NP4010

STUDIES ON OPTIMAL APPLICATION OF BUILDING INTEGRATED PHOTOVOLTAIC/THERMAL SYSTEM FOR COMMERCIAL BUILDINGS IN AUSTRALIA

RESEARCH QUESTION

How will building-integrated photovoltaic/thermal system in double-skin façade (BIPV/T-DSF) contribute to reduction of energy demand and carbon footprint of commercial buildings in Australia?

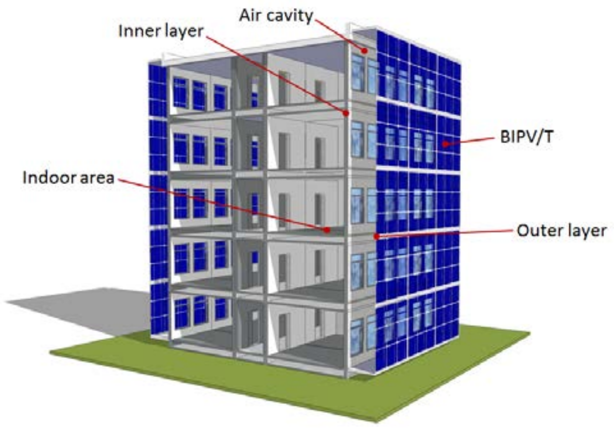
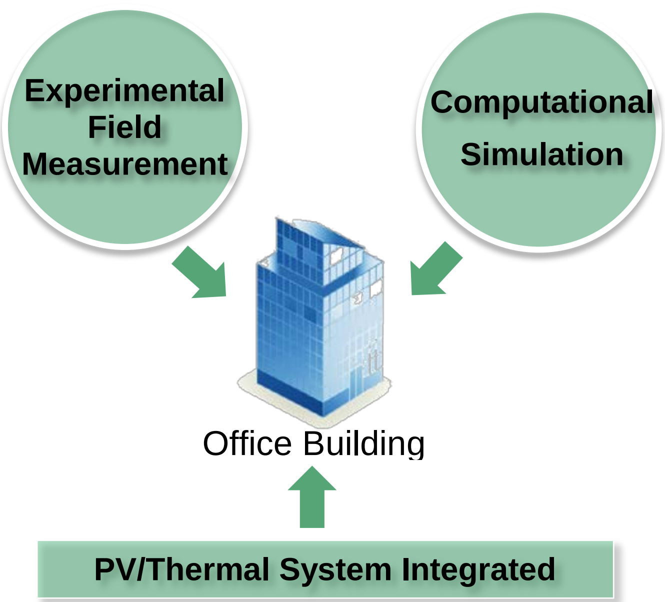


Figure 1: Sample effect drawing of the BIPV/T-DSF system in the building.

METHODOLOGY



The building with BIPV/T-DSF system will be modelled in Trnsys (thermal modelling software) to determine the PV module temperature, airflow temperature within the cavity of the DSF as well as heating and cooling load of the building. The results will be validated by using the data based on in-situ measurement of a mock-up building.

RESULTS

The first stage of the research is currently performed. A testing model has been developed in Trnsys based on the experimental results have been taken from the existing research [1].

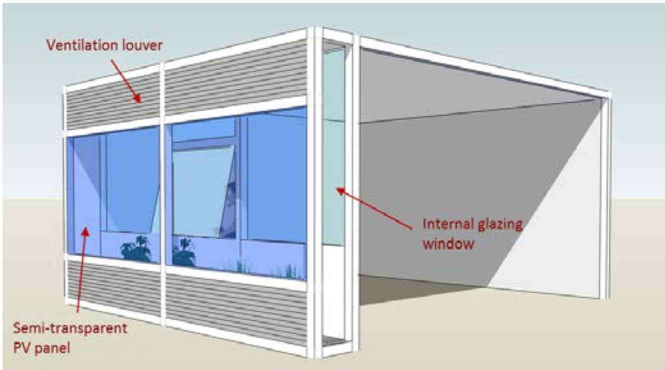


Figure 2: Schematic diagram of the BIPV/T-DSF based on the existing research.

