

Simulation of energy performance of buildings: comparison of computational tools Domus and EnergyPlus

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1 Introduction

Worldwide, buildings are responsible for approximately 40% of energy consumption [1]. In Europe, North America and Asia, they are subject to intense campaigns and legal measures, with the objective of making them more efficient in their energy consumption.

In Brazil, the type of energy most used in buildings is electricity, which is mainly generated in hydroelectric plants [2] and its increasingly consumption provides a greater share of thermal generation.

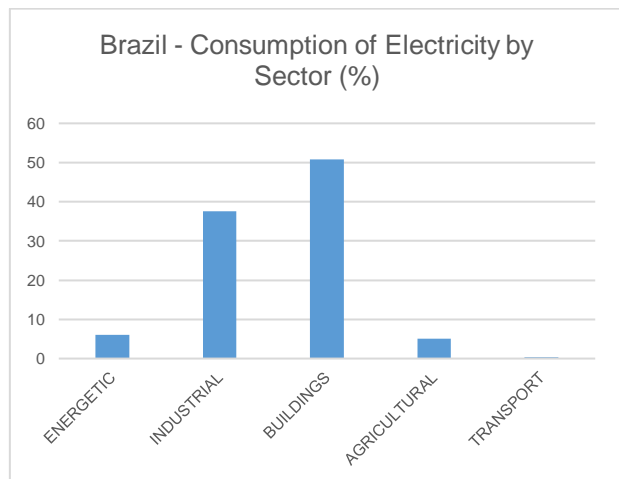


Fig. 1: Consumption of electricity I Brazil by sector.

The Technical Requirements for the Quality of the Energy Efficiency Level of Commercial, Services and Public Buildings (RTQ-C) [3][4] has the objective of providing evaluation mechanisms based on minimum performance criteria, using two methods to evaluate the energy performance of a building: the prescriptive and simulation.

1.2 Simulation

A building can be compared to a machine whose energy performance can be optimized [5]. However, the determination of the energy performance is not trivial task, since it involves a great amount of interdependent variables, whose mathematical modeling is complex.

Energy building simulation can evaluate the thermal and energetic performance of new and existing buildings, analyzing the different alternatives of architectural design, construction components, lighting systems and air conditioning [6].

Simulation is a process of experimenting with a detailed model of a real system to determine how it will respond to changes in its structure, environment or boundary conditions [7]. The large number of variables, the need for dynamical behavior analysis and repeated calculations to analyze the design alternatives leads to the use of computational tools to guide the evaluations under study. Currently, there are several simulation tools, among them Domus, developed by the Laboratory of Thermal Systems (LST) of PUC-PR, with agreement of Eletrobras and EnergyPlus, developed by U.S. Department of Energy (US DOE).

2 Methodology

The RTQ-C Simulation Method will be evaluated through the comparative analysis of two simulation tools, EnergyPlus and Domus, simulating an existing public building located at Santos Dumont Airport Area.

The methodology to develop the present work is that of the RTQ-C Simulation Method, which comprises:

- Modeling the actual building (baseline), with all the characteristics.
- Modeling the referenced building according to the required energy efficiency levels (A, B, C and D).

- The consumption of the proposed (actual) project is compared with the consumption of the reference project from the levels of A (most efficient) to E (less efficient). It must be demonstrated that the energy consumption of the proposed project must be equal to or less than the reference building of each level, which will determine the level of energy efficiency of the building.
- For buildings with simulation for natural ventilation will also be analyzed the percentage of hours occupied in comfort (POC).

3 Results

The expected results of this project are:

- Determination of energy efficiency level of the building with the two simulation tools.



Fig. 2: Inmetro's ENCE Label.

- Evaluation and comparison of the inputs and outputs data required by the two simulation tools.
- Evaluate if the RTQ-C Simulation Method is easy to understand for use in architectural and engineering project offices.

4 Conclusions

In addition to assessing the energy efficiency level of a building, the RTQ-C Simulation Method can contribute to the cost-benefit decision-making of design solutions in relation to economic viability and energy consumption.

However, in order for it to be used intensively, it is necessary to carry out studies, developed with academic level treatment, for its dissemination to the Civil Construction stakeholders of buildings segment.

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