Application of BIM in Building HVAC Energy Consumption Analysis

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Background

Previous studies indicated that Building Information Modelling (BIM) could assist in enhancing energy efficiency in building projects (Basbagill et al., 2013). The local construction industry has **hesitated** in adopting BIM in their projects confidently because they may not know the **full potential** of BIM technology in energy analysis. This project intends to discover the **potential of BIM technology for building energy analysis** to help the local industry overcome the hurdles of adopting BIM.

Research Objectives

The main purpose of the study is to:

1. Explore the **suitability** of adopting BIM technology for building energy consumption analysis in minimising building energy use.
2. **Apply BIM technology** in **HVAC** energy consumption analysis with different combinations of building environmental factors.
3. Evaluate the **effectiveness** of BIM in building energy consumption simulation.

Methodology

1. Data collection was by conducting building HVAC energy analysis using BIM software. The **most effective** factor in improving energy consumption was identified.
2. The workflow in adopting BIM technology for building HVAC energy analysis was recorded to evaluate the effectiveness of BIM in building energy consumption simulation.
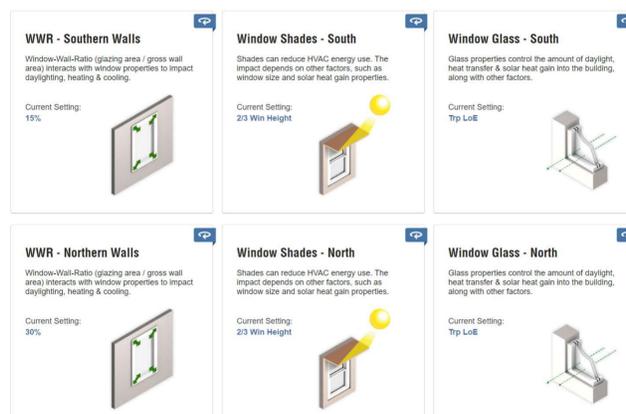

Figure 1. Building Model in Revit

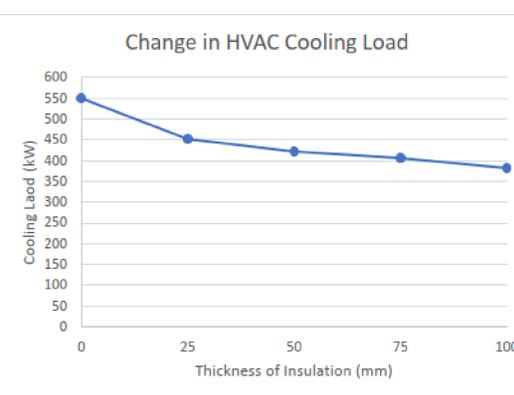Figure 2. Palettes in Autodesk Insight indicating possible energy reduction measures

Figure 3. The effects of insulation thickness to HVAC energy consumption (The most effective factor in improving energy consumption)

Findings

It is concluded that:

1. BIM technology is **suitable** for determining the best building design to reduce building energy consumption because:
   - BIM technology is **mature** in building energy analysis. The overall workflow is smooth with an array of **BIM toolkits** that are available for **building energy analysis**.
   - Interactive energy analysis results using Autodesk Insight with interactive graphs **clearly** shows the **energy saving potential** for buildings.

However, it was discovered that:

1. **Localisation** of BIM software could be seen if more building projects in Hong Kong adopted BIM technology during the design stages.
2. **Incompetence** in BIM software for exploring energy consumption with a different set of parameters.

Conclusion

- This project has revealed the **potential of BIM technology** for building energy analysis to help the local industry overcome the hurdles of adopting BIM.
- Further studies could be conducted to discover the **interoperability of different BIM software** and files for further assessment on the suitability of applying BIM for building energy analysis.
- The building energy model should be **as simple as possible** but include all the **necessary building parameters** for energy analysis, and **avoid excessive data** that may affect the accuracy of the energy analysis along the design process.

Reference
Basbagill, J., Flager, F., Lepech, M., & Fischer, M. (2013). Application of life-cycle assessment to early stage building design for reduced embodied environmental impacts. Building and Environment, 60, 81-92.