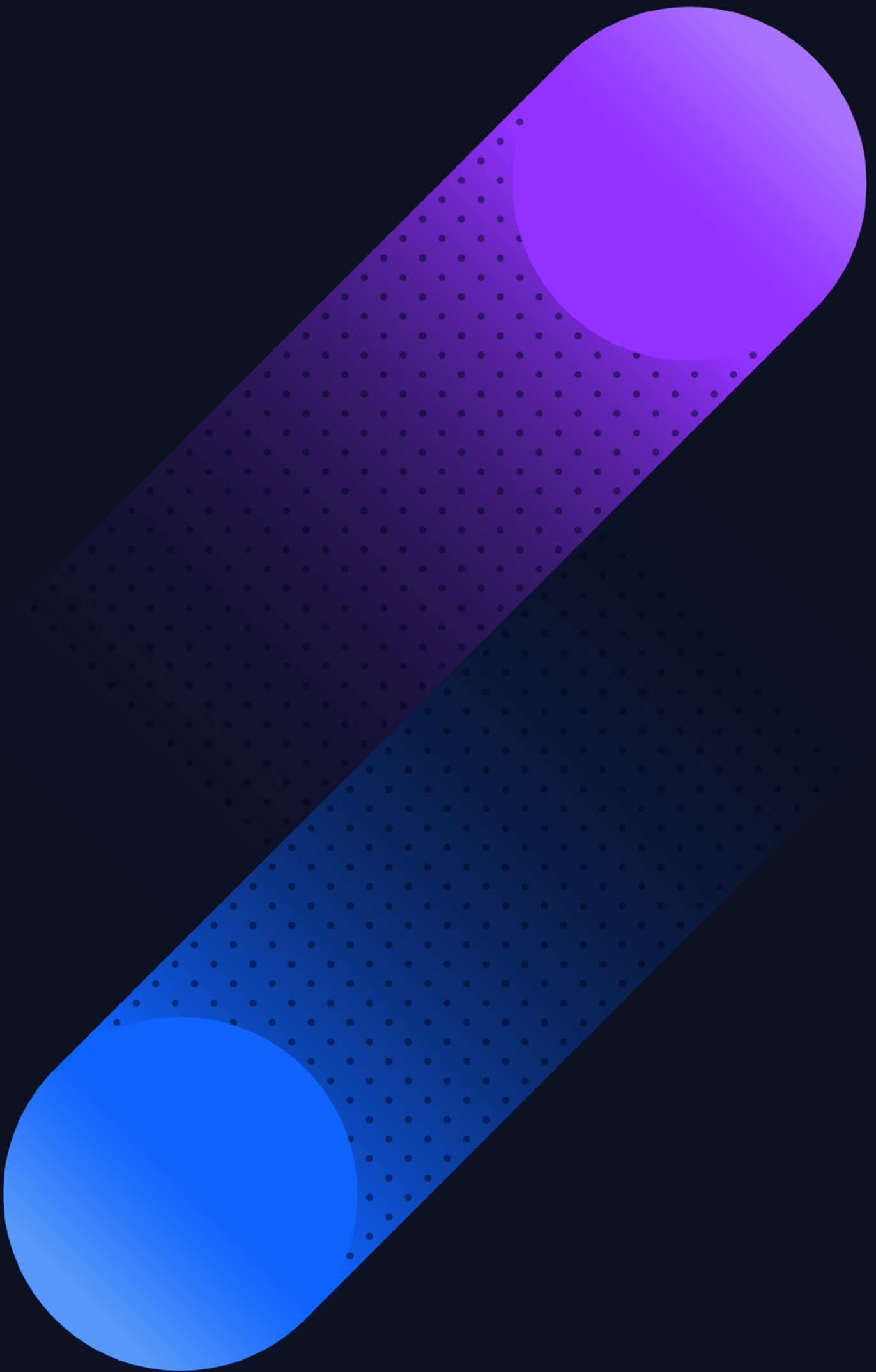# Granular Electricity Meter Data Access

## A Practical Guide for Corporate Clean Energy Buyers

About Flexidao

Flexidao provides organizations with the data and tools to manage their clean electricity portfolios effectively.

The company has expertise in electricity metering and energy attribute certificate (EACs, otherwise known as RECS, GOs, I-RECs, etc.) data access across Europe, the US, Latin America, and the APAC region. Its digital solution aggregates and standardizes this data into an intuitive platform. This offers comprehensive oversight of electricity contracts and EACs, enabling customers to improve reporting processes, mitigate regulatory risks, and cost-effectively enhance their decarbonization impact.

Flexidao also maintains leadership in energy policy, providing key insights into emerging regulations. Notable customers include Google, PepsiCo, Microsoft and Amazon.
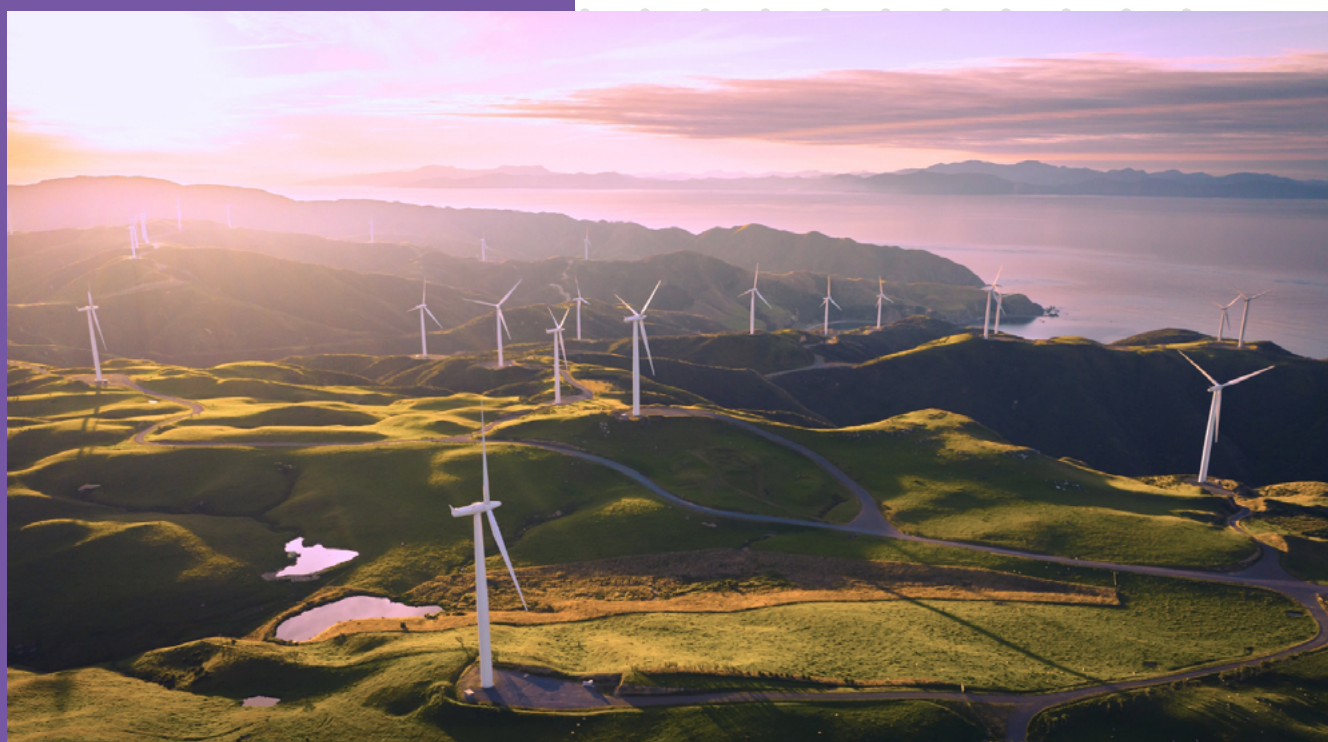
Executive Summary

As corporations increase their clean energy commitments globally, **granular electricity meter data,** which captures electricity production and consumption at hourly or sub-hourly intervals, has become essential.
This data is crucial in improving Power Purchase Agreement (PPA) performance monitoring, enabling advanced clean energy procurement strategies, enhancing carbon reporting accuracy, and aligning with evolving regulations, among other use cases.

This original research by Flexidao provides a **practical guide for corporate clean energy buyers.** It offers insights into the importance of granular meter data, its availability, and accessibility in the main industrialized regions, and how to incorporate it into operations effectively.

Global Analysis of Granular Consumption Meter Data Availability and Accessibility.

The availability and accessibility of granular *consumption* meter data vary significantly across regions and countries. Flexidao's analysis examines these variations based on various factors summarized into two key indicators to provide a comprehensive overview of how easily corporations can collect and use granular meter data globally:

1. **Data Availability** evaluates if the data exists. It is determined by the percentage of smart meter rollout in a region or country. A high smart meter deployment rate generally ensures the availability of granular data.

