WeForming

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The Gateway to Energy Sustainability: Digitalising Building Energy Data

The world is at a critical moment where increasing energy sustainability is no longer a choice, but a necessity. The WeForming project has come to the forefront, leading initiatives that demonstrate how energy digitalisation can transform buildings from passive consumers into active participants in a sustainable energy ecosystem. By unlocking the potential of energy data at both the microgrid and grid levels, we are opening doors to a more efficient and sustainable energy future. The key to this transformation is not just energy data availability but its interoperability, ensuring that data from various systems can seamlessly communicate to optimise energy use across the building and grid interface.

The Surge on Energy Data Availability

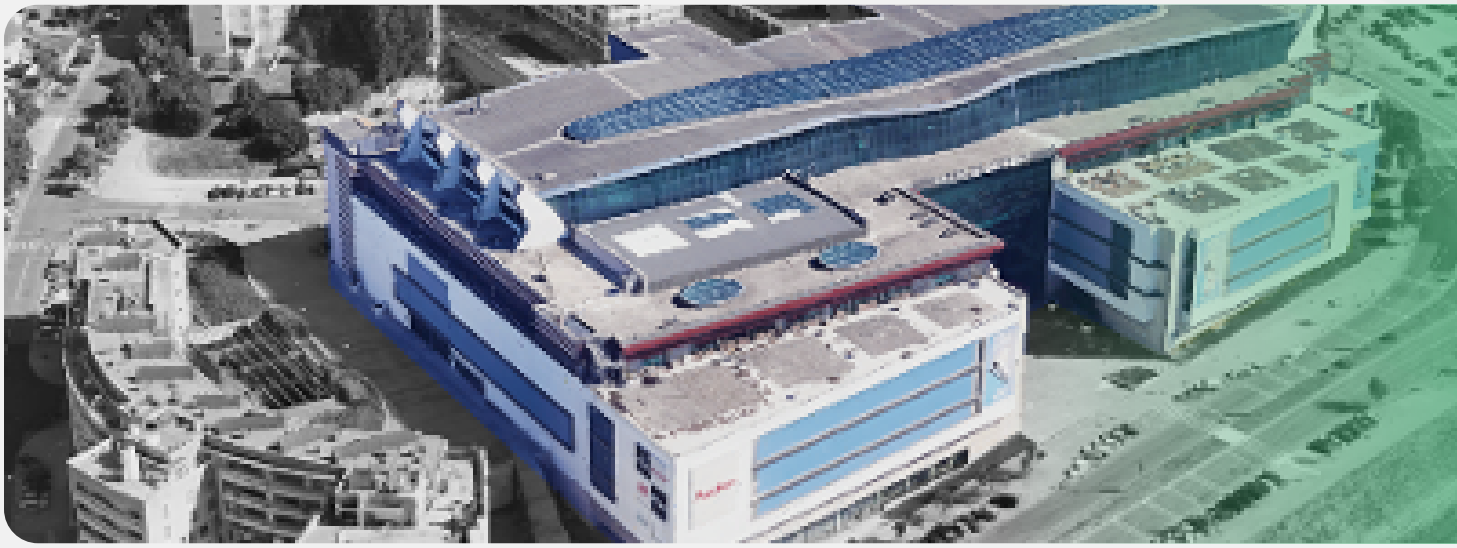
In recent years, the volume and quality of energy data collected within buildings and at the grid level have significantly changed. At buildings like Palácio do Gelo (WeForming's Portuguese demo site), for example, smart systems continuously monitor energy use from various assets, including HVAC systems, ice generators, swimming pools, and electric vehicle (EV) chargers. Simultaneously, the grid's data landscape is evolving, driven by increasing metering sophistication and real-time data collection capabilities. Also, concepts such as grid digital twin and market simulators are getting more popular.

This new level of data availability presents a rare opportunity to unlock buildings' untapped potential. In the past, energy usage was tracked but rarely optimised in real-time or integrated into grid-level operations. Now, with more data flowing in and improved data quality, there is a unique opportunity to create synergy between buildings and the broader energy ecosystem.

