BIMERR
RENOVATION 4.0

SUSTAINABLE PLACES 2021
Sep. 28 - Oct. 1, 2021 | Rome, Italy

BIMERR Renovation 4.0 toolkit

BIM-based holistic tools for Energy-driven Renovation of existing Residences

Giorgos Giannakis

HYPERTECH energy labs

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 820621
Call identifier: LC-EEB-02-2018

In a nutshell

BIMERR *- Design and develop an ICT-enabled Renovation 4.0 toolkit comprising tools for AEC stakeholder support throughout the energy efficiency renovation process of existing buildings.*

BIMERR is an **EU-funded project** under Horizon 2020, related to the Building Information Modelling (BIM).

16 partners from **9 Member States**

Budget: approx. **7€ million**

Project duration: **45 months** (1/2019 - 09/2022)

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BIMERR Pilot sites

Pre-pilot Kripis

KRIPIS home, the first Smart Near-Zero Energy Building in Greece, with IoT, Smart Home solutions

Pre-pilot Athens

Residential building in Athens for smart sensors installation, audits, surveys, and digital model population activities

Pilot Bilbao

Residential building in Bilbao, Spain. 5-storey high with 60 apartments that will be renovated using the BIMERR tools

Pilot Warsaw

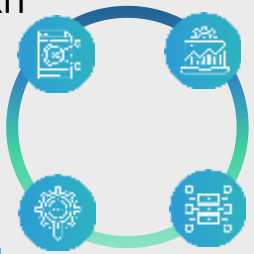
Residential building in Warsaw, Poland. L-shape, 4-storey building will be renovated using the BIMERR tools

BIMERR Consortium

BIMERR Objectives

PROCESS AND WORKFLOW MANAGEMENT TOOLKIT

AUTOMATED CREATION OF BIM (IFC STANDARD)