2. **Data Accessibility** evaluates how easy it is to access the data. It depends on factors like utility concentration and data collection processes. Regions with fewer utilities or centralized data hubs tend to offer easier access to granular meter data. Accessibility is classified as:

   - **High:** Data is easily accessed through streamlined processes and centralized sources.
   - **Moderate:** Multiple utilities or data sources require more integration efforts.
   - **Limited:** Access is complex, with fragmented data sources.
   - **Low:** Data collection is highly complex or non-existent due to insufficient processes.
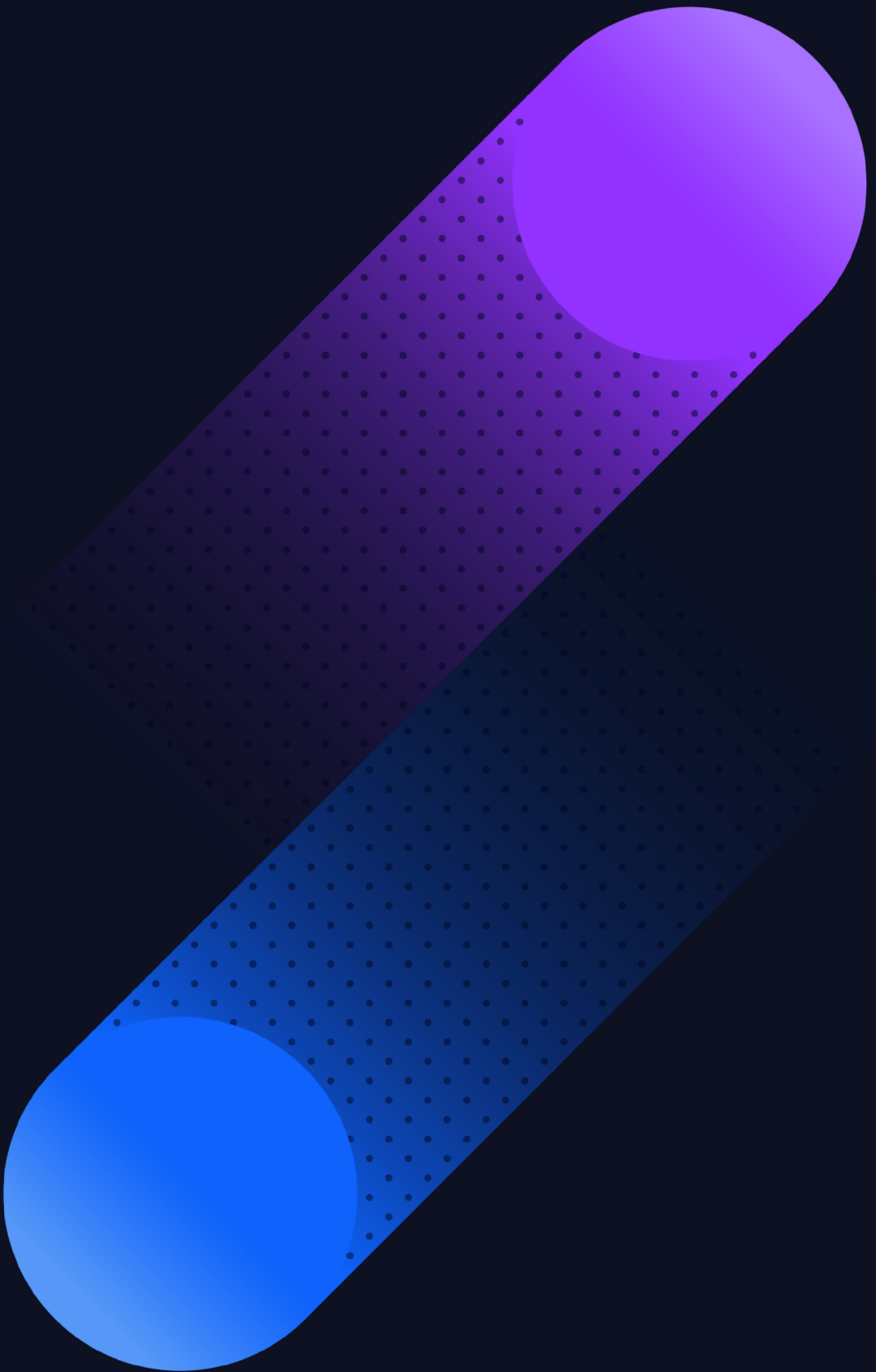
The results of Flexidao's analysis show that in most industrialized regions, granular consumption meter data is mostly available and accessible. Ongoing initiatives like Linux Foundation Energy, EDDIE (European Distributed Data Infraestructure for Energy)., Green Button Initiative, and EnergyTag foster progress toward broadening availability and access to granular consumption meter data through their research and policy advocacy. With that being said, substantial variation exists across different regions:

- **Europe:** Four of the EU's top five economies score high on availability and accessibility. This means that countries like France, Spain, the Netherlands and Italy have high availability and easy access to granular meter data due to extensive smart meter rollout and easy access to granular meter data due to extensive smart meter rollout and options for third party data access. However, large economies like Germany and Poland face more limited access due to a combination of lower smart meter deployment and fragmented utility markets.

- **United States and Canada:** Both countries present a high availability of granular meter data due to widespread smart meter deployment (72% in the US as of 2022). In the US, four of the top five states with the highest concentration of manufacturing sites score high in the availability index. However, accessibility remains fragmented across thousands of utilities, each with its data-sharing processes, making integration more complex, particularly in states with smaller utility providers.

- **APAC and LATAM:** The rollout of smart meter systems in major economies like Japan, Australia, and China has led to relatively high data availability. Countries like Brazil and Uruguay in Latin America show promise, though widespread access is still evolving. Access to granular data in these regions often depends on engaging directly with local utilities or energy providers.

When incorporating granular meter data, establishing streamlined operations is paramount to keep costs under control and ensure scalability while transitioning to more impactful clean energy strategies. The paper offers several recommendations for corporate clean energy buyers to do so:

1. **Portfolio and Data Needs Mapping:** Begin by maintaining a comprehensive overview of your energy portfolio. This includes keeping an updated repository of which utility or grid operator services each site, how many meters are installed, and which legal entity is the legal owner of the site and the data. It is also crucial to define the granularity and update frequency of the data required, as this impacts the data collection process and costs.

2. **Prioritize Regions Based on Analysis Results:** Given the variations in data availability and accessibility, companies can rely on this whitepaper's analysis to prioritize regions with high availability and accessibility. This will help streamline data collection efforts and focus on areas where quick wins are achievable.

3. **Consider Authorizing Third-Party Providers:** For corporations managing large energy portfolios across multiple regions, working with a third-party service provider can greatly simplify the process. However, it is important to manage the administrative steps involved in authorizing third-party access to meter data. Depending on the region, this may involve signing digital authorization forms, authorization letters or securely sharing access credentials to utility customer portals.

4. **Data Quality Assurance:** High-quality data is essential for ensuring accurate reporting and effective energy management. Implementing checks for completeness (e.g., ensuring all expected data points are recorded), consistency (e.g., avoiding gaps or duplicated readings), and accuracy (e.g., comparing granular data with billing volumes) is critical for maintaining the integrity of the data.

5. **Ongoing Data Maintenance:** The process of collecting and managing granular meter data is not static. As utility systems and data-sharing protocols evolve, companies must be prepared for changes in data collection methods and possible integration challenges. Regular monitoring of data quality and seamless integration updates are necessary to maintain efficient energy operations over time.

6. **Leased Facility Data:** In cases where a company operates in leased facilities, collecting granular consumption data becomes more complex. The energy buyer may need to coordinate with the landlord to gain access to meter data, particularly in multi-tenant facilities where consumption is shared. Establishing clear authorization procedures with both landlords and utilities is key to managing this complexity.

7. **Adapt Your Contract Language To Include Data Access:** When negotiating new energy contracts, it is crucial to include provisions that address the sharing of granular meter data. Contract language should specify the frequency and format of data sharing, the responsibilities of each party in ensuring data access, and any requirements for third-party service providers to access the data.

The paper concludes that despite regional differences in data availability, companies can effectively collect and use granular meter data. The right strategies and tools can minimize costs and complexity, whether for adopting advanced clean energy strategies, monitoring PPA performance, or reporting to frameworks like the 24/7 Carbon-Free Coalition Flexidao's expertise in energy data management across regions positions it well to help companies overcome challenges and capitalize on granular meter data opportunities. By acting now, businesses can enhance energy performance and lead in clean energy management.

Contents

Definitions

Advanced Metering Infrastructure (AMI): A system (smart meter, communication network, and data management) that enables two-way communication between the utility and the customer's meter, enabling real-time data exchange and remote meter management.

Application Programming Interface (API): A set of rules, protocols, and tools that enables seamless communication and data exchange between different applications, services, or operating systems.

Automatic Meter Reading (AMR): A system that enables the automatic collection of meter readings from electricity meters, typically periodically.

Balance Responsible Party (BRP) / Scheduler: An entity that balances electricity supply and demand within their designated portfolio. This involves managing energy injections and withdrawals to match actual consumption, preventing imbalances in the power system.

Data Management Models: Frameworks or structures that organize, store, and process electricity-related data. In the context of this paper, we consider Data Management Models centralized solutions (e.g., datahubs) or decentralized models that can be used for meter data exchange within a region. Typically driven by regulatory mandates and implemented at the country or state level, these models are crucial for ensuring data accessibility, security, and efficiency in energy management, supporting market operations, and regulatory compliance (Geode, 2020).

Distribution System Operator (DSO): The entity responsible for operating, maintaining, and managing the low- and medium-voltage electricity distribution network, ensuring the reliable delivery of electricity to end-users.

Granular Electricity Meter Data: Electricity production and consumption settlement metering data with hourly or sub-hourly granularity.

Most Prominent Data Source: The primary or most accessible repository of granular meter data within a specific geographic region. It represents the optimal starting point for data aggregation and analysis due to its potential to provide comprehensive coverage of electricity consumption data.

Net Energy Metering (NEM) / Net-metering: A metering system that records both the electricity injected into the grid and the electricity consumed (off-taken) from the grid by a customer.

Power Purchase Agreement (PPA): A long-term electricity supply agreement between two parties, usually between a power producer and a customer (an electricity consumer or trader).

Retailer: A company that purchases electricity from generators or suppliers and resells it to end-users, such as households, businesses, or industries.

SCADA-level Data: Data collected from Supervisory Control and Data Acquisition (SCADA) systems monitor and control industrial processes, including electricity generation and distribution. SCADA data provides real-time information on system performance and operations.

Secure File Transfer Protocol (SFTP): A network protocol to securely transfer computer files between hosts.

Smart Meter: A digital electricity meter that records consumption data at regular intervals and can communicate this data to the utility. Usually, AMI systems must be in place to consider smart metering.

Supplier: An entity that generates or procures electricity and sells it to retailers or directly to consumers.

Synthetic Volumes: Artificial data generated to supplement real-world data for modeling, testing, or training purposes. Synthetic volumes can be used to create representative scenarios or fill data gaps.

Telemetry Data: monitoring systems that collect and transmit data from on-field sensors.

Transmission System Operator (TSO): The entity responsible for operating and maintaining the high-voltage electricity transmission grid.
Validated meter data: meter readings that the grid operators have validated.

Granular Certificate: A Granular Certificate (GC) compliant with EnergyTag is a Certificate relating to the Attributes of energy produced during a period of one hour or less, Issued in compliance with the requirements and rules of operation of the EnergyTag GC Scheme Standard.

