



Prescient building Operation utilizing Real Time data for Energy Dynamic Optimization

2

***“Smart solutions for
sustainable buildings”***

NEWSLETTER



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ABOUT

The PRELUDE project represents the improvement of the buildings smartness through minimization of energy utilization, maximization of self-consumption and Renewable Energy Sources investment and personalization, reduction of CO₂ footprint and improvement of comfortable and healthy indoor conditions. This will be possible through the combination of innovative, smart, low-cost solutions and proactive optimization service.

For more information you can visit this website: www.prelude-project.eu

This is the second release of the PRELUDE Project newsletter. A brief report of the key activities conducted during the last months is provided, focusing on Work Packages 2, 3, 6 and 7.

RESULTS UPDATE

WP2_T2.2_EMTECH Application Information Model

While many intelligent systems exist for a plethora of applications where they are usually well-established and perform well, the development of new systems is facing some constant challenges. The most significant challenge is to **aggregate and incorporate data** from different local or remote resources into a **single application**.

Apart from that, finding and integrating separate tools for the **data analysis** and **decision making** is also a difficult task. Expanding the system or using it as a part of more complex applications also presents a difficulty with **data mapping** that has led to the development of general-purpose (or more specific) information models. The fusion of data from different perspectives is not only a characteristic of Decision Support systems, but is also met in collaboration environments, where information from specifications, testing, simulation, design, etc. must be seamlessly incorporated into a single project to facilitate efficiency throughout the lifecycle of various products. This is also the case for PRELUDE project, where we aim to facilitate the **transition to clean energy** by combining **innovative, smart,**

low-cost solutions into a proactive optimization service.

In this regard, the **PRELUDE application information model** aims to provide an understanding of the information flow, define communication protocols, set acceptable file formats, and determine the interconnection and execution sequence of models, optimizers, and processing functions.

The PRELUDE information model must serve to abstract the data handled by the system as well as enable the discovery of the available information. For these reasons, the information model refers essentially to the **objects and meta-data** that describe the type and **structure** of information inside the PRELUDE.

Opposed to traditional decision modelling techniques that describe specific information flows, an application that acts in a heterogeneous environment with diverse and often incompatible data definitions shall have a **unique, unified approach** to represent and handle information flows.

Knowing also that the implementation of decisions entails the support of information systems, and information systems require decision-making components to be competitive, we built an application information model, which should be the cornerstone for the intelligent proactive optimization service of PRELUDE solution.

As expected, the investigation and documentation of the different PRELUDE tools, drives us to a **holistic approach** of representation of the information, which allows the PRELUDE idea to compete worthily in the interoperable world of information. The proposed approach respects current standard tactics used in building energy simulations and acquires and expands this logic, creating its own pathways.