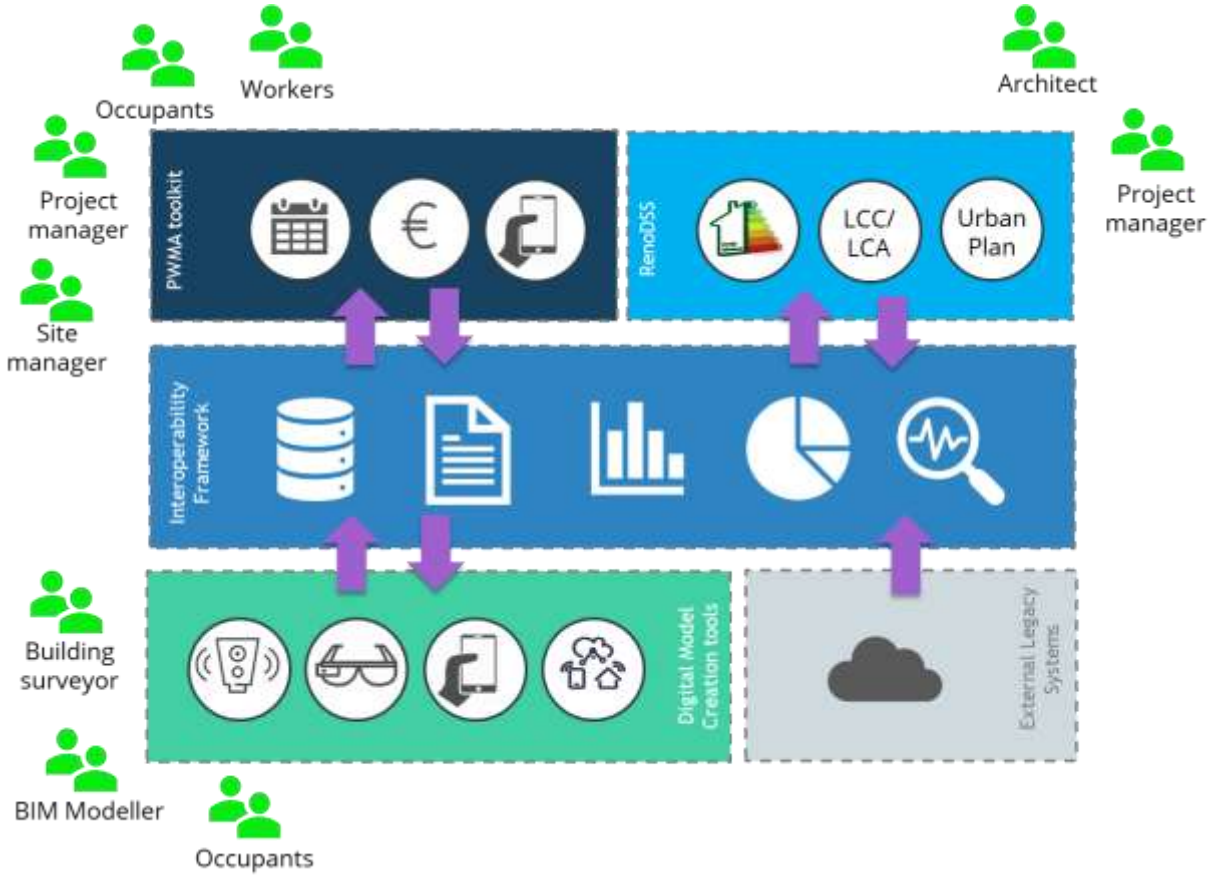


RENOVATION DECISION SUPPORT SYSTEM

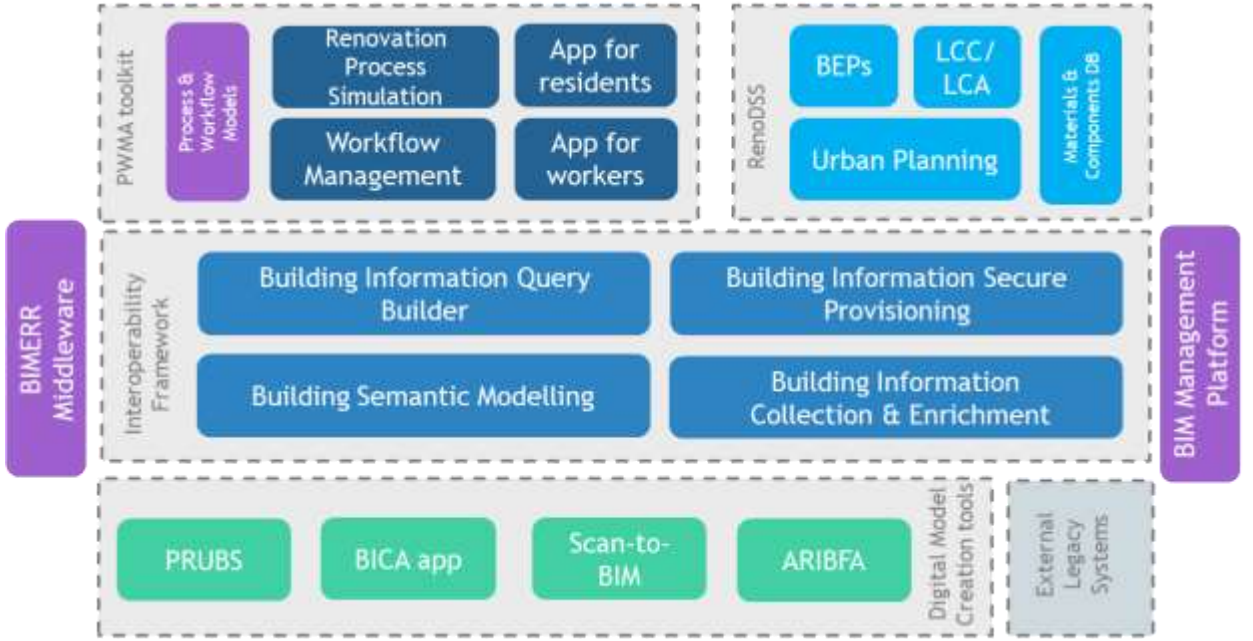
INTEROPERABILITY FRAMEWORK

From the concept to delivery

BIMERR concept



BIMERR solution



BIMERR Components

RENOVATION 4.0

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Architect

Project Manager

Students & Researchers

Building Surveyor

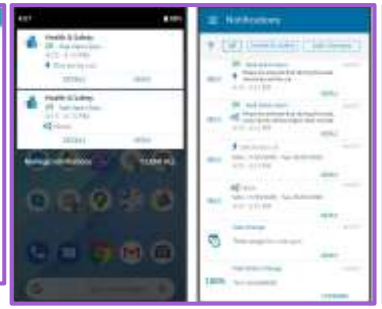
BIM Modeller

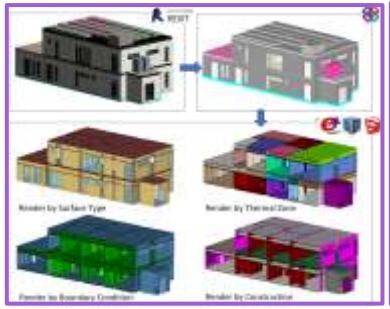
Workers

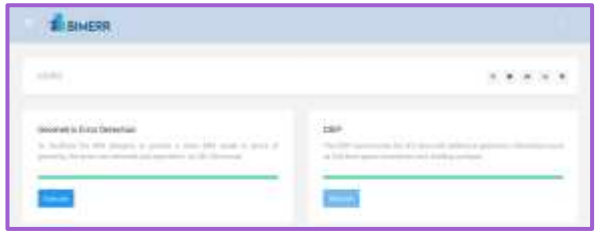
Project Manager

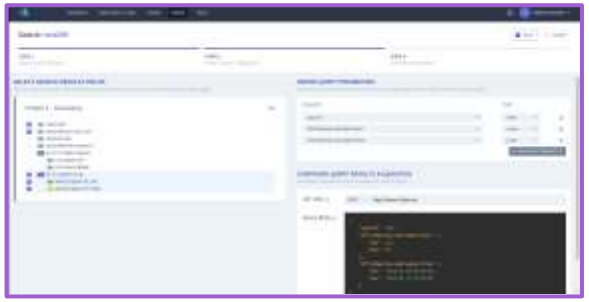
Site Manager

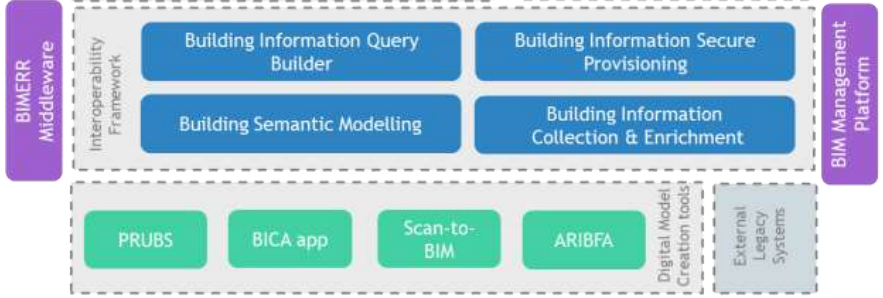
Occupant

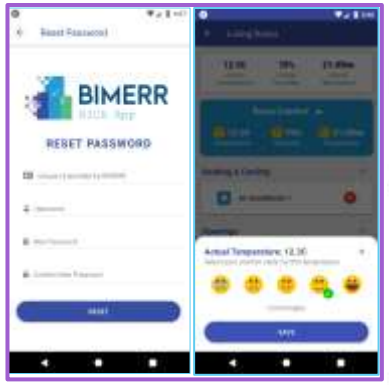