Introduction
& Purpose

Introduction

As the global race to decarbonize accelerates, electrification emerges as the most efficient path to achieving our environmental goals. Corporations are playing a crucial role in funding new clean energy projects worldwide. This push is driven by voluntary initiatives like RE100[1] by The Climate Group[2], which recognizes companies for their clean energy efforts by expanding on the GHG Protocol Scope 2 Guidance for market-based accounting. The recent introduction of mandatory reporting and more ambitious voluntary programs has intensified these commitments, leading to increasingly complex arrays of corporate clean energy supply contracts.

As such, complex and diverse sets of clean energy supply contracts bring new opportunities and pose new challenges. Companies must manage more data to ensure their contracts perform as expected and report confidently and cost-effectively on progress against their climate commitments.

In this evolving landscape, electricity metering data is the cornerstone for better oversight of end-to-end clean energy operations. **Granular electricity metering data[3]** is defined as settlement data for electricity production and consumption with hourly or sub-hourly granularity. This data unlocks many use cases, some of which are listed below:

• **PPA financial risk control:** As the corporate PPA market continues to grow globally, companies are increasingly interested in controlling the economic performance of their portfolio to ensure profitability from such long-term agreements. **Power markets usually operate at 60- to 15-minute intervals, and volatility is at an all-time high; therefore, a financial risk management strategy should examine the problem with the same granularity.**

• **Enable advanced procurement strategies:** The most prominent and **sophisticated corporate procurement strategies need granular metering data. Hourly matching is also included in several directives and**

tax credit frameworks globally[4], such as the ones for clean hydrogen in the EU and the US.

• **Stay ahead of evolving carbon accounting standards:** as corporate procurement strategies get more sophisticated, the underlying **carbon accounting standards are also evolving** The GHG Protocol is the principal standard for carbon accounting, used in most mandatory and voluntary frameworks. It is currently undergoing a review process of its Scope 2 Guidance. The updated version is expected to be released in late 2025, and we expect there to be recognition for more accurate carbon footprinting, which relies on better energy data. As an example that goes in this direction, CDP[5] already gives organizations the ability to voluntarily disclose location- and time-matched clean energy purchases using EnergyTag's[6] Granular Certificate (GC) Scheme Standard. So, companies should consider how to **start efficiently incorporating granular metering data into their operations.**
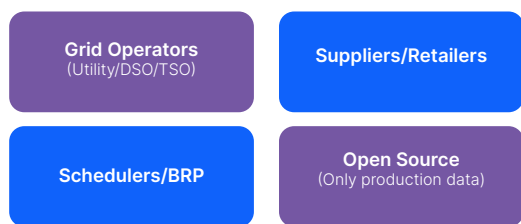
• **Issuing and trading granular certificates (GCs):** Granular data is necessary for issuing time-stamped energy attribute certificates (GCs) under the EnergyTag standard in lieu of registries offering the capability. GCs can be traded to optimize procurement or monetize PPAs in another way. They are an essential instrument to substantiate carbon accounting claims, as mentioned above.

Purpose

In this ever-evolving landscape, incorporating granular electricity metering data into a corporation's clean energy operations is becoming increasingly essential, requiring companies to develop new capabilities. One of Flexidao's core strengths is **simplifying the process of establishing and maintaining relationships with key organizations (Fig.1) on behalf of our clients.** This ensures seamless data collection, integrity, and enables various use cases, such as clean energy supply contract monitoring, procurement optimization, carbon accounting, and reporting.

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[1] RE100 is the global corporate renewable energy initiative led by The Climate Group and CDP bringing together hundreds of large and ambitious businesses committed to 100% renewable electricity.
[2] An international nonprofit organization whose network includes over 500 multinational businesses in 175 markets worldwide. TCG convinces, challenges, and helps organizations make climate commitments and turn them into action. More info

Grid Operators (Utility/DSO/TSO)	Suppliers/Retailers
Schedulers/BRP	Open Source (Only production data)

Figure 1: main stakeholders companies must engage with to collect granular meter data

Since the publication of Flexidao's initial paper, *Mapping Metering Data Access in Europe* (Flexidao, 2022), our company has gained valuable experience through collaborations with clients and hundreds of stakeholders globally, all of whom are involved in electricity metering operations. **This paper distills Flexidao's evolving expertise into an actionable guide for corporate clean energy buyers, focusing on incorporating granular metering data into their operations.** These insights provide essential tools for developing and executing modern clean energy procurement strategies, carbon accounting methodologies, and monitoring the financial performance of clean energy contracts like PPAs. As many corporate buyers are taking their first steps in this direction, often adopting a phased approach depending on the maturity of clean energy markets around the globe, the paper helps them **understand where to first transition from traditional to advanced energy and carbon strategies.**

Additionally, the paper highlights The Climate Group's 24/7 Carbon-Free Coalition, a voluntary corporate reporting program building on the success of RE100, which acknowledges the shift toward time, and location-matched clean energy procurement as a critical evolution in corporate energy and carbon strategies.

Structure

To accomplish our stated goal, this paper provides:

1. A **deep-dive into granular meter data collection** including:

   a. A geographically comprehensive analysis of granular consumption meter **data availability** and **accessibility.**

   b. A deep-dive into production granular meter data collection.

2. A **list of important considerations** to remember when incorporating granular meter data into your organization's energy operations, followed by **recommendations** on how to proceed and how Flexidao can assist. The section sheds light on the three main parts of granular meter data operations:

   a. Data Collection
   b. Data Quality Assurance
   c. Integrations Maintenance

3. A list of **key initiatives revolving around granular meter data globally.**

Global access analysis
While our previous publication centered on **Europe**, this updated analysis significantly broadens its geographical scope. It now encompasses **North America,** providing a detailed examination of each U.S. state, as well as **key economies in the APAC and LATAM** regions.

Metering Data Operations
The core of this research **investigates the operations required to collect electricity meter data from third parties,** including data hubs, utilities, energy suppliers, and service providers. Although we recognize that installing owned telemetry systems is a viable alternative, our analysis underscores that grid-connected meters remain the most reliable method for ensuring data security, reducing CAPEX and OPEX, and enhancing overall data reliability.

As mentioned above, beyond mere access to metering data, **this paper delves into the crucial aspects of data quality and maintenance**, two essential pillars of effective meter data management. High-quality, well-maintained data is vital for accurate, clean energy procurement, robust performance monitoring of supply contracts, and the development of emerging carbon accounting methodologies.

Evolving standards and regulations
Finally, the insights presented in this paper are designed to **inform policymakers and standard-setters on the global status of granular metering data availability and access complexity.** Given the critical role of this data in enabling sophisticated strategies for corporate clean energy strategies, carbon accounting, and emission reporting frameworks, we aim to provide valuable insights into what's feasible today and induce further reflection regarding how to increase availability and reduce complexity where needed.

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[3] Notably time, and location-matching, that imply procuring local clean energy produced during the same hour when the consumption occurs or emission-matching, that emphasizes the importance of deploy new clean energy generation capacity on grids where the displacement of dirty power would be maximized.
[4] To EU RFNBOs DA, 45v Tax Credit, Irish Climate Plan
[5] CDP runs the global environmental disclosure system. Each year, CDP supports thousands of organizations to measure and manage their risks and opportunities on climate change, water security, and deforestation. We do so at the request of their investors, purchasers, and city stakeholders.
[6] EnergyTag is an independent non-profit that defines and promotes Net-Zero-aligned electricity carbon accounting, enabled by real-time tracking with Granular Certificates.

Granular Meter Data Collection

Deep Dive

The Analysis:
Granular Consumption Meter Data Collection

This section of the paper examines the **collection of granular electricity production and consumption meter data.**

Although similar, production and consumption meter data differ significantly in ownership (i.e., the buyer owns its consumption but needs to request production) and available data sources. For these reasons, the analysis will address the two datasets separately.

In saying that, both consumption and production meter data have something in common: the large number of stakeholders companies must establish and maintain relationships with to collect them continuously.

Part I: Methodology

The paper's methodology for analyzing *consumption* meter data collection from the perspective of corporate clean energy buyers is built over two main KPIs:

- **Availability** addresses whether the data exists.
- **Accessibility** addresses how easy it is to access the data.

Please consult Annex I for a comprehensive description of the methodology.

For the analyses, we assume the rollout of smart meters in a region or country is a good proxy for calculating the **availability** of granular electricity meter data.

a. Smart Meter Rollout:

I. **High Availability:** the electricity smart meter rollout in the country/region is 75% or higher

II. **Moderate Availability:** the electricity smart meter rollout in the country/region is between 50% and 74.9%

III. **Limited Availability:** the electricity smart meter rollout in the country/region is between 25% and 49.9%

IV. **Low Availability:** the electricity smart meter rollout in the country/region is lower than 24.9%

Once we understand whether granular meter data is more or less available in a specific region, the second KPI offers information on its accessibility. There is a direct relation between accessibility and cost to access granular meter data, making accessibility a reasonably **reliable proxy for data access cost estimations.** This evaluation is dependent on the following KPIs:

b. Utility Concentration:

I. **High Concentration:** one dominant utility managing more than 80% of coverage in the region/country or just one utility operating in the region/country.

II. **Medium Concentration:** Multiple utilities, with the three biggest managing over 60% of the coverage in the region/country.

III. **Low Concentration:** Multiple utilities, with the three biggest ones managing less than 60% of the coverage in the region/country.

c Coverage with One Integration:

I. **High Coverage:** incorporating the most prominent data source covers 75% or higher of the country/region.

II. **Medium-High Coverage:** incorporating the most prominent data source covers between 50% and 74.9% of the country/region.

III. **Medium-Low Coverage:** incorporating the most prominent data source covers between 25% and 49.9% of the country/region.

IV. **Low Coverage:** incorporating the most prominent data source covers less than 24.9% of the country/region.

d **Data Collection Process:**

I. **Third Party Process:** the most prominent source in a region/country offers a process for third parties or energy service providers to access the client's data. This can happen in different ways, such as an authorized user in the Customer Portal, via an API, CSV dropped in an SFTP or periodic manual requests.

II. **Client Request / Portal / Login Credentials:** the most prominent source in a region/country offers the client (data owner) means to visualize/access interval electricity meter data, independently of how it is conducted, via a formal letter request, a customer portal, or any other means. In this situation, energy buyers can rely on third-party services to collect the data on their behalf, for example, securely sharing login credentials with the portal to retrieve the data.

III. **No Options / Information:** the most prominent source in a region/country does not have a process to access/visualize the interval electricity consumption data or where no information has been found.