Palácio do Gelo, a large shopping mall in the north of Portugal, is one of the demo sites for WeForming. The building has numerous flexibility points such as the ice generation system, HVAC system, and swimming pools. By integrating these systems with a cloud-based energy management platform (provided by Builtrix Energy Data Platform as the technology provider of this demo) using AI and machine learning (ML) tools, and informed by forecasted grid side demands (as an input from R&D Nester, another technology provider of this demo), Palácio do Gelo has the opportunity to not only optimise its energy use but also contribute actively to grid stability.

The Role of Interoperability in Building-to-Grid Interaction

Despite this positive trend in data availability, significant challenges in energy data interoperability remain. Currently, many buildings still operate in silos, where systems within a building don't "talk" to one another and do not enable sharing data with external grid operators. Interoperability means allowing diverse systems, whether HVAC, lighting, or distributed energy resources like solar PV or batteries, to exchange information in real-time.



At WeForming, interoperability is seen as the backbone of creating Intelligent Grid-Forming Buildings (iGFBs). These buildings, equipped with cutting-edge energy management systems, must interact seamlessly with the grid to provide services like demand-side flexibility, peak shaving, and energy storage management. A key part of this effort is ensuring that the various energy assets within a building, such as the solar PV system, combined heat and power (CHP) plants, and even EV chargers, can communicate effectively with one another and with the grid.

Take the example of Palácio do Gelo's CHP system. The CHP system supplies energy to the grid during peak demand hours. Without interoperability, these systems could not be optimally controlled to respond to grid signals or energy price fluctuations. With it, they can operate in great orchestration to maximise energy efficiency and revenue generation.

Tapping into New Energy Markets: Flexibility as a Revenue Stream

The next wave of building energy management is not just about efficiency; it is about revenue generation. The WeForming project recognises the untapped economic potential within building energy systems. By leveraging flexible consumption patterns, buildings can participate in energy markets in ways that were previously impossible.

Energy flexibility - essentially the ability to adjust energy consumption in response to external signals - is a critical aspect of this. Buildings like Palácio do Gelo can shift energy-intensive operations, such as cooling or ice generation, to off-peak hours when electricity prices are lower. This not only saves costs but also allows the building to sell flexibility back to the grid, contributing to balancing services. The ice storage system at Palácio do Gelo, for instance, can act as a thermal battery, storing energy during off-peak hours and reducing grid load during peak times.

For building owners, this presents a dual benefit: energy savings and new revenue streams. At the same time, engaging building operators in these energy markets motivates them to invest further in energy-efficient technologies and sustainable practices, helping to achieve broader decarbonisation goals.

Challenges and Opportunities in Realising Interoperability

Despite the clear benefits, several challenges remain in achieving full interoperability between buildings and grids. One major difficulty is standardisation. Across Europe and globally, energy systems are built with different technical specifications, often using proprietary software that hinders seamless data exchange. Moreover, security and privacy concerns arise when sensitive building data, such as occupancy patterns or energy use, must be shared with external entities like grid operators or third-party aggregators.

There is no way to tackle these challenges, but by demonstrating advanced data technologies, leveraging the use of secure data sharing and AI, which are the core components of six WeForming demonstrations across different European countries. All demos are engaged in solving challenges with an overarching perspective that considers practical constraints such as energy market regulations in each market region. This will also include looking at both DSOs and TSOs with their opportunities as the market operators.

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Energy digitalisation, backed by strong data interoperability, represents the next frontier in creating sustainable and smart buildings. The WeForming project demonstrates how buildings like Palácio do Gelo can evolve from passive energy consumers to active participants in the energy system, capable of generating revenue through flexibility and contributing to grid stability.

As we move towards the future of energy data spaces where energy data is more available and accessible, the challenge will be to ensure that this data can be effectively used to meet sustainability goals. The WeForming project provides a blueprint for how buildings can engage with the grid, offering hope for a future where energy efficiency, sustainability, and economic viability go hand in hand.

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As the co-founder and CTO of Builtrix, Mojtaba Kamarlouei is passionate about driving innovation in energy, data, and sustainability. With a background in Renewable Energy Technologies through his master's and PhD, he has dedicated his career to creating impactful solutions that address energy challenges. He thrives on building strong partnerships and leading teams in developing customer-focused, sustainable technologies. At Builtrix, he enjoys working alongside passionate professionals to bring innovative ideas to life, always eager to learn and grow with each new project.

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