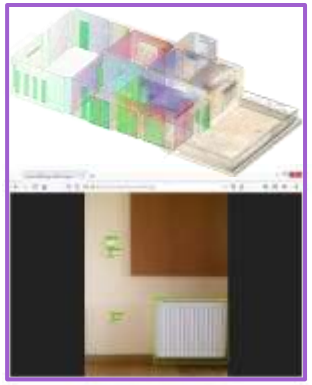












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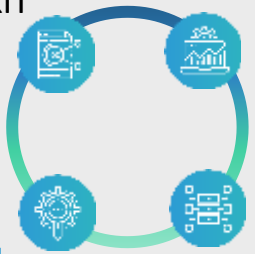
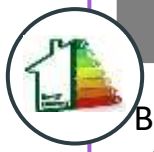


RENOVATION DECISION SUPPORT SYSTEM

INTEROPERABILITY FRAMEWORK

BEP Simulation - Requirements



Static Data

Building Information Model:
- ✓ Geometry
- ✓ Construction
- ✓ Materials
- ✓ HVAC components

Dynamic Data

Operational Schedules:
- ✓ HVAC setpoints, status
- ✓ Openings Operation
- ✓ Artificial Lighting
- ✓ Electric Equipment

Weather Data

Typical Meteorological Years:
- ✓ Dry Bulb Temperature
- ✓ Relative Humidity
- ✓ Solar Radiation
- ✓ Wind speed/direction, etc.

Other simulation Parameters

Domain Expert Information:
- ✓ Simulation timestep
- ✓ Surface convection algorithm
- ✓ Heat balance algorithm
- ✓ Convergence criteria, etc.

Building Performance Simulation Engines

Reno DSS

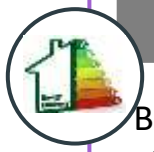
- ✓ Static data collection is very time-consuming process, often requiring more time than is available within project deadlines
- ✓ Static data transformation non-standardized process; results can significantly vary from one modeller to another

- ✓ oversimplified and modelled as either deterministic or predefined rule-based schedules

EPW

JSON

BEP Simulation - BIM & obXML



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Building Performance Simulation Engines