Combining the three accessibility KPIs described above informs the **Accessibility** index, defined as High, Moderate, Limited, or Low. The index is informed by the three KPIs as follows:

I. **High:** The complexity is considered low for the regions/countries with medium-high or high coverage and the most significant integration, and a third-party process is in place to get the data. Where access to interval electricity consumption meter data is reasonably assured, there are existing and well-defined processes for third parties to access it on behalf of the clients.

II. **Moderate:** Different combinations can make a country be classified within this label. These are situations with a medium concentration of utilities and a medium-low coverage with the most relevant data source; there is an option for interval data access, or when there is a medium or medium-high concentration, with a medium or medium-high coverage and a client portal/process, or the cases where there is a medium concentration, a medium-high coverage with the most prominent integration. There is a process for accessing interval data (client options or third party). The region offers favorable conditions for accessing interval electricity meter data in many scenarios.

III. **Limited:** regions with processes to access interval consumption data (Portal or 3rd Party Process) from the most prominent data source. Still, the coverage is medium-low or low. Flexidao considers this considerably complex as access interval data in the region for multiple sites might require integration with several data sources, therefore driving up the number of integrations and maintenance efforts, resulting in higher costs.

IV. **Low:** No current process exists for visualizing/ accessing the interval electricity meter data from the most prominent source. So, any region/country where the data collection process KPI is ¨No Options / Information¨ directly is classified as low. However, this does not exclude the possibility that other potential regional utilities could offer some options to access interval electricity meter data.

Annex I provides more comprehensive information about the methodology and the resulting index.

It's essential to recognize that while this analysis provides a valuable tool for energy buyers, it may not account for every edge case or regional variation. The methodology is designed to offer practical insights, but it may not capture every nuance of real-world scenarios. Nonetheless, it provides a global perspective businesses can leverage to understand reliable and efficient access to interval consumption meter data.

Geographical scope

As mentioned in the intro, this paper broadens the geographical scope compared to the first edition. Flexidao selected countries for inclusion based on their significant industrial and business activities, which contribute substantially to global GHG emissions. However, Flexidao plans to expand the analysis to additional countries and regions in future editions.
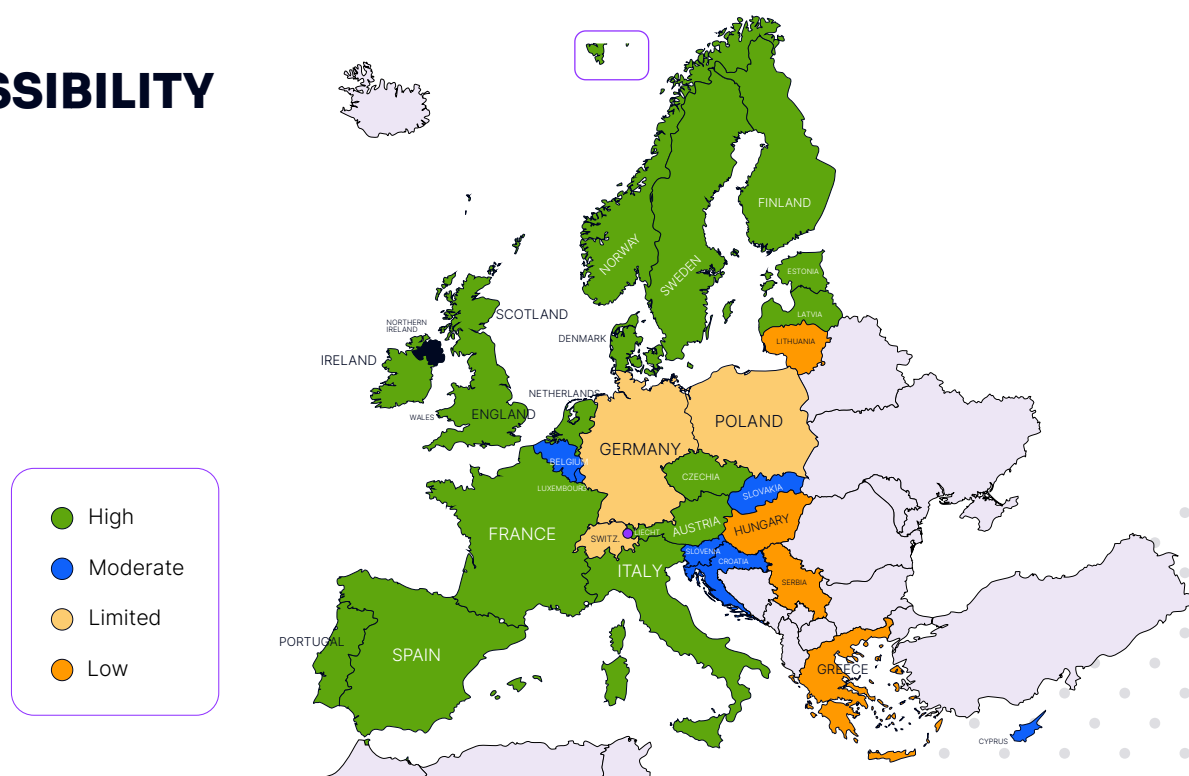
Part II: Results

EUROPE

DATA AVAILABILITY
EUROPE
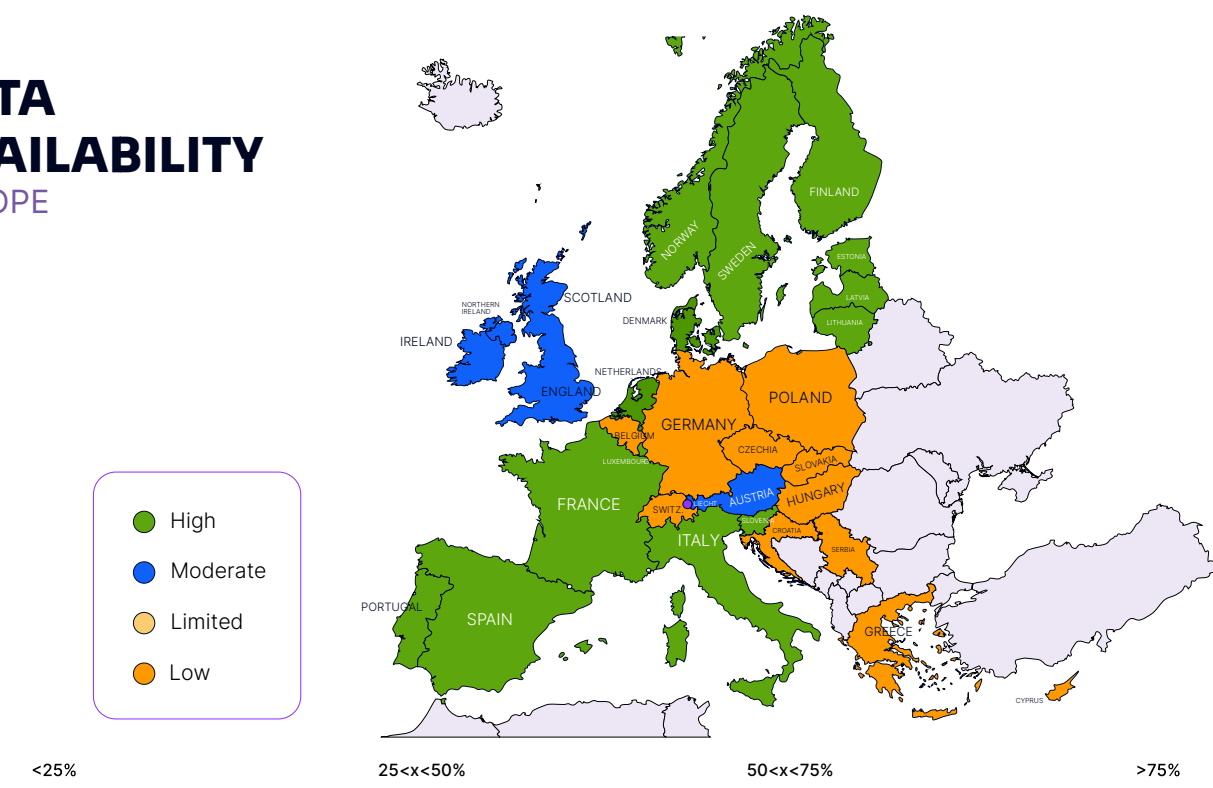
Figure 2. Granular meter data availability results in European countries are considered in the scope of this research paper.
Sources: (De Paola et al., 2023) / (Eurelectric, 2023) / (Krishnan, 2024)/(Jrishnan, 2024) and other sources at the national level.

DATA ACCESSIBILITY
EUROPE

Figure 3. Results of granular meter data accessibility on the european countries considered on the scope of this research paper.
Sources: (De Paola et al., 2023) / (Eurelectric, 2023) / (Krishnan, 2024)) and other sources at the national level.

The analysis reports that **four out of five major EU economies[7] guarantee high availability (>75%) of consumption granular meter data.** Seven of the top ten European economies are in the two top tiers. Meanwhile, the first and sixth economies, Germany and Poland, are lagging. Nevertheless, large loads already have grid-connected smart metering devices that allow the collection of consumption granular metering data. The results should serve as a call to action for policymakers and other stakeholders to urge the rollout of smart meters in regions with moderate, limited, low, or no availability to level the playing field, enabling advanced use cases such as the ones mentioned in the introduction of this paper. An interesting case is Austria's smart metering roll-out plan, where competent authorities consciously halted the roll-out between 60 and 70%, leaving the rest as an on-demand service.

The trend shown by Figure 2 correlates with Figure 3, which reflects the accessibility of consumption granular meter data access in Europe. Figure 3 presents an equally bright scenario regarding accessibility, with **11 European countries ranking High.** These countries offer centralized access to all smart meters with clear and well-defined third party access processes.

On the other hand, countries like the UK and Austria, which are moderately accessible anyway, offer Data Management Models that allow consumers to access data. Germany and Poland stand out as more complex cases among the largest EU economies, with significant challenges in data access mainly due to low availability and low data concentration in Germany (many stakeholders involved). Despite this, overcoming access barriers is manageable with the support of an expert partner like Flexidao.