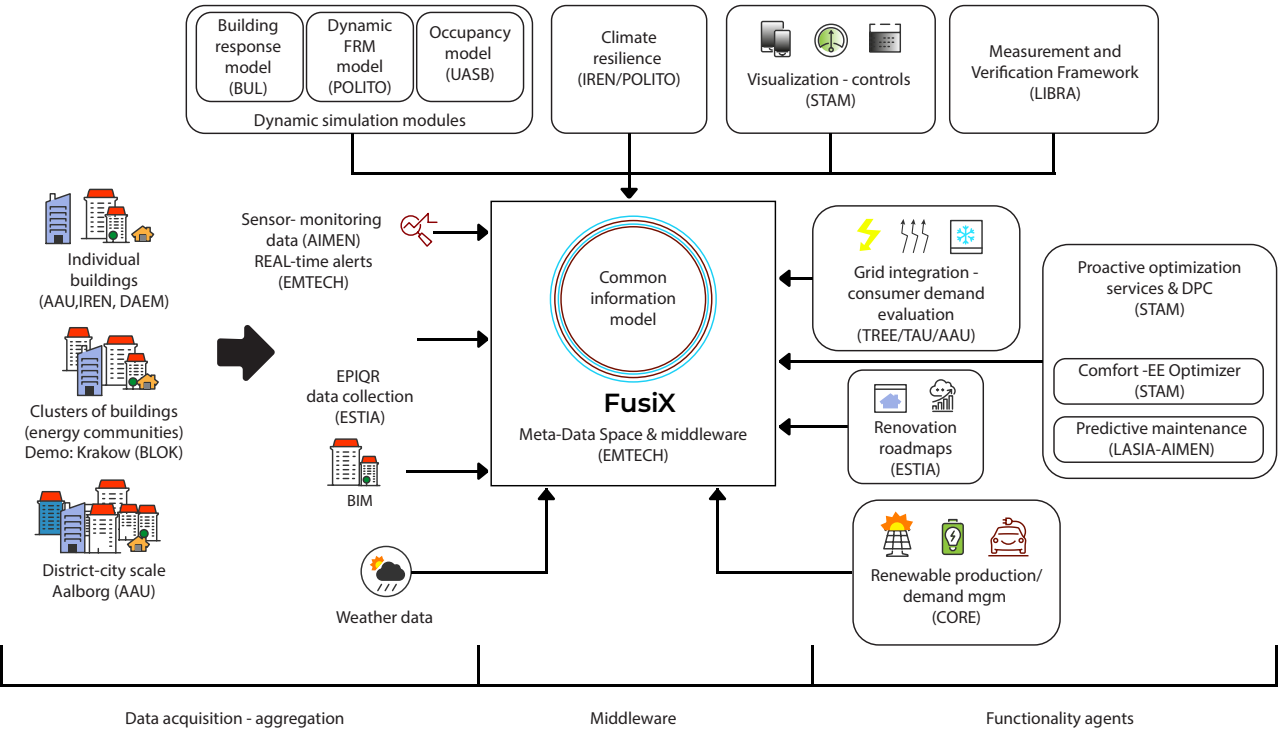


Figure 1. Schematic overview of the PRELUDE architecture.

WP3_POLITECNICO DI TORINO

Interoperable dynamic module integration in multisimulation dataspace

During these months all WP3 tasks are continuously working to support the development of all contents correlated to the development of **interoperable dynamic modules**. Task 3.1 have explored the possibility to **forecast** (with acceptable error) several **environmental variables**: temperature, shortwave radiation, direct radiation, diffuse radiation, relative humidity*, and precipitation* (*higher forecast error) and model development and training is undergoing for all demo locations.

In parallel, in Task 3.2 Energyplus simulations are run via the PREDYCE tool, a new Python package which allows automatic parallelized simulation runs and input file modification supporting **FR and geo-climatic analyses**. Devoted actions and KPIs have been implemented to handle properly overhangs, shading systems and ventilation inside buildings, together with associated control strategies. Additionally, it is under development a specific usage scenario to support 24h forecast suggestions to users for shading and window opening optimization. Task 3.3 have worked

on the **occupancy monitoring strategy** in connection with WP6. Basic working schemes for occupancy and behavioural models have been defined supporting a behavioural rule extractor toward agent-based occupancy model prediction.

For T.3.4, an **indoor-outdoor correlation model** is being developed which utilises weather-related inputs and building data to forecast indoor conditions. First, weather conditions of the four demo building locations were examined using bioclimatic rules and some tests were carried out using CONTAM software to examine indoor air quality conditions. Then a simplified thermal model with typical building schedules was developed using EnergyPlus and is being tested using weather files of two demo sites, Krakow and Athens. Correlations enabling forecast of indoor conditions of thermal, visual and IAQ from weather files are being developed which will then be tested for all demo sites for a tailored version of PRELUDE and validated using data from the Energetikum Living Lab.

WP6_FORSCHUNG BURGENLAND Preparations in living lab Energetikum for validation

The **Energetikum Living Lab (ELL)** continues to play a fundamental role within the PRELUDE project as it provides all the necessary **test** and **simulation** instruments hence guaranteeing the set end objectives of the plan. Such instruments entail the prerequisite HVAC-, control- and monitoring systems. This Living Lab is also fitted with various energy supply systems and coupled with over 2000 monitoring points (temperature, humidity, CO₂, VOC, water and air enthalpy flow, heat meters etc.) to ensure a detailed room air quality and energy flow analysis. It is additionally equipped with an open platform communication and building automation and control network interface that will be modified to serve the PRELUDE **proactive optimization functions**.