Reno DSS

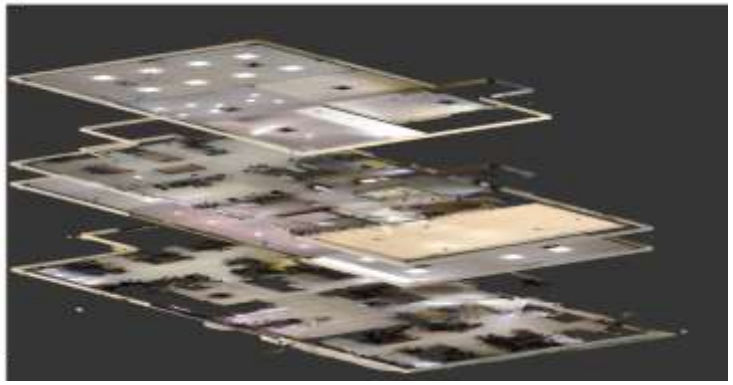
obXML

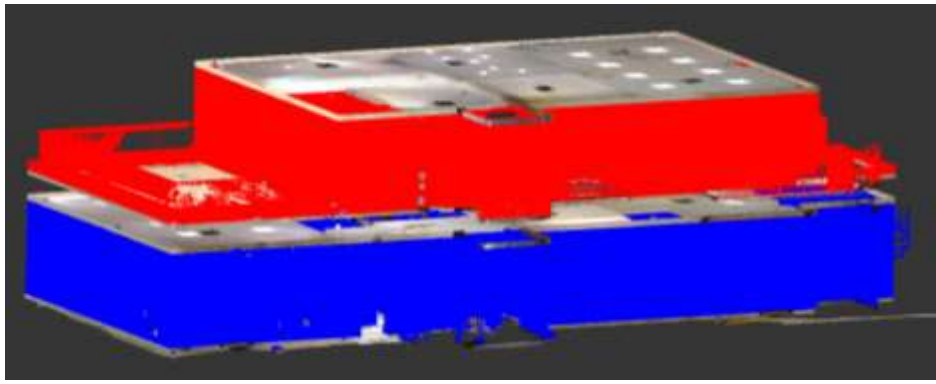
EPW

JSON

- ✓ Automated IFC to Input Data Files of Simulation Engines – streamline & expedite the static data acquisition
- ✓ obXML – methods and models to reduce the gap between simulated and measured BEP by representing OB in a standardized XML schema

Automated creation of BIM: Scan-to-BIM



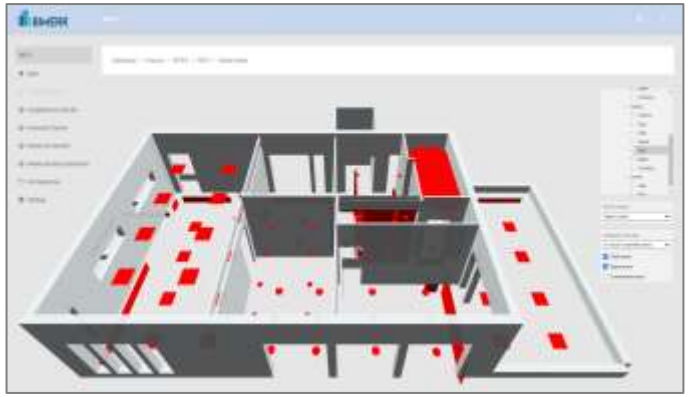


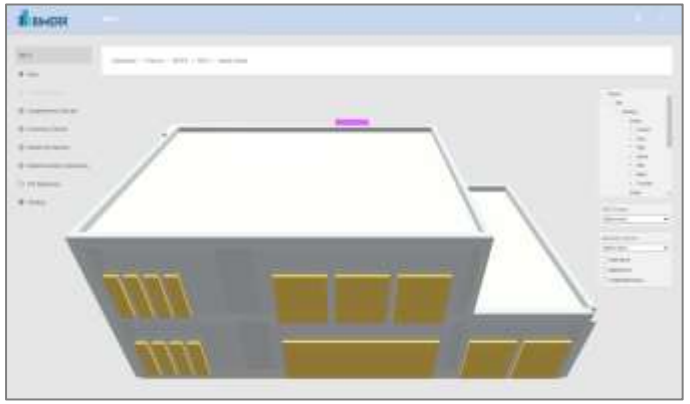
Scan-to-BIM: A toolset for the automated creation of BIM

- ✓ Input – the laser scanning and photography
- ✓ Output – a Building Information Model of the building, that includes structural components (walls, floors, openings) and MEP components (e.g., HVAC, sockets, and switches)
- ✓ Scan-to-BIM Structural sub-component – to create the structural BIM model from the point cloud data
- ✓ Scan-to-BIM MEP sub-component – to enhance the previous BIM model with MEP components
- ✓ Scan-to-BIM Editor – to modify the generated BIM model by adding information about materials and properties
- ✓ Sub-components are integrated in an umbrella component with Graphical User Interface (GUI): the Scan-to-BIM Interface

