



The Horizon 2020 BIM-SPEED project



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BIM-SPEED – which is an acronym for Harmonized Building Information Speedway for Energy-Efficient Renovation – is a newly funded project by the European Union’s Horizon 2020 funding scheme. It is funded under the energy efficient buildings program with a project start in November 2018. In four years, the project will develop

- a cloud-based BIM platform that is open, affordable and user-friendly and
- a set of inter-operable BIM tools, existing and new ones, all connected through the BIM cloud platform.

Additionally, around these technical innovations, validated and standardized procedures for BIM-based

activities throughout the whole renovation process will be developed.

The project starts from the premise that BIM for renovation and asset management of existing residential building stock is viable. This viability has already been proven in pilot projects by the BIM-SPEED consortium members and stakeholders, so that the BIM-SPEED project is set to get off to a “flying start”. Housing corporations, research institutes, as well as, engineering and construction firms involved in BIM-SPEED have already successfully implemented Building Information Modelling (BIM) for energy-efficient renovation of residential buildings in Spain within a Smart Cities project led by housing corporations and contractors; in Germany by housing corporations in collaboration with BIM consultancy firms and universities; in France by housing corporations in relation with research institutes; and in Poland by the municipality of Warsaw together with a construction company.

Despite these initially successful projects, for a large-scale uptake across Europe, technological, economic and organizational bottlenecks remain so that the full potential of BIM can be leveraged. BIM-SPEED sets out to remove all these barriers by providing every stakeholder in the housing renovation market with holistic solutions during the four main stages of a renovation project:

1. Existing building data acquisition
2. Renovation design and engineering
3. Performance analysis
4. Execution of renovation works

Because the implementation of new innovative HVAC systems is one of the main tasks during the energetic renovation of buildings, BIM-SPEED will also develop new innovative HVAC related process solutions for each of the phases as described in the rest of this article.

Mapping existing HVAC systems

As a first step in every renovation project a sound understanding of the existing building needs to be developed. This is challenging for HVAC systems as much of the systems consist of non-visible parts that cannot be mapped by state-of-the-art survey methods, such as laser scans. BIM-SPEED will therefore develop advanced data fusion and machine learning methods for the optimal combination of non-destructive scan technologies (for example radio frequency, thermog-

raphy, or radar) to reconstruct HVAC systems and installations. The methods will also fuse information fragments that are partially available in different existing documents such as as-built plans and specifications. As for most buildings it can be expected that the HVAC survey, despite all the use of latest technologies, will be incomplete, BIM-SPEED will develop an automated categorization scheme that can provide engineers a strong indication about the completeness of a specific reconstructed HVAC model.

Integrated renovation design and engineering

To support renovation design and engineering activities, BIM-SPEED will develop a BIM library of the most common HVAC equipment components that can be installed in the existing stock of residential buildings in the EU. An IT solution will additionally be provided to interface with the catalogues of renovation products/solutions for existing buildings provided by the major building companies, manufacturers and suppliers in the EU renovation market. The interfaces together with the library of parametric HVAC objects will allow seamless data exchange with existing design and engineering applications and databases and hence significantly improve the renovation design and engineering process. A specific focus of BIM-SPEED will be to ensure that the ontologies and interfaces provide all the information that is required for life-cycle analysis and costing assessments is available to renovation designers and engineers, so they can clearly understand the ramifications of implementing different HVAC solutions. All these solutions will be specifically designed to support renovation projects and will therefore contribute significantly to our ability to plan advanced HVAC solutions.

Performance analysis of HVAC renovation solutions

BIM-SPEED will also develop advanced methods to accurately evaluate the performance of different HVAC renovation solutions based on sophisticated whole building energy modeling (BEM) and simulation methods. Various simulations for building renovation modeling guidelines will be developed using relevant BEM tools, comprising energy, thermal load and HVAC performance analyses. BIM-SPEED will prioritize the use of BIM open standards over the usually proprietary input models of the commercial analysis tools. For this purpose, an automated input/output interface will be designed. This will allow for running multiple simulations of varying renovation solutions in search of the optimal energy performance that can

account for different aspects of a building - not only including energy behavior, but also user comfort and life-cycle costs. Advanced simulation experimentation methods will also be established that will allow engineers to conduct large scale parametric studies of different possible renovation alternatives, understand the sensitivity of a building's energy performance on certain aspects of a building system, and to grasp the uncertainties inherent in any simulation result. Besides, possibilities for the automatic parametrization and calibration of simulation models with real-time data and weather forecast will be investigated to run dynamic simulations, extract results, and calculate key performance indicators, such as energy savings per year. In all aspects of simulation of building performances, the accurate simulation modeling of the HVAC systems will play an important role during the research and development work conducted on BIM-SPEED. The project will increase our possibilities to truly assess the effects of HVAC renovation solutions on building performance which will allow HVAC engineers to better size a building's new systems.

Execution of renovation works

BIM-SPEED will also provide new methods and processes to execute the renovation construction work. The project will develop a set of generative rules for deep renovation design that deal with building regulation compliance, for example, with regard to fire safety, renovation strategies, and the availability of building and HVAC product solutions at specific locations in Europe. The design rules will be defined by experienced building and HVAC designers, engineers, construction firms, technical consultants and asset managers. All design rules will be incorporated in a BIM-based

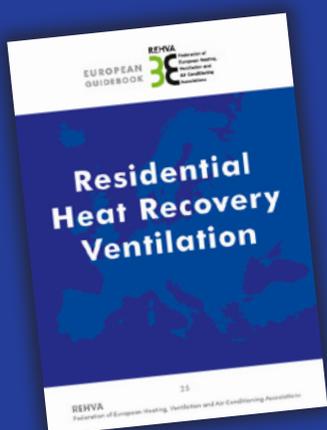


tool. This BIM-based tool will provide automated rule-based validators that can check candidate solutions with respect to their regulatory compliance and will discard all candidates that do not comply.

Additionally, different technical solutions will be developed for a cost-effective use of Virtual Reality (VR) and Augmented Reality (AR) to visualize the renovation process. The spatial visualization will allow building professionals and inhabitants to observe the renovation interventions within the building and in relation to the surroundings before the start of construction work. This will allow for planning all construction work upfront to enable a seamless installation of the chosen HVAC renovation products, but also to support workers on site with accurate installation instructions that are customized to the existing conditions of the building. The AR/VR solutions will be helpful to support the detailed engineering work that is required to integrate HVAC renovation products within existing buildings as it can support the engineering of connections and other interfaces. This task will also be concerned with developing an interface between the BIM platform and VR/AR platforms. ■

REHVA European Guidebook No.25

Residential Heat Recovery Ventilation



Heat recovery ventilation is expected to be a major ventilation solution while energy performance of buildings is improved in Europe. This European guidebook prepared by REHVA and EUROVENT experts includes the latest ventilation technology and knowledge about the ventilation system performance, intended to be used by HVAC designers, consultants, contractors, and other practitioners. The authors of this guidebook have tried to include all information and calculation bases needed to design, size, install, commission and maintain heat recovery ventilation properly.