This bright scenario is due to EU Directive 2019/944 (European Union, 2019), which states that this data must be available to final customers and eligible parties, and Regulation 2023/1162 (European Union, 2023), which regulates interoperability requirements and transparent procedures for access to meter data.
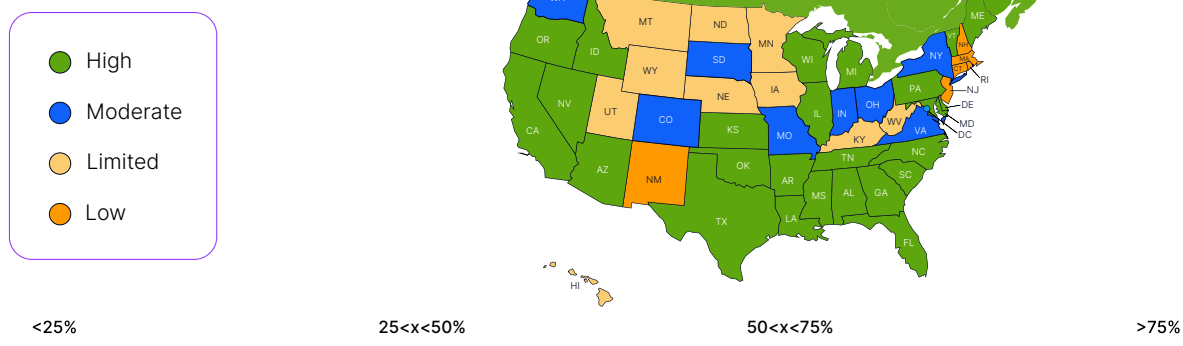
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[7] France, Italy, Spain, Netherlands
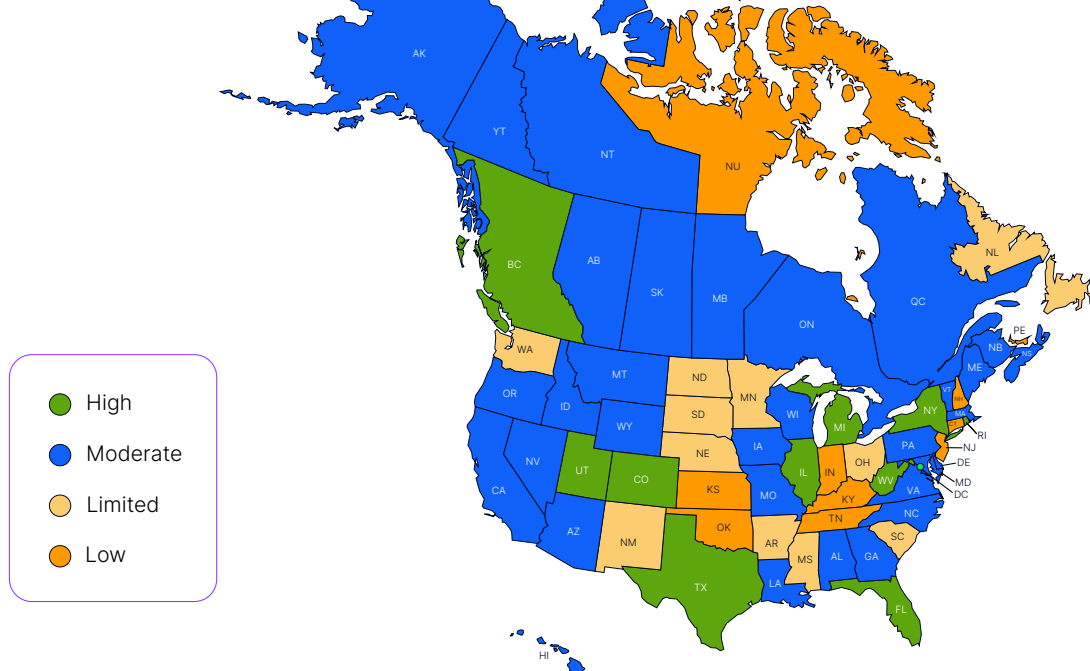
USA & CANADA

DATA AVAILABILITY
USA & CANADA

Figure 4. Results of granular meter data availability in North America. US results by state, while no reliable information was found for Canada's provinces. Sources: (Energy Information Administration, 2022)(Energy Information Administration, 2024)/ (Jrishnan, 2024)

DATA ACCESSIBILITY
USA & CANADA

Figure 5. Results of granular meter data accessibility in the US and Canada. Sources: listed as references
Sources: (Energy Information Administration, 2022)(Energy Information Administration, 2024)

Our analysis shows that in North America, both the USA and Canada offer high granular consumption meter data availability. While Canada shows high availability on average, the USA does in 45 states. As a reference, the national smart meter deployment in the US was around 72% in 2022, based on the latest published data from EIA (Energy Information Administration, 2022). Organizations operating in **three out of the top five US states for annual electricity consumption[8] due to the high concentration of heavy industry facilities and data centers can benefit from high consumption meter data availability.** The remaining two states of this group, Ohio and Indiana, score on the upper side of the medium availability tier (approximately 72%)[9]. The **situation is even brighter if we look at states with the highest concentration of manufacturing sites, excluding heavy industry and data centers:** all these states have high data availability except Ohio.

The smart meter rollout in North America has laid a solid foundation for granular meter data accessibility. However, regarding accessibility, the US presents a highly fragmented scenario, with over 3,000 utilities, including investor-owned utilities, municipalities, and electric cooperatives, each implementing their data-sharing solutions (Energy Information Administration, 2024).

For this reason, clean energy buyers in the United States and Canada still encounter challenges when collecting granular meter data. They often rely on utility-customer portals to download or retrieve data, which can be time-consuming, particularly when managing multiple locations. Additionally, municipal utilities and cooperatives, typically with fewer resources, offer more limited options for accessing customer data, sometimes requiring manual requests and processes.

The results indicate that the largest electric utilities in many US states and Canadian provinces offer means to access and visualize granular data, leading to a low or moderate complexity in data management. However, third-party processes need further adoption, posing challenges during integration, such as specific registration requirements and differing technical procedures. As a result, data-sharing often relies on ad-hoc remote integrations that companies like Flexidao develop with utility customer portals. However, **the good news is that accessibility challenges can be effectively overcome by establishing a robust data infrastructure,** ideally with an experienced partner's support, as explained in this section.

Flexidao advocates for advancing third-party data collection processes and actively participates in initiatives like the Green Button Initiative and the Carbon Data Specification Consortium under Linux Foundation Energy. Our Data Team is always well-positioned to assist our clients in getting ahead of the curve and taking advantage of existing and upcoming data integration opportunities to cut operational costs.
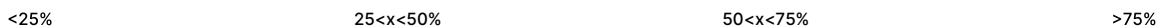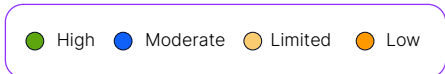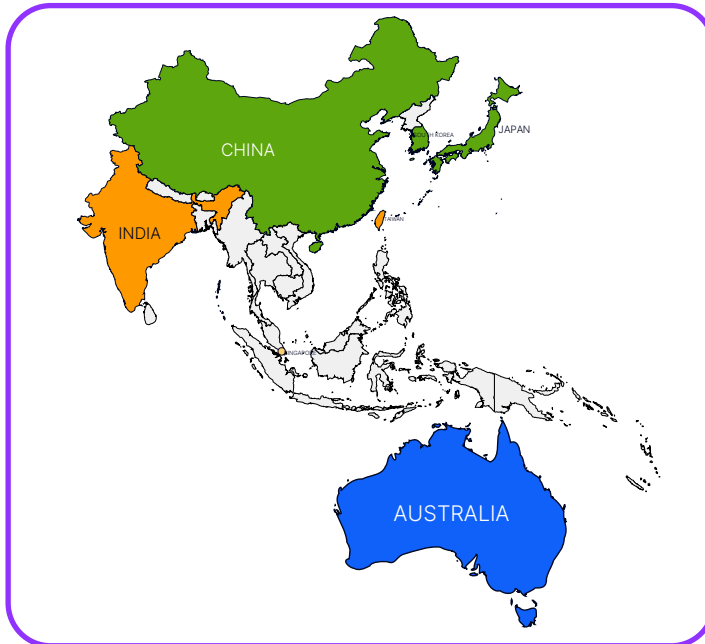
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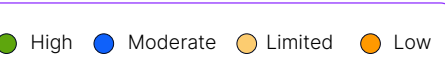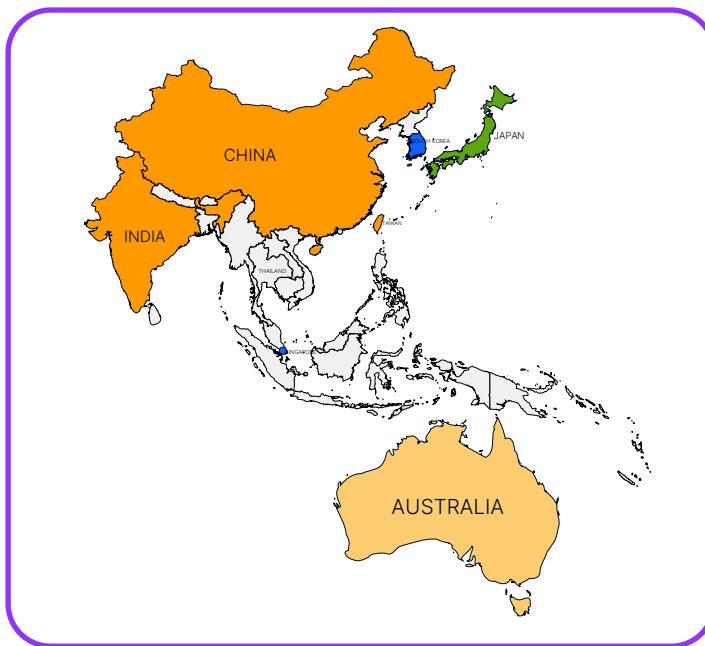
LATAM & APAC

DATA AVAILABILITY
LATAM & APAC

Figure 6. Results of granular meter data availability in APAC & LATAM for the countries considered in the scope of this research paper. Source: (Jrishnan, 2024)

DATA ACCESSIBILITY
LATAM & APAC

Figure 7 . Results of granular meter data accessibility in APAC & LATAM for the countries considered in the scope of this research paper

Figure 6 and 7 show that the smart meter rollout in LATAM and APAC depends on the country level. It is generally limited today, except for Japan, China, and Australia, which are progressing in line with their national plans. Despite this fact, the electricity meter market in LATAM is set to grow. By the end of the decade, a penetration rate of 20% of AMI implementations is expected (Spencer, 2024). There are many pilot projects in place or already achieved by the electric utilities to make the first steps toward the smart metering rollout; an example is Enel in São Paulo. Even though not analyzed in this research paper, there are also more positive rollouts in LATAM, such as UTE in Uruguay, with more than 60% of the service points of UTE with a smart meter implemented. Flexidao recommends energy buyers raise the need for granular data for their utilities, as there might already be programs in place for a smart meter installation under request or petition.

