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Building Information Modeling for Building Energy Management Systems

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The BIM4BEMS project investigates how to **achieve improved reporting of energy and comfort related parameters in the building operation phase**. A dynamic building information model (BIM) is developed in which facility data are combined with building energy management system data. The **BIM** is derived semi-automatically **from available design, operational and maintenance data** with semantic and geometric reasoning. The requirement of incomplete and poorly structured base data affect the definition of the data model and workflows for semi-automated generation of the dynamic BIM.

PROJECT GOALS

Goals of the BIM4BEMS include:

- Definition of **use cases** for improved reporting and visualization by combining BIM data and building automation and building energy management (BEMS) data and their validation through stakeholder feedback
- Creation of an integrated **semantic BIM4BEMS data model**
- Design of a **system architecture**
- Development of a **process model** for the creation and maintenance of the BIM4BEMS model
- Integration of available tools into a prototype, **proof-of-concept framework**
- Implementation of data model, system architecture and process model for a **test building**, with coupling between data model and monitoring data from the building management system
- Validation of the proof-of-concept framework in the test building
- Cost-benefit analysis for the optimization and improvement of the process quality in terms of scalability and applicability in larger buildings and building complexes

METHODOLOGY

Define and validate use cases for improved reporting and visualization

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Develop an integrated building data model and a modeling workflow model

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Document a test building as-designed/as-built/as-is (Architectural/FM + HVAC)

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Test data and workflow models with the test building

USE CASES

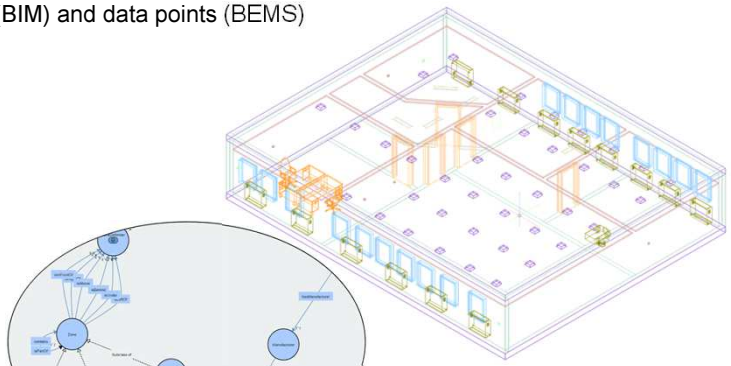
Use cases for improved reporting and visualization of combined architectural and building automation and energy management guide the development and implementation of the BIM4BEMS model. They include:

- Visualize **datapoint values** in a spatial context
- Visualize **alarms** in a spatial context
- Visualize **radiant cooling/heating elements**
- **Energy reporting**
- Visualize **logging data** in a spatial context

For each use case, actors, triggers, basic flow, and necessary information are captured. Actors typically include a building manager and building information and energy management models. Most use cases are triggered either on demand or by an automated check. Required BIM data includes rooms, room functions, and relational data, such as room adjacencies. HVAC data include HVAC terminals and their locations as well as grouping of rooms into zones and zone adjacencies. Typical visualizations highlight the spatial distribution of datapoints in the context of their rooms together with their readings.

MODEL DESIGN

The model is designed as an **integrated semantic data model** with knowledge representation and definition of the structure of metadata (BIM) and data points (BEMS)



The semantic data model is based on an existing ontology for smart building energy management.

City of Tomorrow is a research and technology programme commissioned by the Federal Ministry for Transport, Innovation and Technology (BMVIT) and carried out by the Austrian Research Promotion Agency, Austria Wirtschaftsservice Gesellschaft mbH and the Austrian Society for Environment and Technology ÖGUT.