TIMEPAC

Towards Innovative Methods
for Energy Performance Assessment
and Certification of Buildings

TIMEPAC FACTSHEET

Exploring future scenarios for EPC enhancement:

Generating enhanced EPCs with BIM data

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TIMEPAC aims to modernize building certification practices according to the latest Energy Performance of Buildings Directive (EPBD) review. Through five future "Transversal Deployment Scenarios," we enhance certification by integrating diverse data sources like operational data and renewable energy production. We also merge energy performance certificates with other assessment instruments like the Smart Readiness Indicator (SRI) and sustainability metrics. Our focus includes improving EPC reliability using BIM technologies during renovations and utilizing EPC databases for decision-making in large-scale renovation programmes.

In this scenario, we have developed guidelines to assess the feasibility of generating EPCs from BIM models, ensuring their quality and fostering widespread adoption of BIM for this purpose.

Using BIM to support building renovation

The last EPBD recast recommends that architects and planners apply digital modelling and simulation technologies during the planning, designing, building, and renovation of industrial or residential buildings to assess and improve their energy performance. Moreover, it encourages the use of digital twins to reflect the real-time status of buildings over successive renovations during their lifetime and to incorporate them in the calculation of the Smart Readiness Indicator.

A seamless integration of BIM models with energy simulation tools can enhance the quality and reliability of Energy Performance Certificates (EPCs) and facilitate building renovation. Furthermore, this integration can support the transition from a one-off certification to continuous assessment of building performance over time, taking into account both the building and its environmental impact. In this regard, these technologies can aid in the creation of Renovation Passports and become a part of building logbooks, while also being utilized to calculate life-cycle global warming and the Smart Readiness Indicator (SRI). Utilizing BIM as a source of data can enhance the accuracy of input to simulation and certification tools, and the successive updates of the digital model can reflect the evolving characteristics of the building. Furthermore, by adhering to standardized open interoperability procedures, BIM data can be seamlessly integrated into the EPC generation process, regardless of the specific modelling and simulation software being used.

Benefits of using BIM

A building certification process integrated with BIM and simulation technologies would be beneficial for a variety of stakeholders involved in building performance assessment throughout the building lifecycle (Figure 1).

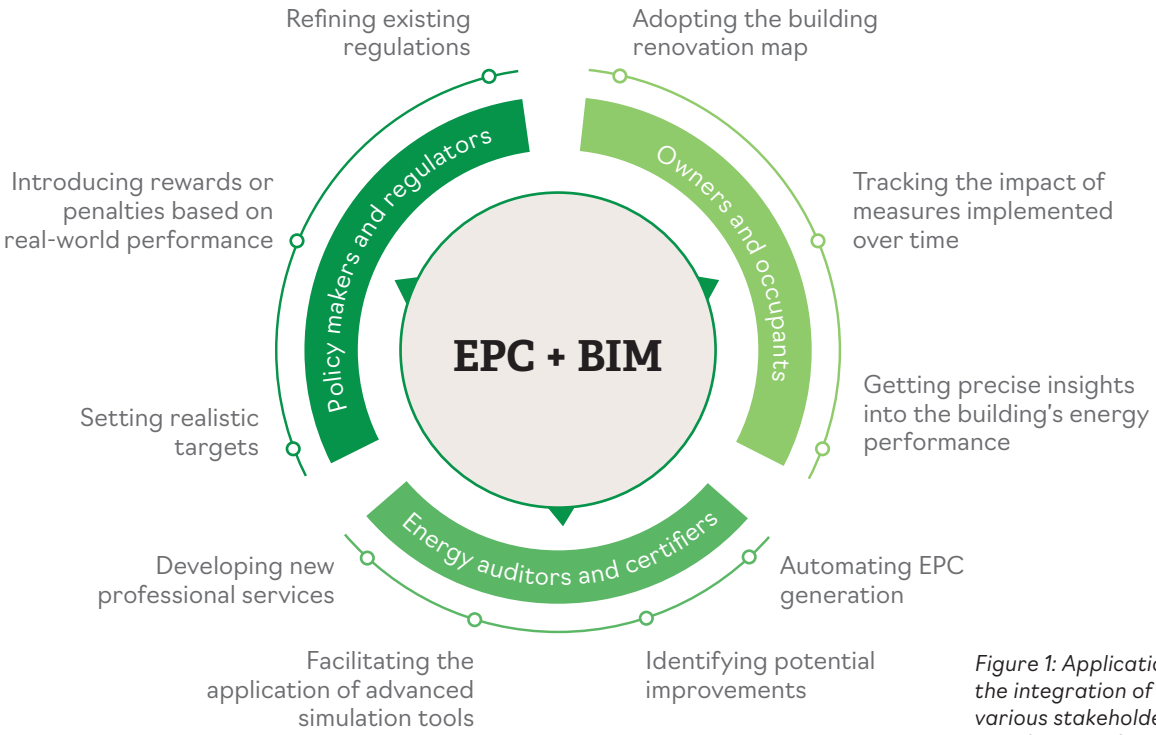


Figure 1: Applications resulting from the integration of EPC and BIM by various stakeholders involved in the certification lifecycle