No current data management models at a country level are in place in LATAM or APAC, and granular data collection, when available, still relies on utility solutions and processes in most cases. Some efforts are being made in some countries towards data interoperability. One of them is the creation of the Electricity Data Management Association in Japan, which intends to make electricity data available for various energy services and companies.

The results show few granular meter data access options for the client or third parties. Some exceptions are with utility applications or portals that enable the visualization of granular meter data. However, this is a high-level approach; it does not necessarily mean that granular data is inaccessible; it all depends on the type of customer, the site's characteristics, and the utility solutions. For example, as a success story for a large industrial energy buyer, data could be accessed in Chile via the TSO data portal (the "Coordinador Eléctrico Nacional") as the load connection was directly at high-voltage level. So we suggest that each case is analyzed on an individual basis, identifying if there is a smart meter in place (or if there is any submetering system that could be used in the meantime by the energy buyer) and verifying with the utility which options exist to receive granular meter data records. As explained above, companies like Flexidao develop securely sharing utility customer portals to circumvent existing barriers.

As smart metering systems are being implemented in the APAC and LATAM regions, industry market players should push for the standardization of energy data in data-sharing implementations. There have been some efforts in this regard, such as the roundtable at the Asia Action Summit by Climate Group - "Getting Granular: advancing power system decarbonization through data." The session aimed to describe the current situation of energy data access in APAC and the needs and requirements for further development. One of the primary outcomes of such a session was that data access is the biggest challenge encountered in APAC for third parties and customers.

Granular Production Data Collection

As explained previously, this paper has not applied a similar approach for granular production data to the one used for granular consumption data. Access to consumption data is more uniform or centralized with grid operators. Large energy buyers will typically have a specific service or customer portal from their utilities to access their interval meter data for the connections they own. For this reason, only tackling utilities or DSOs is a good approximation. For the case of production, even though the utility (or TSOs in the case of large projects connected at the transmission level) is still responsible for managing the validated meter data, they might not have a process in place to provide this information to the off-takers or energy service providers. There might be large utilities that provide data exchange services. Still, in this situation, there is another factor to consider: the authorizer that can enable this data sharing is the owner of the connection of the production plant, also known as the project owner.

For this reason, as of today, granular production meter data collection usually relies on suppliers or other market participants, such as schedulers/balance responsible parties. Therefore, it would have been challenging to determine KPIs per country as there is a strong dependency on production data collection options based on energy contracts and their counterparties, which differ for each energy buyer.

Recommendations to Incorporate Granular Meter Data into Operations

Incorporating granular meter data into a corporate's clean energy operations encompasses many more considerations than availability and accessibility, as discussed in the previous chapter. In particular, ensuring that the integrations with the data sources are maintained to guarantee seamless ingestion of the collected data into internal systems, as well as monitoring data quality and resolving issues, are equally crucial processes. This section outlines important considerations for these areas, along with Flexidao's recommendations on addressing potential challenges. As an energy service provider, we aim to support energy buyers in efficiently onboarding granular meter data, helping them easily navigate any obstacles and ensuring a smooth transition into enhanced clean energy management.

🔔 **Considerations**.

⚙️ **How Flexidao can help**

Data Collection

As determined in the section Meter Data Collection, Deep Dive, there are no standard rules or processes regarding the accessibility and complexity of granular meter data collection. In addition to system-level factors, company, or industry, specific factors have an influence (e.g., the retail industry often encounters issues with leased facilities). Flexidao, with its extensive experience in helping energy buyers, provides some considerations and recommendations on tackling granular meter data collection.

🔔 **Maintain up-to-date and comprehensive knowledge of your energy portfolio.** Don't underestimate the complexity and time required to collect the relevant information, whether the data collection task will be performed internally or outsourced to a provider like Flexidao.

> ⚙️ **Maintain up-to-date and comprehensive knowledge of your energy portfolio.** It is essential to map for all the sites and supply contracts the relevant information: utility/system operator serving the site, number of meters for each site, the legal entity owning the site, Business Unit responsible for the site, and installed capacity / contracted power

🔔 **Define which data types need to be considered and the data update frequency.** Depending on the use cases, it is important to determine which data type is required as well as how often the data needs to be updated. This will influence the decision on how to incorporate the data considering the available options (e.g., conducting an API integration or receiving the data once a year via CSV).

> ⚙️ **Assessment of the data collection needs.** At Flexidao, we leverage our prominent position in the clean energy digitalization and climate policy spaces to assist energy buyers in assessing and sometimes predicting their data needs. We consider our client's specific operations and the dynamic climate policy landscape to achieve operational efficiency and climate leadership at scale. A few examples:

Use case	Data Type	Granularity	Frequency	Validated
PPA Monitoring	Production	1-60 seconds	1-60 seconds	No
Settlement Verification	Production	Settlement (5min, 15min, 30min)	Monthly	Yes
Granular Scope 2 Reporting	Consumption + Production	1 hour	Yearly	Yes

🔔 **Collecting production and consumption data involves different processes in different regions**. While consumption data is usually accessible in the customer utility portals (as energy buyers own this data), production data typically depends on the solutions used to share data by the supplier or scheduler´s side (in some regions, the TSO might have a process in place also to share this data). Occasionally, data for large energy projects can also be collected on open-source portals.

Evaluate all available data collection options that best suit your needs. Map out all the data collection options available for each region/country, considering the various factors that can impact the collection process. This can be time-consuming and the results of the previous chapter can significantly decrease the amount of time required. Contracting data aggregators like Flexidao are always more efficient than performing this analysis internally.

Make sure granular meter data is available in your next energy contract. As shown by the results in the previous chapter, accessing production data is generally more complex than consumption. Actions can be taken to ensure granular meter data from the supplier side is available. Flexidao has collaborated on PPA granular meter data contract requirements and data-sharing options that can help later in the data collection. In addition, if working with an energy service provider, adding some clauses referring to sharing this data with such parties is valuable. Flexidao provides contractual specifications for clients to be added to clean energy procurement tenders. Please reach out to know more.

🔔 **Be ready to deal with at least 2 data sources per country/state.** When collecting granular production and consumption data for many sites in different countries or regions, the data is very fragmented, meaning companies must consider many integrations and data sources. This also raises the need to adapt to several data schemas and protocols for data exchange, making the data collection processes more complex, expensive, and exposed to risks.

Synchronize and collect all the data with a unique integration. Flexidao can coordinate all the granular meter data collection and integrations for an energy buyer, providing flexibility and adapting to the data sharing options at the data sources. So, in the absence of broad adoption of emerging standards to improve scalable data access, it is essential to be flexible and adapt to the best options available from the source. Having worked with such data already makes us experts in considering all the details per data source to ensure a correct onboarding of the meter data. Flexidao has developed means to transfer the granular normalized meter data collected as an energy service provider to its clients in an automated way via API.

🔔 **Be ready to deal with manual processes.** Options for data collection automation (e.g., Application Programming Interface (API) or SFTPs) are not always viable today. Allocating resources to research data availability and access pathways and building bespoke data infrastructure will be inefficient and come at the expense of scalability.

Outsource manual processes. Where automation is unavailable, let an expert partner handle these aspects (e.g., granular meter data normalization processes). We take responsibility for all the processes and apply data quality checks to guarantee that all the data has been collected, transformed, and stored correctly. Outsourcing ensures faster implementation, secure data exchanges, and scalable operations

🔔 **Outsourcing data collection requires administrative tasks to authorize the provider.** Company-level granular meter data, even though not considered personal data, is sensitive and can only be shared with its owner (the off-taker) and to authorized parties (except in some specific regions with stricter regulations that currently do not allow this last point). So, you must authorize an energy service provider to collect your data while working with them. This process varies depending on the source; some situations still require authorization letters.

Identify the signatory and the process to be followed. Ensure your company has a streamlined signature process for this scenario. Flexidao can support both manual and digital authorization methods. For manual processes, we can provide templates to grant access. For digital processes, Flexidao is available to assist in completing the necessary steps to authorize us.

Be open to providing access to your utility customer portal. Although third-party integrations to data sources are becoming more streamlined, in some regions, current practices still rely on accessing utility customer portals for consumer meter data. As a result, utility portal credentials must be securely shared with energy service providers to facilitate meter data collection.

Enable coordination and share information. The eligible party might require specific information about an energy buyer's facilities and contracts to collect granular meter data. For this reason, it is important to have constant communication with both parties. In addition, it must be highlighted that in data collection processes, the eligible party is not the contractor of any service with the data source, and sadly, this sometimes can influence data collection purposes. For this reason, the energy buyer is recommended to make introductions and highlight their data needs to the utilities or data sources (especially in those scenarios where a third-party process is not in place).

Create a data collection playbook. Standardizing the way to approach clean energy stakeholders enhances operational efficiency. Flexidao helps its clients develop playbooks that distill years of experience in engaging with organizations involved in corporate clean energy procurement organizations.

🔔 **Leased facilities always add complexity.** Whenever consumption comes from a leased facility for which the tenant does not own the energy supply contract, companies depend on the landlord to access it. In addition, energy buyers often have to consider their consumption share in terms of the total consumption of the facility (this applies to the case of multi-tenant facilities).

Manage the authorization process. Two different configurations can happen under leased facilities.

- For leased facilities where the energy buyer is the single tenant and does not contract the electricity, the landlord needs to authorize Flexidao to access the data.

- For leased facilities with multi-tenancy, the authorization and data collection strongly depend on the landlord, which data it possesses, and how it is allocated to the tenant—so this scenario needs to be evaluated on a one-to-one basis.

🔔 **Normalize your data.** It is very likely that each data source has its own format or provides data in different local time zones, requiring transformation steps. If these transformations (also known as data normalization) are not implemented correctly, they can lead to errors. Therefore, when collecting granular meter data from multiple sources, it is essential to normalize the data before incorporating it into your database or internal systems.