The vital tools, functions and interoperable interfaces needed for implementing the PRELUDE solution are in their development phase. A specific work package (WP6) is in its implementation phase, and it brings together the PRELUDE solutions (FusiX dataspace, predictive maintenance system, energy efficiency optimizer, climate and weather data acquisition algorithm,

measurement, and verification framework, Dynamic FRM, occupancy models, climate correlation model etc.) to a functional mode with the implementation carried out in a living lab environment. The long-term **tests**, detailed **validation** and optimization of the developed PRELUDE functions and proactive operation module are slated to be conducted under real operating conditions.

At this stage of the Prelude project implementation, the consortium members prepare a collaborative **validation methodology** and associated plan to implement the PRELUDE solutions in the LLE. The corresponding partners would ensure the installation of their modules in the LLE and monitor and evaluate its operation.

During the validation period, no direct communication between the single PRELUDE modules and the LLE is planned. Therefore, an interface is to be developed to support selected bidirectional communication protocols between FusiX and the LLE. In addition, all PRELUDE modules should be able to communicate with FusiX, so that the FusiX dataspace

works as a middleware for the overall communication process. Progress indeed has occurred, and the future of the project looks bright.

Interested in knowing more?
Take a look to the PRELUDE website for the complete news!

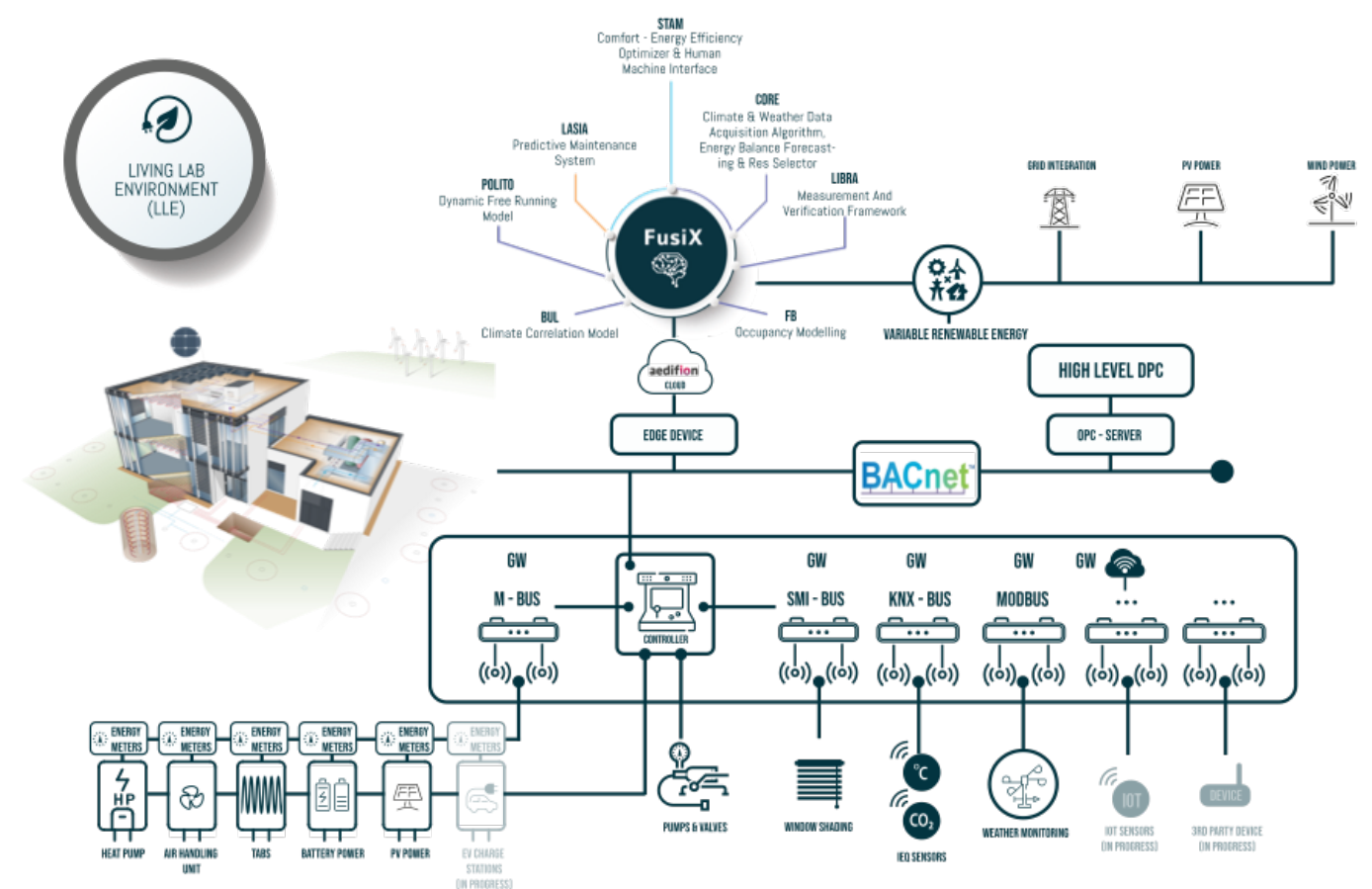


Figure 2. Developed Interface that supports selected protocols for a bidirectional communication between FusiX and the LLE.

WP7_1AI Demonstrations in operational environment