***Scan-to-BIM**: the first version of the BIM model in IFC format is ready to be processed by ARIBFA and BIM platform*

Automated creation of BIM: BIM Platform



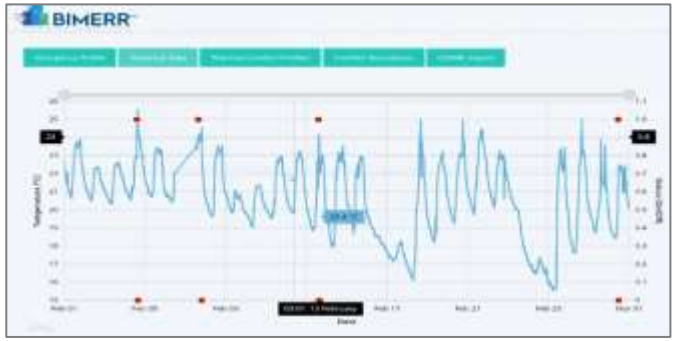


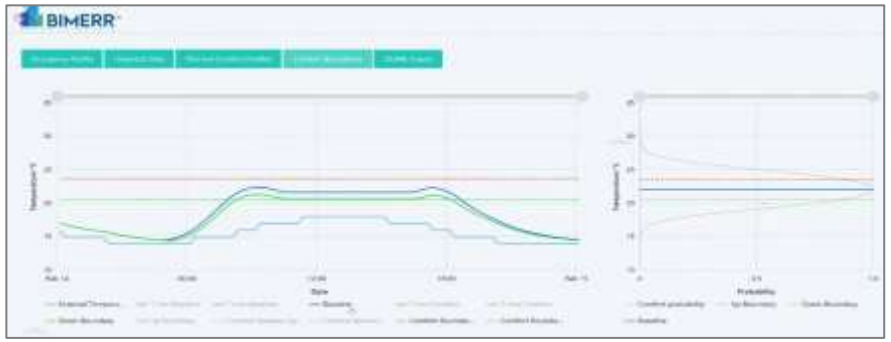
BIM Platform: A toolset that optimises and checks the completeness & correctness of the BIM model

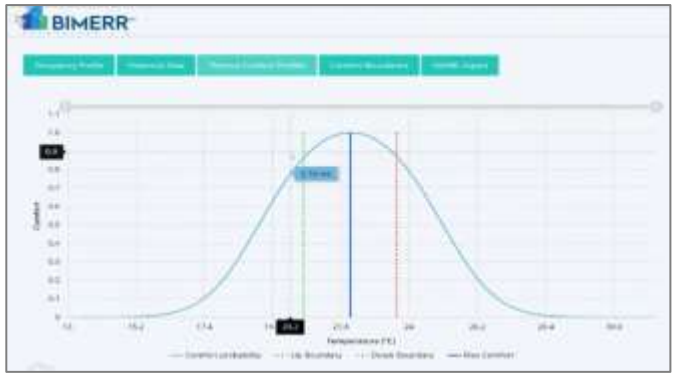
- ✓ Input – BIM model in IFC format
- ✓ Output – a complete, correct and optimised IFC model that meets the building performance simulation static data requirements
- ✓ 3D Model viewer
- ✓ Completeness checker of the BIM model
- ✓ Correctness checker of the BIM model
- ✓ BIM model geometry generator - OBJ

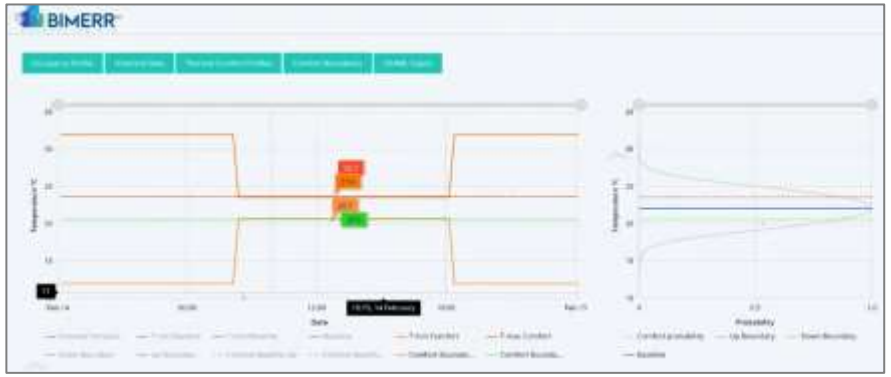
***BIM Platform**: the BIM model in IFC format is ready to be processed by the Renovation Decision Support System of BIMERR*

