

Energy analysis of school building using Autodesk Insight 360 In context to EUI (Energy Use Intensity)

Asst. Prof. Anand Patel¹, Mr. Vatsal Joshi²

¹Assistant Professor, Civil Engg. Dept., Indus University, Rancharda, Ahmedabad, India

²Student, M.Tech, Construction Project Management, Indus University, Rancharda, Ahmedabad, India

anandpatel.cvl@indusuni.ac.in, joshivatsal8@gmail.com

Abstract

As a part of a research project tools for simulating building performance on energy efficiency, thermal comfort, indoor air quality (IAQ), lighting, moisture, and acoustics is investigated. The tools are tested for compatibility with building information modelling (BIM) methodology and are evaluated with their current functions and calculation methods.

The Model are furthermore evaluated on their abilities for interactive collaboration and intended or necessary level of detail for performing simulations. This research is focused on thermal comfort and IAQ. Simulations in Insight 360 has been done to establish an overview of the necessary inputs and thereby determine the required level of detail to perform such calculations without making improbable assumptions. Aspects of the life cycle of a building is suggested to establish more comprehensive results, leading to improved sustainable solutions.

Study Area Profile

Eklavya Model Residential School(EMRS), jagana is the school which is taken under the scope of study, data collection & analysis. School is located 10 kms away from palanpur near village jagana as shown in Google Map below.



Figure 1 Key location

For my Research an institutional building over residential building and commercial building and the reason behind doing that is:

- Institutional building required major part to energy during day time means it required energy at from solar PV system while system is generating energy at day time. So, battery arrangement and all other requirement for storing energy can be sorted out with minimum effort and lower cost.
- In this thesis, tribal school is the institutional building we are working on which is situated at remote location for the education purpose of tribal child and tribal development.
- In the context of the trend of establishing quality residential schools for the promotion of education in all areas and habitations in the country, the Eklavya Model Residential Schools (EMRS) for ST students take their place.
- Because it is located at remote location it is hard, inconvenient and financial costly to connect the building with conventional grid. Transmission lines, electrical poles and other arrangement may prove costly.
- So this are the reasons this schools have tailor maid solution go for Zero energy building. As the energy required at school will be generated by renewable resources and smart grid established at site.
- The campus of Eklavya residential school contains five building:
 1. School building
 2. Boys hostel
 3. Girls hostel
 4. Canteen building
 5. Staff quarters
- Other important Data for Energy Analysis of school is given below:
 - Average monthly electricity consumption: 20000 units (including all the building in campus)
 - Average monthly electricity bill: 1,20,000 Rs
 - The school is equipped with facilities like music hall, auditorium, Indoor sports equipment, Science lab, Classroom with adequate space and daylight also cross ventilation provided for better air circulation.
 - School staff quarters have 16 blocks of 1 BHK which is placed just behind the school.
 - The boys hostel and girls hostel are designed same with the capacity for 240 students in each. Both building have 8 blocks with 35 students in each block.

Insight 360

Insight 360 is like GBS developed by Autodesk and is a plugin for Revit. It can simulate heating, cooling and lighting. The inputs are taken directly from the Revit-model, with possibilities for adjusting the zones, and schedule the loads. The simulation is performed online as GBS, with similar pros and cons.

A simple simulation has been performed for reviewing outputs regarding thermal comfort. The output consists of peak heating and cooling loads, which are summarized in a table with all the parameters causing either heating or cooling.

This feature draws attention to the potential issues regarding energy efficiency, and allows the user to adjust the critical parameters early in the conceptual phase.

However, hourly operative temperature results are necessary to state anything about the thermal comfort.

Parametric Model Analysis

As described earlier Insight 360 is an application from Autodesk that can be implemented into Revit. It is based in the EnergyPlus engine, which provides a fast and precise calculation. When that is done, you chose the Generate Insight, and the model will then be analyzed on a server, and you will get a message on email when it is done. In the application platform is it possible to compare models or chose to perform some improvements on one model. This is the option to make a heating and cooling calculation using the EnergyPlus engine.



Figure 2 Revit Model of school Building

EUI (Energy Use Intensity)

EUI stands for Energy Use Intensity. It is the energy use per square foot at a property (energy divided by square foot). EUI enables you to compare different sized buildings.

The EUI is expressed as energy per square foot per year. It's calculated by dividing the total energy consumed by the building in one year by the total gross floor area of the building.

Generally, a low EUI signifies good energy performance. However, certain property types will always use more energy than others. For example, an elementary school uses relatively little energy compared to a hospital.

All the data generated in Insight 360 measured with EUI as basic parameter of energy analysis.

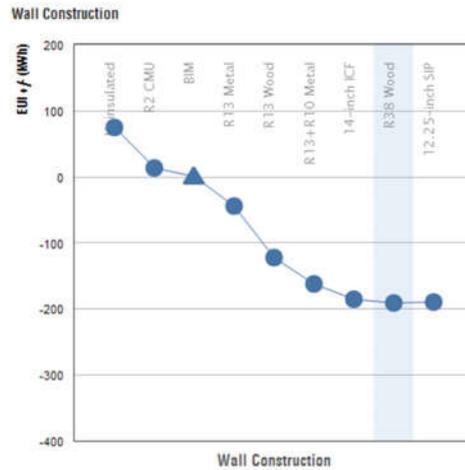


Figure 4 Comparative Chart through Autodesk Insight 360

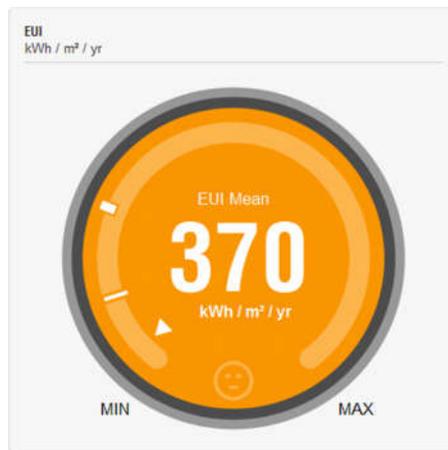


Figure 5 Energy cost per year

Conclusion

Based on the research can it be concluded that much of the software that is related to BIM, and can make performance calculations, is developed for the early design phase. The early design phase is the phase with the highest influence on how the building will perform and the sustainability of the project.

Energy efficiencies is an extremely important topic for getting a sustainable project. Insight performs analysis on the building and also compares available opportunity to decrease EUI (energy use intensity) using different thermal material, Orientation of building & changing Properties of roof and walls. Provides comparative charts and statistics for analysis.

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