For the Work Package 7, several **pilots** are being prepared for the implementation and validation of the PRELUDE solutions.

In order to achieve a better understanding of the pilots and their characteristics, a compilation of **Business Use Cases** (BUC) of the PRELUDE solutions has been established.

The preparation of these BUC has allowed us to determine:

- whether the pilots are ready for a full **implementation** of all the modules included in PRELUDE;
- **scope** of application in each case;
- **reorientation** in some of the pilots of their goals and objectives.

The BUC have also been crucial for establishing priorities and finalise the definition of the **monitoring** solutions in some of the pilots.

On the pilot side, a more comprehensive definition has been determined based on the level of **smartness** of each one of the pilot buildings.

This will grant a first overview on the possible advancements and specific solutions that could be applied to each of the pilots.

Moreover a continuous work has been carried out in order to bring most of the pilots to operation.

The PRELUDE project accounts for 9 pilots located in 5 different areas (**Athens, Turin, Krakow, Geneva and Denmark**).

As represented in the image below the pilots present a different smartness level from one another.

All but one (Athens) have started or are about to start the monitoring operational status, meaning that they are already collecting data for the baseline period that will serve as reference point for evaluating results after PRELUDE integration.

It is also important to note, that global logistic crisis and the COVID pandemic have had an important impact in deploying this monitoring operational status of the pilots.

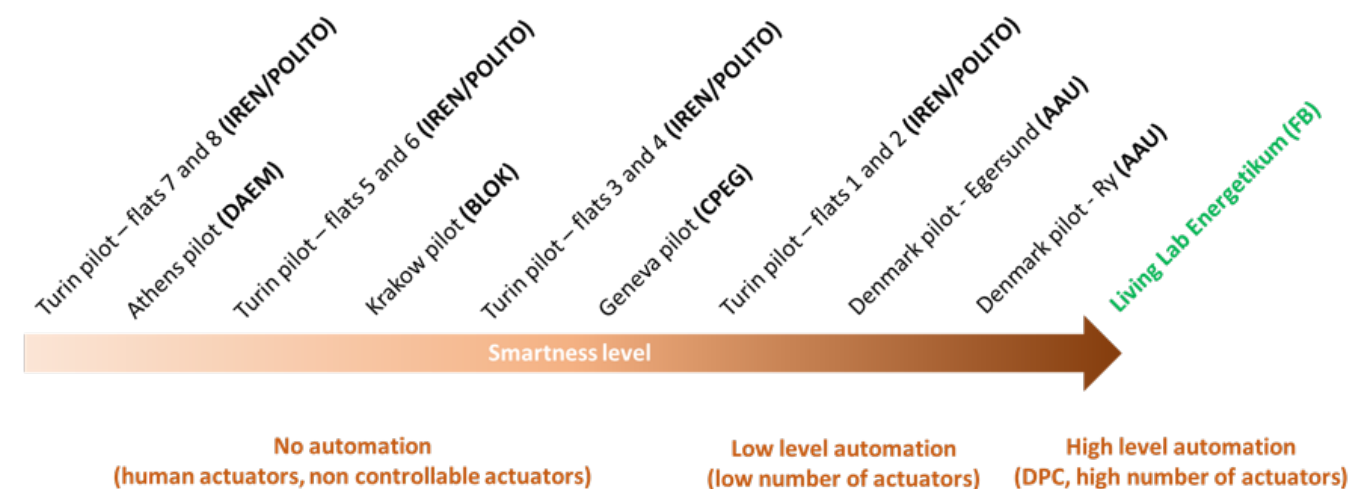


Figure 3. Smartness level of pilot buildings.