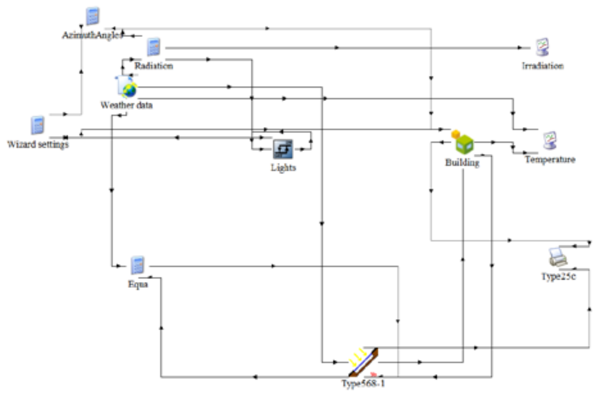


Figure 3: Schematic diagram of the BIPV/T-DSF system in Trnsys.

A primary result – PV module temperature – has been simulated as well as compared with the experimental results (refer to Figure 4). The discrepancy between Trnsys result and the experimental data was subjected to various factors (e.g. meteorological data), which will be calibrated on next stage.

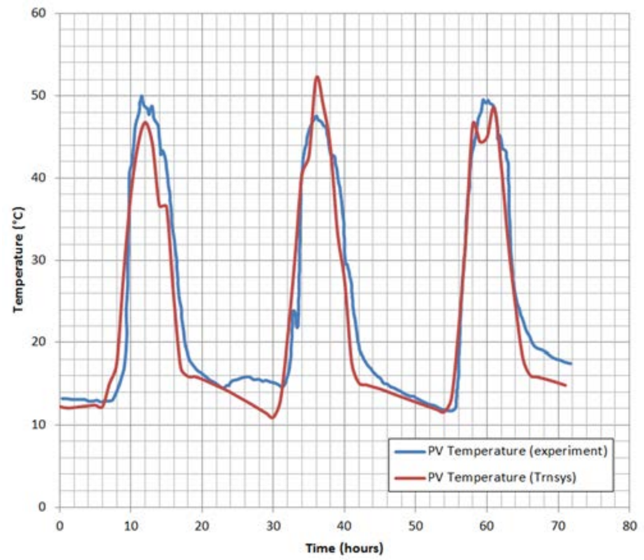


Figure 4: Comparison of PV temperature between the experiment and simulation.

ANTICIPATED IMPACTS

BIPV/T	DSF
• Electrical power production • Thermal energy production	• Energy efficiency enhancement • Indoor thermal comfort improvement

The proposed research project will give the answer on how the performance of the combined BIPV/T-DSF system will be.

CONCLUSIONS

According the current results, Trnsys can certainly produce a similar result compared to the experimental result though the discrepancy is observable. The proceeding calibrations are expected to improve the accuracy of the Trnsys simulation results with no significant errors. The evidence-based calibration method [2] will then be used for modelling of the project building.

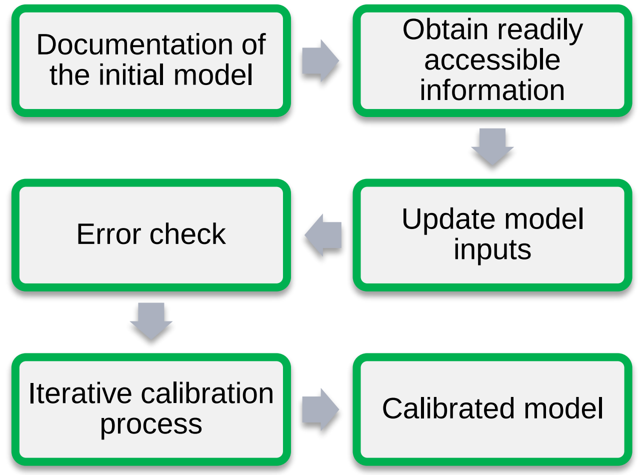


Figure 5: Process of the calibration methodology

REFERENCES

[1] Peng, J., L. Lu, and H. Yang, *An experimental study of the thermal performance of a novel photovoltaic double-skin facade in Hong Kong*. Solar Energy, 2013. 97: 293-304.

[2] Raftery, P., M. Keane, and J. O'Donnell, *Calibrating whole building energy models: An evidence-based methodology*. Energy and Buildings, 2011. 43(9): p. 2356-2364.

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