Development of an Energy Simulation Software: BCORE

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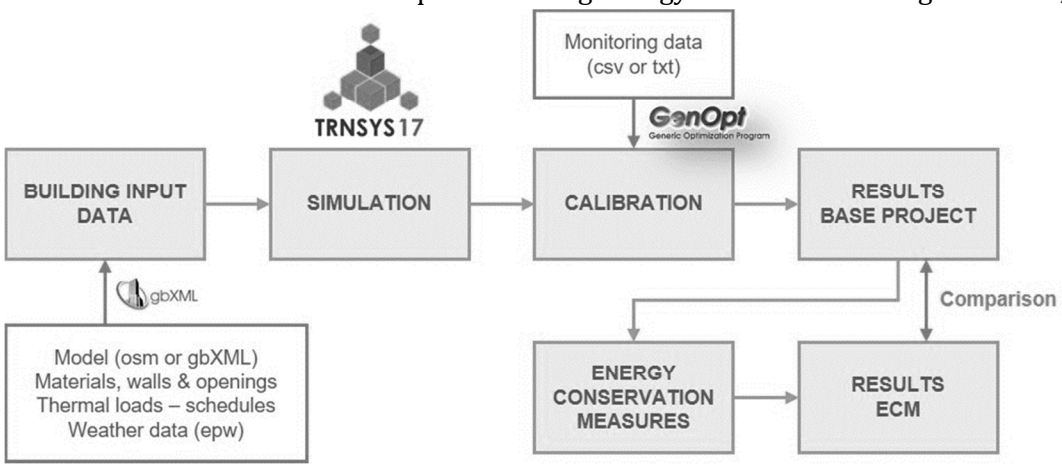
1. Abstract

In recent decades, energy efficiency in buildings has taken a significant role in energy saving, both at national and European level. In fact, energy certification of buildings is currently a requirement derived from Directive 2010/31/EU and Directive 2012/27/EU on the energy performance of buildings. In this field, the computer tools are a breakthrough and a great help for the building energy management.

This work presents BCORE, a new automated energy simulation and calibration tool for buildings. This software allows any user, without having to be an expert in the handling of Information Technology (IT), to perform energy simulations of buildings in a friendly environment and using a clear and intuitive interface. This is an innovative solution, since through a holistic approach this program integrates into a single tool, multiple utilities and applications that are currently not available in any commercial software.

BCORE's starting point is a geometric and constructive model that can be imported directly into the software in OpenStudio Model (OSM) or Green Building XML (gbXML) formats. Then, the software allows the creation of a complete building energy model introducing materials, walls



and openings. Thermal loads of the building can be also entered as well as its schedules. The tool also allows to choose different basic energy generation and distribution systems. Once the energy model of the building has been completed, simply by providing the program with a weather file in EnergyPlus Weather (EPW) format of the area in which the building is located, it can automatically simulate the building. The calculation engine used in the simulation is TRNSYS [1], a transient simulation software with a modular structure formed by components called "Types". Normally, a first simulation does not produce realistic results, there are always discrepancies between the results of the simulation and the real data. A model that is not realistic is completely useless in order to analyze the building energy performance. At this point, it is where the software presents its main contribution, which is the capability to automatically calibrate the building model. Calibration is necessary to reduce these discrepancies between simulation results and actual data [2]. Calibration in BCORE is automated and performed using GenOpt optimization tool, which uses a search algorithm to generate the optimum calibration option. Another novel point of the application is the possibility of implementing Energy Conservation Measures (ECM) that allow to carry out the parameterization of the model to simulate changes in the envelope, the reality of use or the meteorological data. These measures will improve the energy performance of the building. Finally, the application shows the results of temperatures, powers and demands of both the base project and the ECMs, allowing the user, through technical and economic evaluations, to efficiently manage the building. The general overview of the operation of the software can be observed in Figure 1.

Figure 1: Operation of the software

To sum up, next the main differentiators of BCORE compared to other software are listed:

- First and foremost, it is the automated calibration of the simulation, allowing to obtain highly realistic results.
- Incorporation of predefined and expandable libraries of materials and enclosures for any type of building.
- Provision of different infiltration models that calculate loads using statistical techniques.
- Parameterization of the model to simulate changes in the building enclosures, the reality of use or the weather data through the implementation of ECM, which allow the user, through a technical evaluation, to manage the building efficiently.

- Incorporation of predefined basic energy generation and distribution systems in a building.
- Friendly framework, clear and intuitive interface.

2. Acknowledgements

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3. References

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