Owners and occupants

Accurate EPC information aids building owners and occupants by providing precise insights into building characteristics and energy performance. Integrating BIM with energy data is crucial for creating effective building renovation roadmaps and monitoring measure impacts over time. facilitating informed decision-making.

Energy auditors and certifiers

BIM models can streamline EPC generation and enable advanced simulations, surpassing simplified tools typically employed in certification. Energy consultants can leverage simulations to identify potential improvements, while facility managers can assess and optimize a building's performance throughout its lifecycle. The integration of BIM models with the Renovation Passport also fosters new professional services.

Policy makers and regulators

Utilizing BIM, energy simulations, and real energy consumption data aids evidence-based decision-making by comparing actual building performance to simulated or certified energy efficiency levels. This information can assist policymakers in refining existing regulations, setting realistic targets, and introducing incentives or penalties based on real-world performance.

TIMEPAC guidelines for using BIM

Integrating BIM and EPC fully is a long-term goal that faces several challenges, with one of the main hurdles being the interoperability between different modelling and simulation tools. To progress toward this goal, we have formulated a set of guidelines for calculating EPCs from BIM models using existing technologies. These guidelines have the potential to foster the development of standardized and reliable protocols for utilizing BIM in energy performance certification across the European Union. The guidelines have been applied by users in the six countries represented in TIMEPAC.

BIM-to-EPC guidelines development

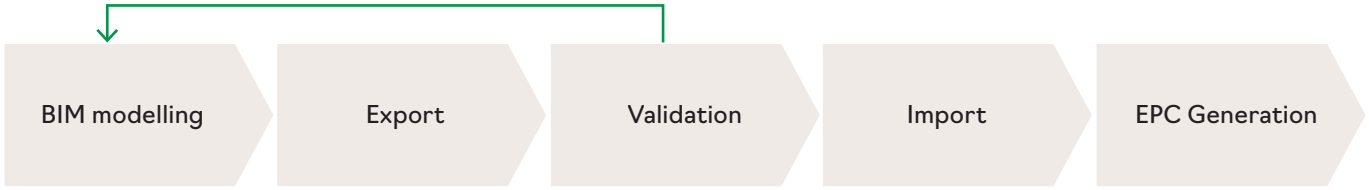
The guidelines cover the process of extracting pertinent data from BIM models and converting it into the necessary inputs for EPC calculation tools. This involves information regarding the building's geometry, materials, systems, and performance characteristics. By utilizing BIM as a source of precise and uniform data, the procedures outlined seek to tackle the challenges posed by outdated, inaccurate, or incomplete information that presently impede the accurate generation of EPCs.

The guidelines consider two scenarios in the certification process:

1. **Creating a new BIM model to generate an EPC**
2. **Assessing the suitability of an existing BIM for EPC generation**

In both cases, the Industry Foundation Classes (IFC) is deemed the standard for exchange to assure interoperability across different BIM software and certification tools.

The guidelines delineate a step-by-step process for creating and utilizing BIM models to generate EPCs, covering the following stages:



- **BIM modelling** includes creating an architectural model of the building envelope and its properties, and an analytical model containing spaces and zones for energy analysis.
- **Export** the BIM model as an IFC file.
- **Validation** of the IFC file to identify errors and ensure completeness.
- **Import** the IFC file into the EPC software.
- **EPC generation**, inputting the data extracted from the BIM model into a certification tool.

The guidelines offer practical recommendations for each of these stages. They aim to ensure a seamless and reliable data exchange from BIM to the simulation tool used to generate the certificate (Figure 2).