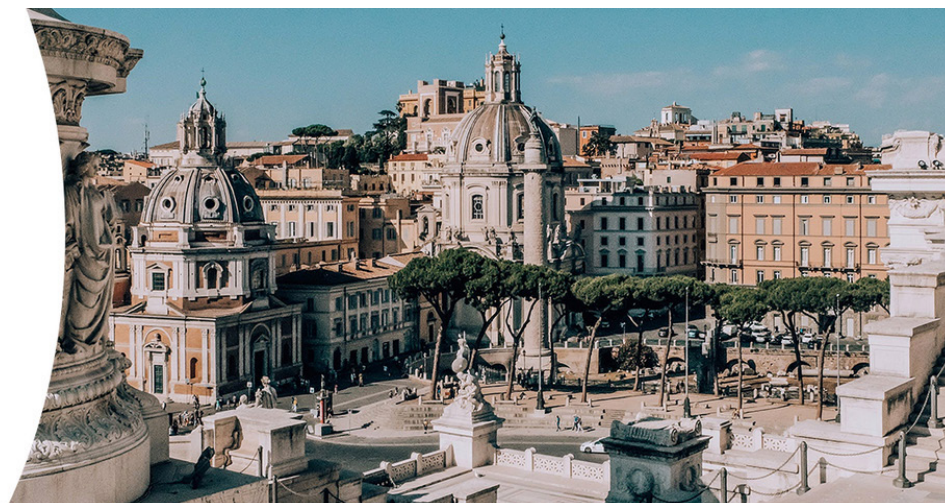


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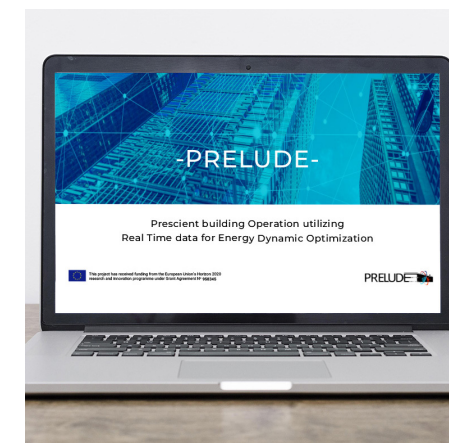
PARTICIPATION TO THE SUSTAINABLE PLACES CONFERENCE September 29th-October 1st ROME

The Sustainable Places Conference represents since its first edition in 2013 a crucial event for the dissemination and discussion of project results in the field of Circular Economy and all those topics related to “Sustainability”, in its multifaceted meanings, with specific focus on the Built Environment. The ninth edition took place with a hybrid

format, both physically in Rome and remotely. PRELUDE joined the event represented by UniSMART partner. The project poster was displayed at the physical venue and uploaded on a specific section of the event website. It was a first networking opportunity for building synergies with PRELUDE-related projects.



2ND PROJECT GENERAL ASSEMBLY 2nd-3rd December 2021 Digital Event



In beginning December PRELUDE project partners met remotely for the second semestral General Assembly. The meeting was planned to be held in Pinkafeld, Austria, at FORSCHUNG BURGENLAND partner's premises, but due to the restrictions associated with the COVID-19 pandemic, it was switched to a digital event. Two dense days during which Work Package leaders presented to the entire Consortium the latest results and the activities conducted in months 6-12. Each session was enriched by proactive discussions aimed also at agreeing on the next steps of project development.

1ST PROJECT REVIEW MEETING 26th January 2022 Digital Event

The Project Review Meeting is a fundamental cornerstone, especially the first one, as it can crucially steer and influence the further implementation of the project, starting from reviewing and assessing the activities conducted during the reporting period. The meeting was held remotely and all the Work Package leaders presented the key outcomes and main challenges of the first 12 months of project implementation. The Project Officer and the External Reviewers provided the consortium with remarkable comments and suggestions, underlying also main criticalities and areas of improvement.



