WeForming

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Unlocking Building Flexibility Across Europe: The WeForming Approach

Energy transition demands smarter and more flexible systems, where built environment is no longer characterized by passive consumers, but by active agents contributing to grid stability, decarbonization, and sector integration. The WeForming Project is demonstrating how Intelligent Grid-Forming Buildings (iGFBs) can become vital, decentralised flexibility providers. By combining digitalization, user engagement, and cross-sector orchestration, WeForming explores how buildings can support energy systems resilience and efficiency, in real time.

What is Flexibility in WeForming?

For WeForming, **flexibility** is not limited to adjusting consumption, it is about enabling buildings to interact intelligently with the grid and markets, dynamically aligning their energy profiles with system needs through grid signals. iGFBs can modulate demand, prioritize self-consumption, or inject stored energy into the grid while preserving comfort and indoor quality. Beyond individual response, IGFBs can contribute to multi-vector integration, interact with energy community and neighbours, and provide services to System Operators (DSOs and TSOs) across different market layers.

The Diverse Assets Delivering Flexibility

Flexibility is delivered through a wide combination of distributed assets, integrated by Building Energy Management Systems (BEMS) and digital control layers:

- Generation and Storage: Rooftop Photovoltaic (PV) systems, behind-the-meter batteries (including second-life batteries), and thermal energy storage.
- Controllable Loads: Electric Vehicle (EV) chargers, HVAC systems (heating and cooling) and adaptive lighting systems.
- Digital Infrastructure: AI-enabled BEMS, interoperable platforms, and flexibility forecasting engines.

These enable crucial flexibility functions including load shifting, curtailment, peak-shaving, and Frequency Containment Reserves (FCR) provision.

Assessing Flexibility Across Europe

The project's core mission is to deploy and validate smart readiness and **energy efficiency and flexibility solutions in buildings** across six highly diverse demonstrators in different European countries (Portugal, Spain, Germany, Belgium, Luxembourg, and Croatia), to validate flexibility potential across different building typologies, regulatory settings, and social contexts. The Demos include shopping malls, multi-energy districts, residential districts, rural energy communities, and holiday island districts, which diversity reflects the project’s ambition to produce scalable and transferable solutions, ensuring broad applicability across Europe’s fragmented building stock and energy systems.

User Engagement, Market Integration, and Policy Alignment

Beyond the technical layer, WeForming recognizes the need to actively engage end-users and building operators. Several demos implement co-creation and behavioral strategies to increase participation and unlock new business models with increased financial reward. Concurrently, the project contributes to policy evolution through:

- Improvements to the Smart Readiness Indicator (SRI) by integrating flexibility dimensions;
- Input to interoperability standards and data exchange models (aligned with EU Data Spaces);
- Development of replicable digital twins for flexibility forecasting and provision.

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Scalable and Reliable Building's Flexibility

WeForming is developing a reference architecture for iGFBs that combines energy intelligence, automation, and user interaction. Its contribution extends across:

- Technology: Real-time controllers, digital twins, AI-based forecasting services;
- Markets: flexibility provision through ancillary markets participation;
- Policy: Input to the SRI, standardization, and the Digitalization of Energy Action Plan.

By delivering solutions across these three vital areas, WeForming shows that buildings are no longer passive assets, but key nodes in a decentralised, resilient, and consumer-driven energy system. This approach ensures the project's flexibility solutions are not only technically sound but also economically and legally viable for widespread adoption across Europe.

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Ângelo Casaleiro is a Researcher at R&D Nester. His expertise focuses on areas such as Sustainable Energy, Renewables, Energy markets, Electric mobility smart integration, and Power system forecasting. He is proficient in Python, Matlab, and Genetic Algorithms and has published work on topics including V2G systems, optimization of Photovoltaic self-consumption, and power quality parameters for vehicle-to-grid. He holds a Master of Science (MSc) in Energy Engineering from the Faculty of Sciences - University of Lisbon.

POWERED BY

Funded by the European Union

The WeForming project has received funding from the European Union's Horizon Europe Programme under the Grant Agreement No. 101123556.

UK Research and Innovation

The UK participant is co-funded by UKRI.