Have all your data with a unique integration. At Flexidao, we have extensive experience working with multiple data sources and addressing the unique challenges of granular energy data exchange. These experiences are embedded in our automated processes, ensuring seamless data integration and normalization. Once processed, this data is accessible to our clients through a single, unified API integration.

🔔 **Utilities don't collaborate, or smart meters are not installed** In some instances, suppliers may be unresponsive, leading to delays, particularly when dealing with multiple suppliers, which can be a significant time sink for large clean energy buyers. A separate challenge arises when there is a lack of smart metering infrastructure. This absence hinders the potential for automation, resulting in lower operational efficiency.

Leverage synthetic load curves. If no measured volumes exist at the tenant level, synthetic curves can be created based on the tenant type and usage pattern. For instance, NREL provides building stock models[10] calibrated through 70+ model updates, supported by electric load data from 11 utilities, 2.3 million meters, and 15 end-use metering datasets. Also, Flexidao's proprietary tool Diagnostic® helps corporate clean energy buyers translate annual consumption and production data into hourly insights using synthetic industry load curves. Moreover, Diagnostic® provides a picture of how an existing set of clean energy supply contracts (or portfolio) perform against reporting frameworks, such as RE100 or the **24/7 Carbon-Free Coalition.** In the same way, the tool can model scenarios to understand what pathway to follow to achieve the best Scope 2 market-based decarbonization performance. Additionally, Flexidao advocates for further research on synthetic load profiles toward widespread consensus on what to use in the transitory period when availability and accessibility are improving.

Integrate with telemetry. As a last resort, knowing if any sub-metering system or telemetry measures tenant consumption and how the landlord allocates the billed volumes to the corresponding tenant can be a resource. As mentioned in the introduction of this paper, Flexidao doesn't encourage this practice.

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[10] NREL End-Use Load Profiles for the U.S. Building Stock (link End-Use Load Profiles for the U.S. Building Stock)

Data Quality Assurance

After defining the data collection process, ensuring the reliability and completeness of the data collected becomes crucial. This section outlines the **most common quality issues with granular smart meter data and recommends checks** companies should implement to address these issues.
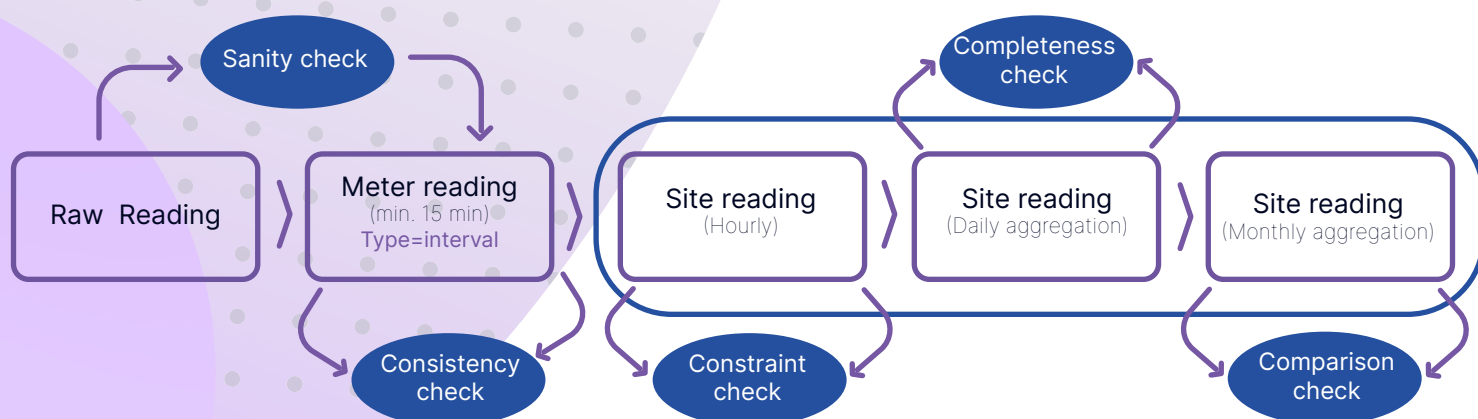
🔔 **Meter data often presents gaps.** Due to communication failures, meter malfunctions, or power outages, meter readings are often not recorded for certain time periods, creating gaps.

> 🌀 **Completeness Checks** ensure that all expected data points are present for each time interval.

🔔 **Issues with the Received Data Structure.** The received readings may exhibit issues in their characteristics, such as unexpected negative values, invalid time periods, or overlapping data points. These are just a few examples of potential problems that can occur.

> 🌀 **Sanity Checks** can help verify that the readings structure aligns with the expected characteristics and, thgerefore, they can be classified as valid. As an example, an alert could be implemented when negative readings are received, expect when they are justified (e.g., for reverse flow in net metering)

🔔 **Data lacks consistency.** Readings sometimes present extremely high or low consumption values that deviate from normal usage patterns due to sensor errors, user anomalies, or data corruption.

> 🌀 **Outlier Detection** identifies extreme values that deviate significantly from typical consumption pattern
>
> **Constraint Checks** flag suspicious readings outside the range of what the site's own constraints allow, such as contracted power or installed capacity.

🔔 **Data Duplication Across Intervals.** Due to software bugs or incorrect aggregation of meter readings, the same meter reading is reported for multiple consecutive intervals.

> **Staleness Detection** stale data affects time-based analysis and could indicate issues with meter functionality. This problem reduces data granularity and hampers real-time monitoring.

🔔 **Data Latency.** Network or communication delays between the smart meter and the data collection system cause delays in receiving meter readings, which affect real-time monitoring

> **Connection Checks** detect delays or failures in transmitting meter data, ensuring the communication link is functional.

🔔 **Deviations of Granular Data with Billing Volumes.** There might exist discrepancies between the granular meter data collected and what has been billed.

> **Comparison Checks** it is a recommended practice always to compare these two datasets to make sure that the data aligns and no issue has happened in the data reception and transformation

It's important to note that statistical checks can vary for each data type and depending on the data-sharing method. For instance, while automated rechecks of historical data are feasible with API integration, they are more challenging with SFTP integration, where updates rely on the source's file-sharing frequency.

Implementing all these checks can lead to high costs and may require skills and resources that are lacking internally. Outsourcing offers a more efficient and secure solution. Additionally, expert **data service providers like Flexidao can resolve the identified quality issues through Predictive Data Overwrite:**

- Use predictive models to generate expected readings.
- Overwrite non-compliant readings with predicted data, ensuring data integrity.
- Maintain a log of overwritten data for audit purposes.

For more detailed information, Flexidao can provide a comprehensive service description.

Maintenance

Maintaining high-quality granular meter data can quickly become resource-intensive, with costs driven by the number of integrations, sites, and data transfer methods. The complexity increases as data is collected in various formats (e.g., CSVs via email, JSON via API, CSVs in an SFTP) and at different time updates (daily, weekly, or monthly). This makes it challenging to ensure seamless operations and prevent data gaps.

🔔 **Maintain all the integrations and be flexible to potential changes.** Dealing with many integrations increases the probability of encountering potential issues or changes in the data sources. Therefore, it is important to have a reliable monitoring system to detect them. However, once spotted, the root cause of an issue must be found and fixed. This can become quite complex, and there can be many triggers for unexpected data behavior.

Contact the data source to solve detected issues or communicate problems. When Flexidao detects an issue or unexpected behavior, it first contacts the data source to verify that the data-sharing process is functioning correctly. Once confirmed, Flexidao consults with the energy buyer to check for any changes in consumption or production patterns, such as a store closure or scheduled maintenance.

Be flexible about potential changes and updates. After a data source integration is completed, changes may occur over time, such as modifying the data schema or releasing a new API version. As a result, it's important to account for new integrations and adapt existing ones, which can affect resource allocation and increase costs.

🔔 **Monitor the data quality and data integrations.** After implementing the data quality checks, a system and process must be established to notify the relevant team members about any detected issues. This may require additional implementation and ongoing maintenance from IT departments.

Flexidao can monitor the performance of data collection pipelines. It has internal tools to monitor the integration pipelines with multiple data sources constantly. In addition, it offers services and dashboards that provide high-level information on alerts and data quality errors to the energy buyers themselves.
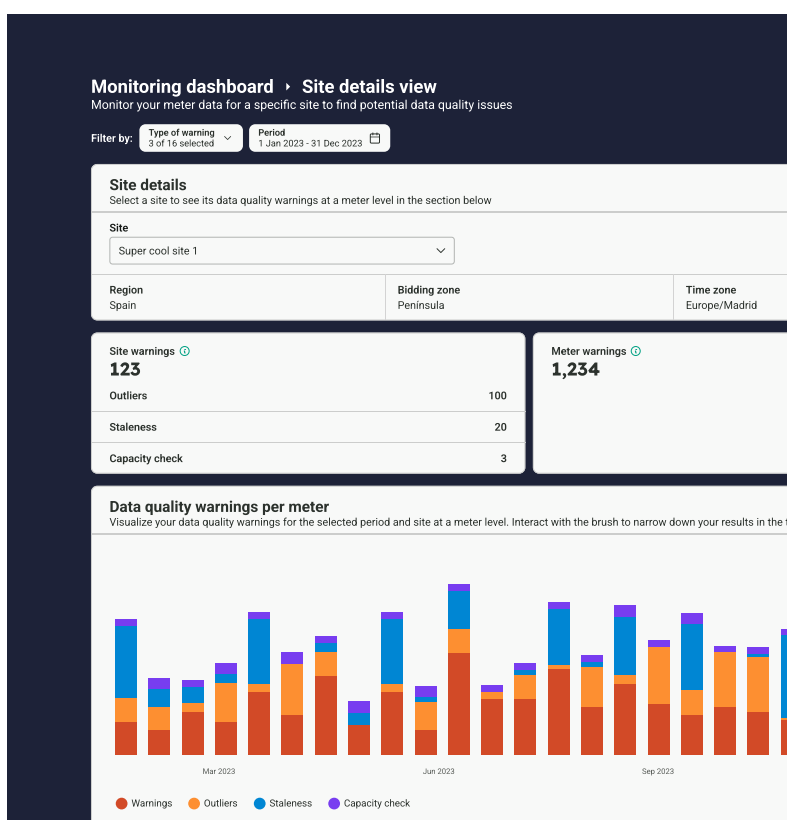
Figure 8. illustrates the Monitoring Dashboard within Flexidao's software, designed to track data quality alerts. The dashboard provides an hourly view of warnings at the meter level (shown in red) and checks at the site level, such as outliers, data staleness, or contracted capacity issues. This helps users identify and pinpoint potential data discrepancies and when they occurred, ensuring more accurate and timely issue resolution.