Connect with us!

Are you interested to stay updated about PRELUDE project developments?

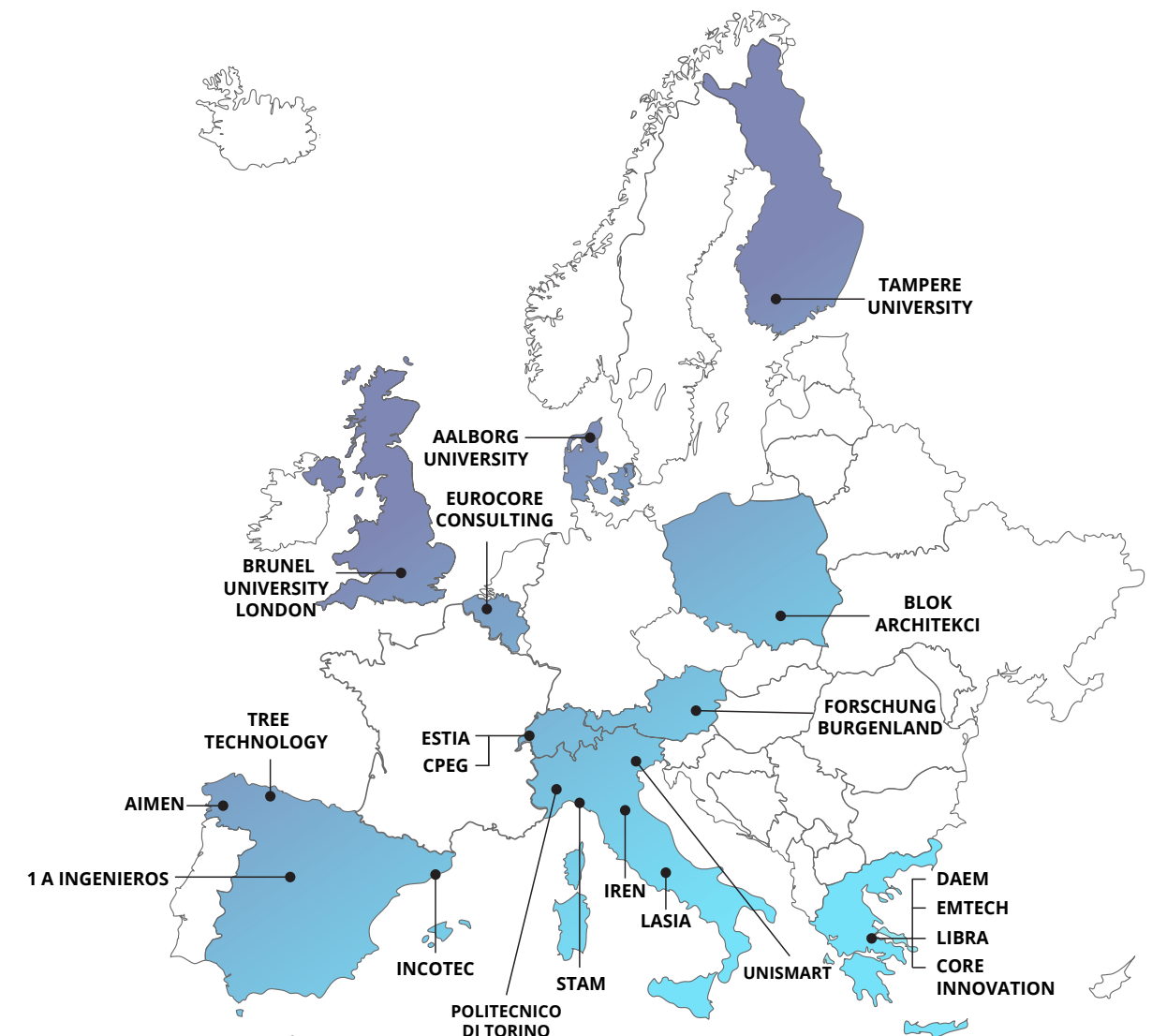
Are you a professional in the field of building or energy service providers interested in collaborating with PRELUDE partners?

Contact us to share your feedbacks and ideas on this page.

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