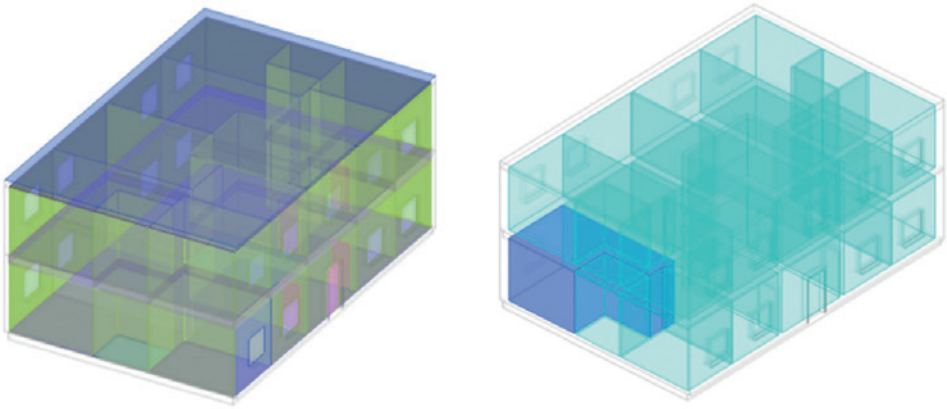


Figure 2: Analytical surfaces and spaces views in Revit, generated from a BIM model

Validating the guidelines with application cases

To demonstrate the applicability and value of the guidelines, a comprehensive validation process was conducted across six partner countries: Austria, Croatia, Cyprus, Italy, Slovenia, and Spain.

The validation process included evaluating the quality and accuracy of the models and EPCs, measuring the time spent on each step of the guidelines, and completing an evaluation form to assess the guidelines' usefulness.

Thirty BIM models, five per country, were generated and assessed using the guidelines. The models represented different types of buildings, such as residential, office, educational, and commercial, with different scales, geometric and spatial complexity (Figure 3), and source materials (e.g. drawings, models and other documents). They were created using two BIM software tools (Revit and Cype) and imported into three EPC software tools (Edilclima EC700, Cypetherm HE Plus, and ETU).

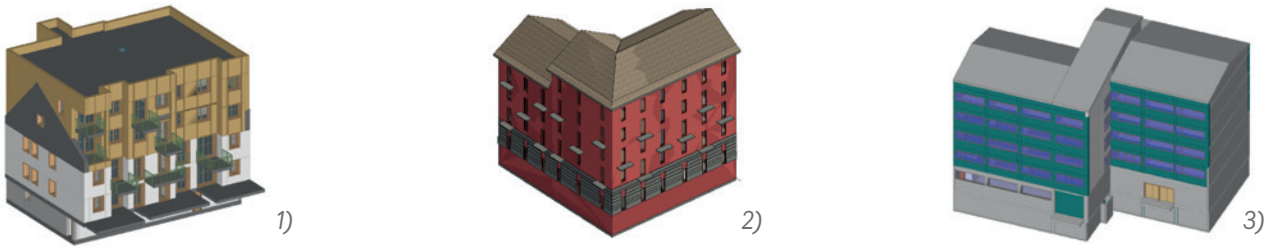


Figure 3: 1) Multifamily building in Austria from 1987, with 685 m² and five floors. 2) Multifamily building from 1920 in Italy, with 2,018 m² and six floors. 3) Office building from 1975 in Croatia, with 2,061 m² and six floors

Analysing the results and providing recommendations

The results of the validation exercise were analysed and discussed, considering the benefits and challenges associated with using BIM for EPC generation in each particular context, with the tools used in each country. Building on these analyses and incorporating user feedback, a cross-country comparison was conducted.

Finally, a series of recommendations were offered for software developers, policymakers, and industry stakeholders to advance in the integration of BIM and EPC tools.

Outcomes

We have demonstrated the feasibility and value of using BIM for EPC generation, while also highlighting some of the existing limitations. The exercises conducted using available tools confirm that BIM can significantly enhance the efficiency of the EPC generation process, improve the quality and reliability of the EPCs, and foster interoperability among different energy simulation and certification tools. However, the results also underscore the need for further improvements in BIM and EPC software tools, the IFC standard, and the training and awareness of the users.

The guidelines provide practical information to address current challenges in integrating BIM and EPC using available technologies. Their validation in the study cases confirmed their applicability and usefulness. Specifically, the guidelines were effective in modelling and sharing geometric information in architectural and analytical models. However, challenges arose in exchanging non-geometric data, with common limitations observed across nearly all application cases. Certain EPC software demonstrated an inability to read complete BIM models or their specific components. Furthermore, evaluating MEP modelling, crucial for creating EPCs, proved difficult and could not be fully executed as outlined in the guidelines. This limitation primarily arises from software development rather than the applicability of the procedures described in the guidelines. Therefore, recommendations were included for software developers, policymakers, and industry stakeholders to contribute to overcome existing barriers hindering the seamless integration of BIM and building certification.

For more detailed information, including the complete guidelines and the results of the validation exercise, please refer to the report "Generating enhanced EPCs with BIM data – Transversal Deployment Scenario 1".

https://timepac.eu/reports/generating-enhanced-epcs-with-bim-data/

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