Current Initiatives to Accelerate Interval Metering Data Access

This paper has demonstrated that granular meter data is mostly available in industrialized regions. However, energy buyers and third parties, such as energy service providers, need further standardization on accessing the data. Several projects and working groups are at the forefront, pushing for standardization and interoperability to make utility customer data more accessible. In this section, we focus on some examples that Flexidao is collaborating with and other initiatives and approaches that could be relevant to consider while assessing meter data collection.

Linux Foundation Energy. Carbon Data Specification Consortium

The Linux Foundation Energy is an open-source foundation that fosters a collaborative community to develop digital projects in the energy field[21]. Flexidao is collaborating on one project linked to data standardization called the Carbon Data Specification Consortium (CDSC). The CDSC intends to build data standards and requirements that enable energy data access for measuring, quantifying, and tracking carbon emissions data. To enable this, the project is divided into three Working Groups: the Connectivity Working Group, the Power Systems Data Working Group, and the Customer Data Working Group. The last one, directly linked with the topic of this whitepaper, intends to define specifications on how companies and third parties can request access to customer data from utilities and other central data sources.

European Distributed Data Infrastructure for Energy (EDDIE)

EDDIE is a European-funded project under Horizon Europe Innovation Actions that intends to close the gap between customers and their rights to access energy data and share it with authorized eligible parties. There is a lack of standardized procedures across the EU, and energy data-driven solutions must adhere to national practices, limiting interoperability and growth opportunities. EDDIE is building a decentralized, distributed, open-source Data Space that enables interoperability in a unified European market. For Energy Service providers, this means that with a unique integration, multiple data sources at different member states are accessible, significantly reducing integration costs and promoting quick growth opportunities. Flexidao is part of the consortium, showcasing a real case scenario of EDDIE's outputs.

Green Button Initiative

The Green Button is an industry-led initiative created to standardize utility energy usage information and make it easily and securely available to utility customers (Green Button—Download My Data) and third parties (Green Button—Connect My Data). With the Green Button Standards, utilities are expected to accelerate the development of standardized implementations to enable data interoperability, which, ultimately, is the key to enabling innovative solutions towards decarbonization.

Recently, Mission:Data has released an online solution called Green Button Explorer (Mission:data, 2024) that helps understand the data landscape across North America on a utility-per-utility basis, focusing on Green Button Connect My Data implementations.

EnergyTag Standards

The rapidly growing rollout of Granular Certificates (GC) is crucial in enhancing the accessibility of granular production metering data, as this data is an intrinsic part of these certificates. EnergyTag, thanks to its standards, plays an essential role in trailblazing the standardization of GC's and advocating for its use. PJM and M-RETS are landmark examples of this growing trend among EAC registries. Flexidao can effectively utilize the GC infrastructure to collect production data efficiently.

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Annex I
A closer Look to the Methodology

The paper's methodology for analyzing consumption meter data collection from the perspective of corporate clean energy buyers is built over two main KPIs:

- **Availability** addresses whether the data exists.
- **Accessibility** addresses how easy it is to access the data.

For the analyses, we assume the **availability of interval electricity meter data** depends exclusively on the rollout of smart meters in a region or country.

a. **Smart Meter Rollout.** This KPI represents the Advanced Meter Infrastructure (AMI)[27] rollout in a specific region/country from the latest official sources. Even though the rollout might be limited in some regions, large industrial customers often have the means or power to request such installations and, therefore, access to granular meter data. This KPI is represented by:

I. <u>High Availability:</u> the electricity smart meter rollout in the country/region is 75% or higher

II. <u>Moderate Availability:</u> the electricity smart meter rollout in the country/region is between 50% and 74.9%

III. <u>Limited Availability:</u> the electricity smart meter rollout in the country/region is between 25% and 49.9%

IV. <u>Low Availability:</u> the electricity smart meter rollout in the country/region is lower than 24.9%

In certain cases, such as in Austria, the smart meter rollout doesn't always represent complete overview of granular data availability. This means that even if a smart meter hasn't been installed, it can still be requested from the utility company in specific situations.

The overview of the availability of interval electricity meter data enables further analyses concerning how the data can be accessed and how complex this operation is for corporate energy buyers. It is essential to mention there are edge cases, and the analysis might not catch all use cases and situations in all regions. Still, it provides a global perspective on where interval consumption meter data can be reliably accessed. This assessment is called interval consumption meter data accessibility. There is a direct relation between accessibility and cost to access granular meter data,

making accessibility a reasonably reliable proxy for data access cost estimations. This evaluation is dependent on the following KPIs:

b. **Utility Concentration.** Interval electricity meter data collection often depends on the grid owners (DSOs/utilities/TSOs). Therefore, getting data might be more complex depending on the concentration of grid operators. For example, imagine a consumer goods company with multiple facilities in a country. Suppose the country has fewer utilities that concentrate a large portion of the market and, therefore, the resulting electricity meter data. In that case, it may enable more unified access rather than more utilities concentrating on smaller data portions. This KPI is represented by:

I. <u>High Concentration:</u> one dominant utility managing more than 80% of coverage in the region/country or just one utility operating in the region/country.

II. <u>Medium Concentration:</u> Multiple utilities, with the three biggest managing over 60% of the coverage in the region/country.

III. <u>Low Concentration:</u> Multiple utilities, with the three biggest ones managing less than 60% of the coverage in the region/country.

c. **Coverage with one integration.** Only evaluating utility concentration might not deliver the whole picture or complexity of interval consumption data access. For example, there might be regions with a very low utility concentration, but there is a datahub that manages all the data. So, with one unique integration, all the meters in the country can be accessed. Therefore, Flexidao introduced this KPI as the **coverage in the region that you can get with the most prominent data access source in the area,** which could be a data hub, a decentralized data exchange, or, in case a data management model[28] is not available, the utility with largest meter coverage in the region. The resulting KPI is represented by:

I. <u>High Coverage:</u> incorporating the most prominent data source covers 75% or higher of the country/region.

II. Medium-High Coverage: incorporating the most prominent data source covers between 50% and 74.9% of the country/region.

III. <u>Medium-Low Coverage:</u> incorporating the most prominent data source covers between 25% and 49.9% of the country/region.

IV. <u>Low Coverage:</u> incorporating the most prominent data source covers less than 24.9% of the country/region.

This first version of the paper doesn't analyze all the utility services and data processes available, which is why the most critical data source was investigated. This data source approximates the practices and processes encountered with the integration that could offer the most extensive coverage.

Data Collection Process: This last accessibility KPI indicates whether there is a streamlined process to access the data from the most prominent data source or not

I. Third Party Process: the most prominent source in a region/country offers a process for third parties or energy service providers to access the client's data. This can happen in different ways, such as an authorized user in the Customer Portal, via an API, CSV dropped in an SFTP, or periodic manual requests.

II. Client Request / Portal / Login Credentials: the most prominent source in a region/country offers the client (data owner) means to visualize/access interval electricity meter data, independently of how it is conducted, via a formal letter request, a customer portal, or any other means. In this situation, energy buyers can rely on third-party services to collect the data on their behalf, for example, securely sharing login credentials with the portal to retrieve the data.

III. No Options / Information: the most prominent source in a region/country does not have a process to access/visualize the interval electricity consumption data or where no information has been found.

The combination of the three accessibility KPIs described above informs the **Accessibility** index, described as follows:

IV. High: The accessibility is considered high for the regions/countries with medium-high or high coverage and the most significant integration, and a third-party process is in place to get the data. Where access to interval electricity consumption meter data is reasonably assured, there are existing and well-defined processes for third parties to access it on behalf of the clients.

V. Moderate: Different combinations can make a country be classified within this label. These are situations with a medium concentration of utilities and a medium-low coverage with the most relevant

data source; there is an option for interval data access, or when there is a medium or medium-high concentration, with a medium or medium-high coverage and a client portal/process, or the cases where there is a medium concentration, a medium-high coverage with the most prominent integration. There is a process for accessing interval data (client options or 3rd party). In many scenarios, the region offers favorable conditions for accessing interval electricity meter data.

VI. Limited: regions with processes to access interval consumption data (Portal or Third Party Process) from the most prominent data source. Still, the coverage is medium-low or low. Flexidao considers this considerably complex as access interval data in the region for multiple sites might require integration with several data sources, therefore driving up the number of integrations and maintenance efforts, resulting in higher costs.

VII. Low: No current process exists for visualizing/ accessing the interval electricity meter data from the most prominent source. So, any region/country where the data collection process KPI is ¨No Options / Information¨ directly is classified as Low. However, this does not exclude the possibility that other potential regional utilities could offer some options to access interval electricity meter data.

This assessment provides a high-level approach to granular data access from an energy buyer perspective. Flexidao is aware that other variables can also influence granular data accessibility, especially while being collected by energy service providers (e.g., registration requirements or data access costs).

Geographical scope

Flexidao selected the countries to be included in the research based on the lion's share of industrial and business activities and, therefore, GHG emissions in the atmosphere. Nevertheless, Flexidao intends to expand the analysis to other countries/regions in the following iterations.

US & Canada:
including all the US states and Canadian provinces.

Europe:
Austria, Belgium, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom

LATAM:
Argentina, Brazil, Chile, Colombia, Mexico, Peru

APAC:
Australia, China, India, Japan, Singapore, South Korea, Taiwan

I. The analysis and classification of regions/countries in this report are based on specific Key Performance Indicators (KPIs) derived from available data. While we strive for accuracy, data limitations may affect some cases. Flexidao does not assume liability for discrepancies and welcomes any contributions to improve future iterations. For inquiries, contact product@flexidao.com.

II. This report provides a high-level analysis of data collection processes without detailed consideration of specific third-party integrations, regional registration requirements, or costs. Flexidao has extensive experience in regional integrations and invites you to contact us for further information.

III. The conclusions drawn here are based on the latest reliable data available. Flexidao assumes no responsibility for inaccuracies arising from outdated information.

IV. If the reader finds this interesting, Flexidao can provide the full KPIs results per region upon individual request at product@flexidao.com.

Flexidao