Dynamic Data - PRUBS









WSN design/installation

Sensors
- Temperature
- Humidity
- Luminance
- Occupancy
- CO_2

Metering
- Plug
- Circuit Board
- Clamp
- Electricity/Gas/
- District Heating

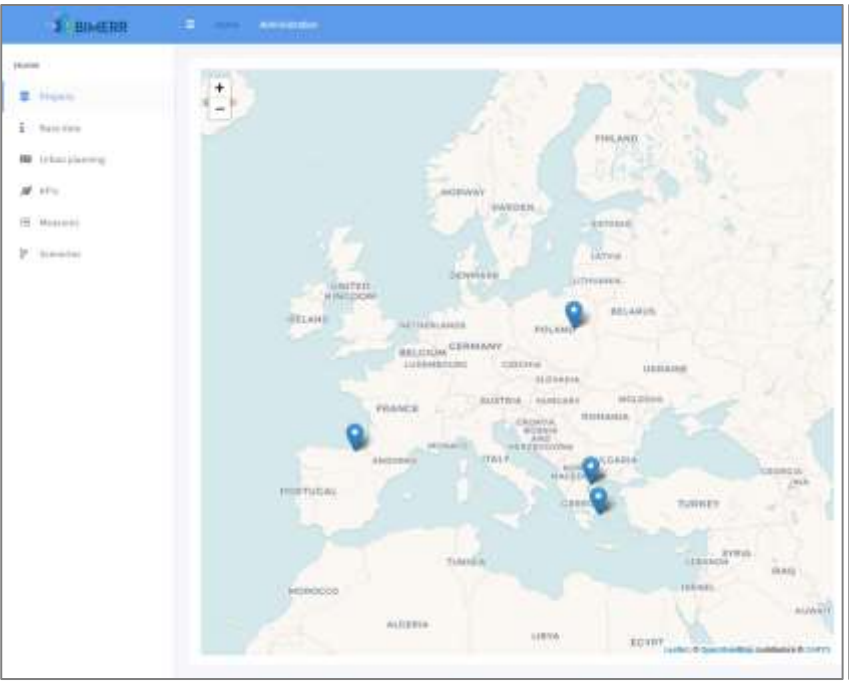
Weather
- Temperature
- Humidity
- Cloud cover

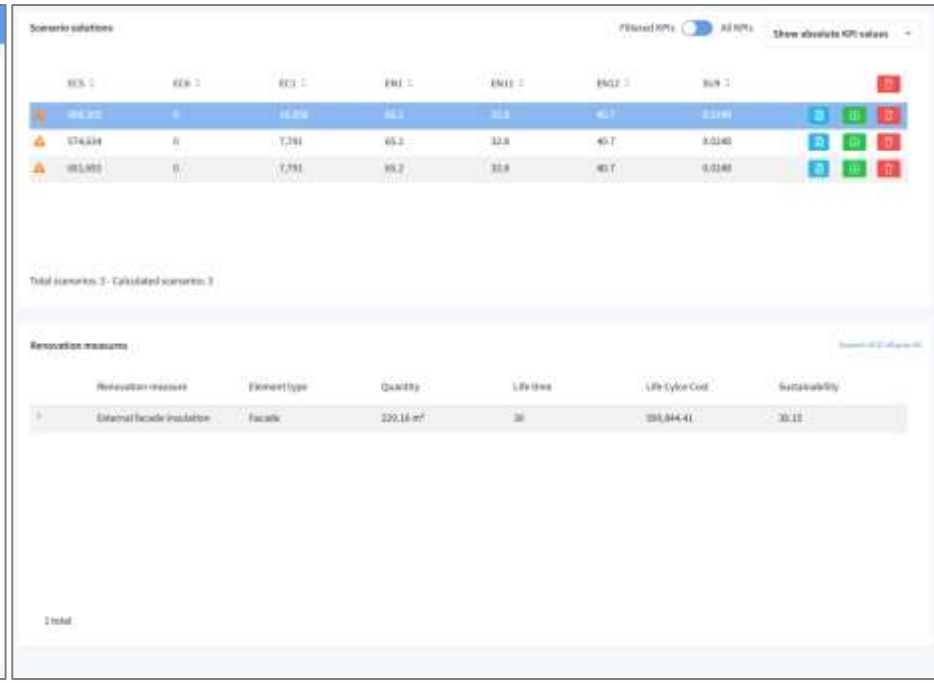
PRUBS: Profiling Residents Usage of Building Systems

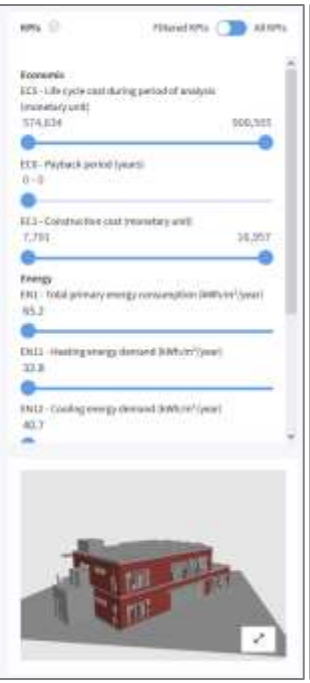
- ✓ Input – IoT data acquired by a Wireless Sensors Network
- ✓ Output – Occupant behaviour models in obXML format that meet the dynamic data requirements of building performance simulation engines
- ✓ Comfort/Discomfort event generator – extract information about occupant's comfort/ discomfort sensation driven only by the collected sensing and monitoring data
- ✓ Occupant behaviour modelling – ML based algorithms that estimate the occupants comfort boundaries and actions or controllable elements based on the comfort/discomfort events
- ✓ obXML data model generator – populates the obXML data model with Occupant behaviour Models data

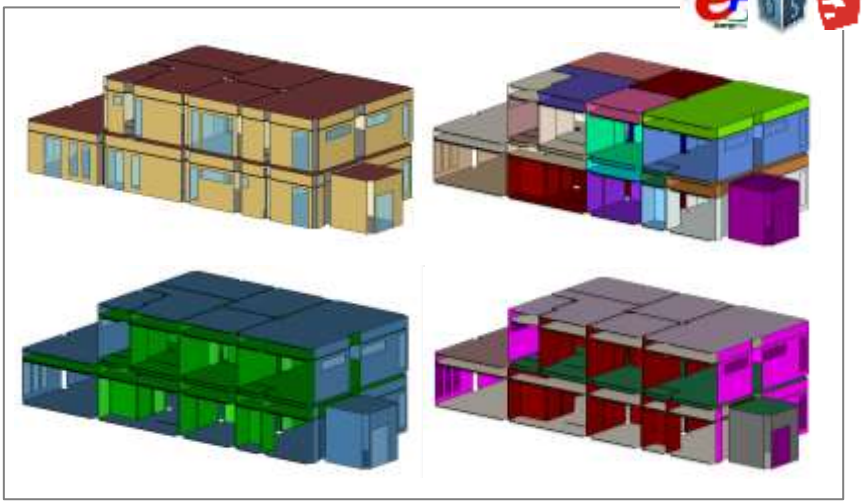
obXML

Renovation decision support system









RenoDSS: A web-based system that can be collaboratively used by multiple users

- ✓ Input – the open industry standard IFC for a given building configuration
- ✓ Output – Energy, sustainability and economic KPIs of a given building configuration
- ✓ Automated generation of renovation scenarios which meet the target KPIs
- ✓ Renovation scenario KPIs sorting, filtering, and comparison
- ✓ Detailed information on single renovation measures on the web
- ✓ PDF reports with detailed information on selected renovation scenarios
- ✓ Download IFC file for each renovation scenario

Contact us

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BIMERR Dessimination & Exploitation Manager

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