

Passive Thermal Daylight Harvester

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Research Need

- Solar heat gain is a major contributor to the cooling load.
- An exterior shading device can help reduce the load while reducing passive heating.
- An optimized system is needed to balance reducing the cooling load while providing passive heating and appropriate daylighting.
- A holistic performance evaluation using experiments and simulation is needed for such a system.

Current Research

- Collaboration with Robert Cohen Architect
- Preliminary simulation performed using honeybee to obtain optimal design parameter for Passive Thermal Daylight Harvester (PTDH)
- Developed prototype design and fabricated the prototype
- Installed PTDH in one of the windows in a south-facing wall for performance evaluation
- Whole-building energy simulation used to evaluate performance at the building level

Major Findings

- The reduction in the cooling load of the room using PTDH in one south-facing window was approximately 5%.
- Almost 25% decrease in simplified daylight glare probability was achieved, thus decreasing visual discomfort from excessive light.
- The annual simulation showed 2%–16% reduction in HVAC energy usage in a medium office building.
- The energy savings were higher in a hotter climate compared with a colder climate.

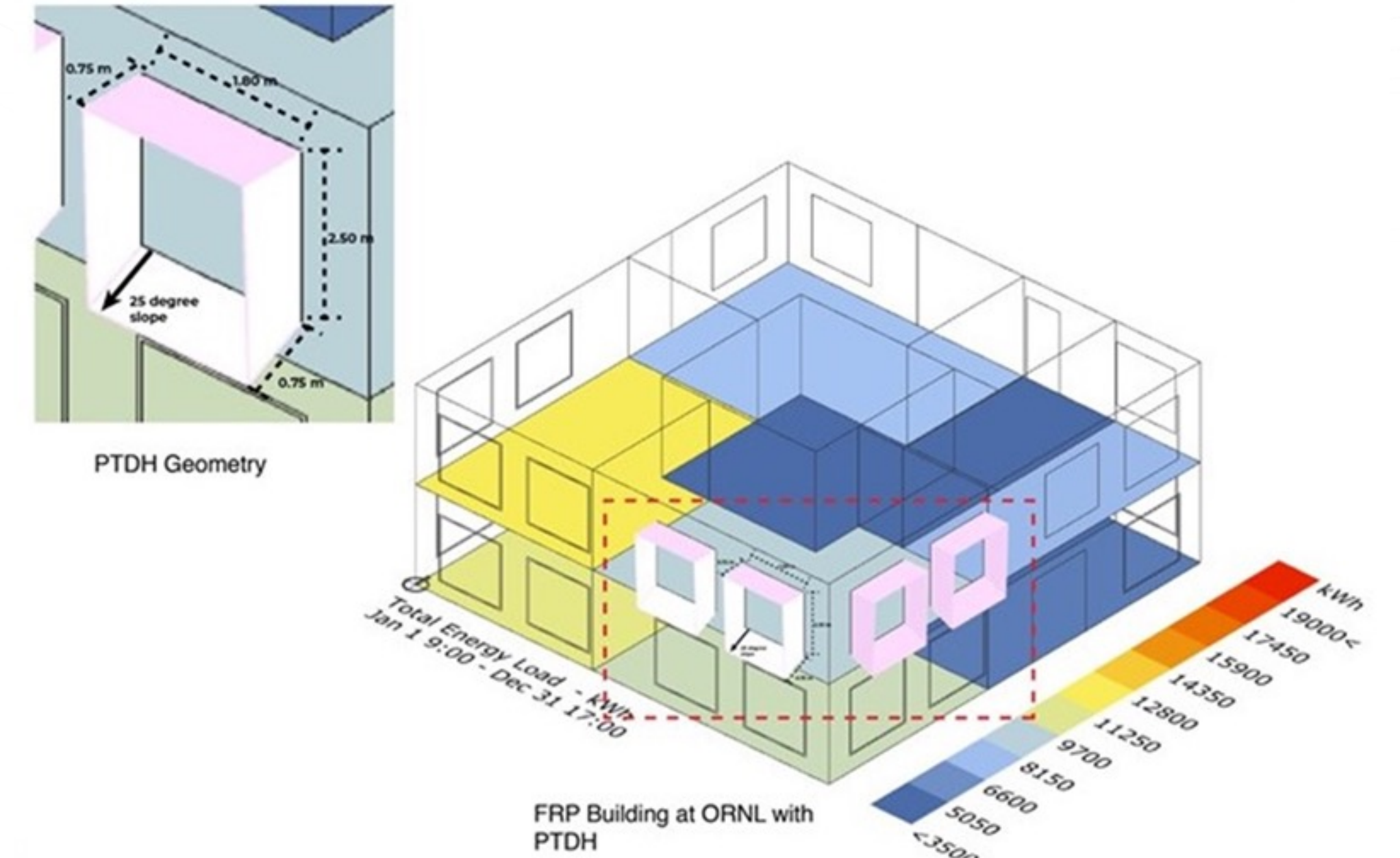
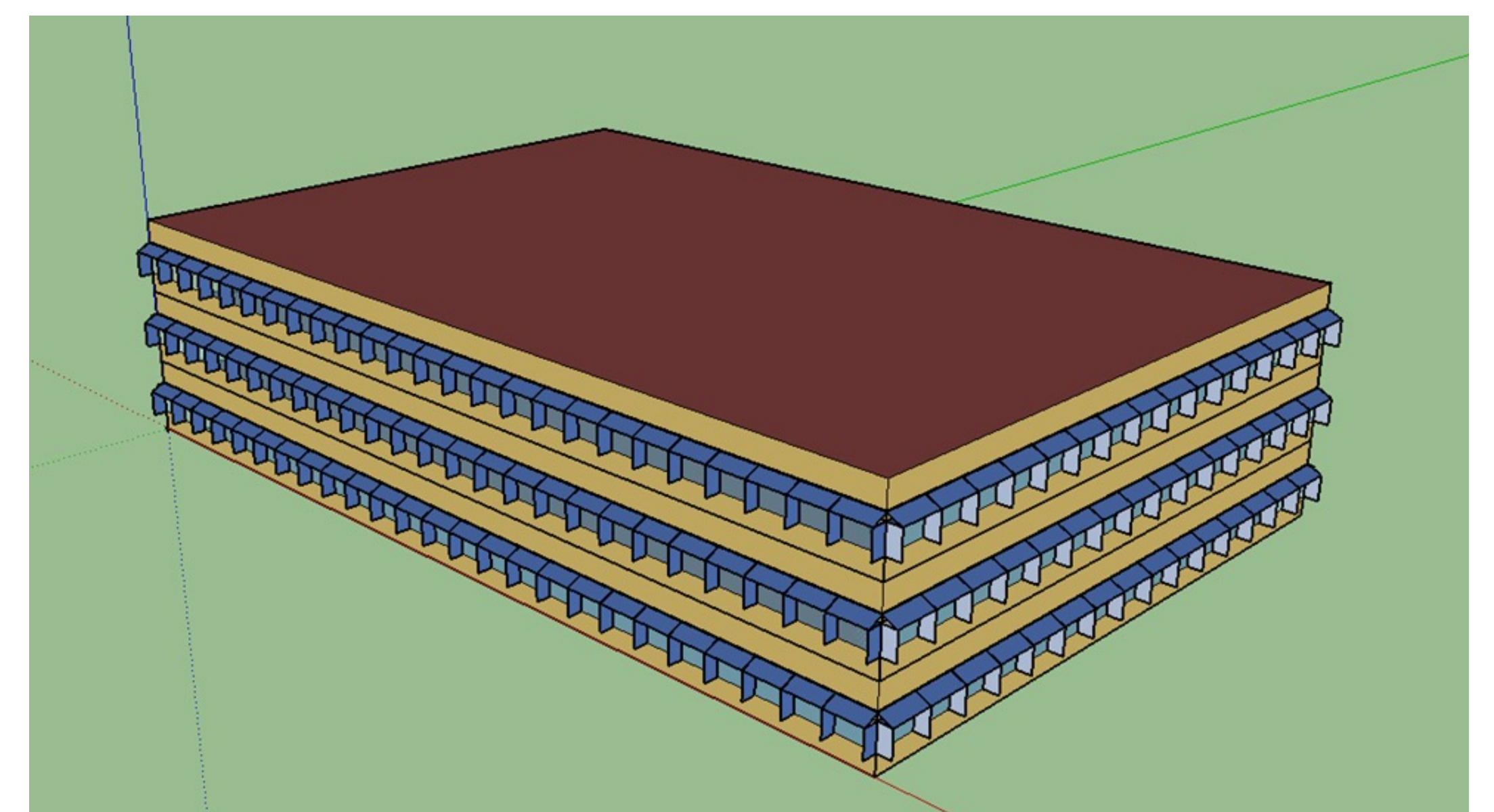


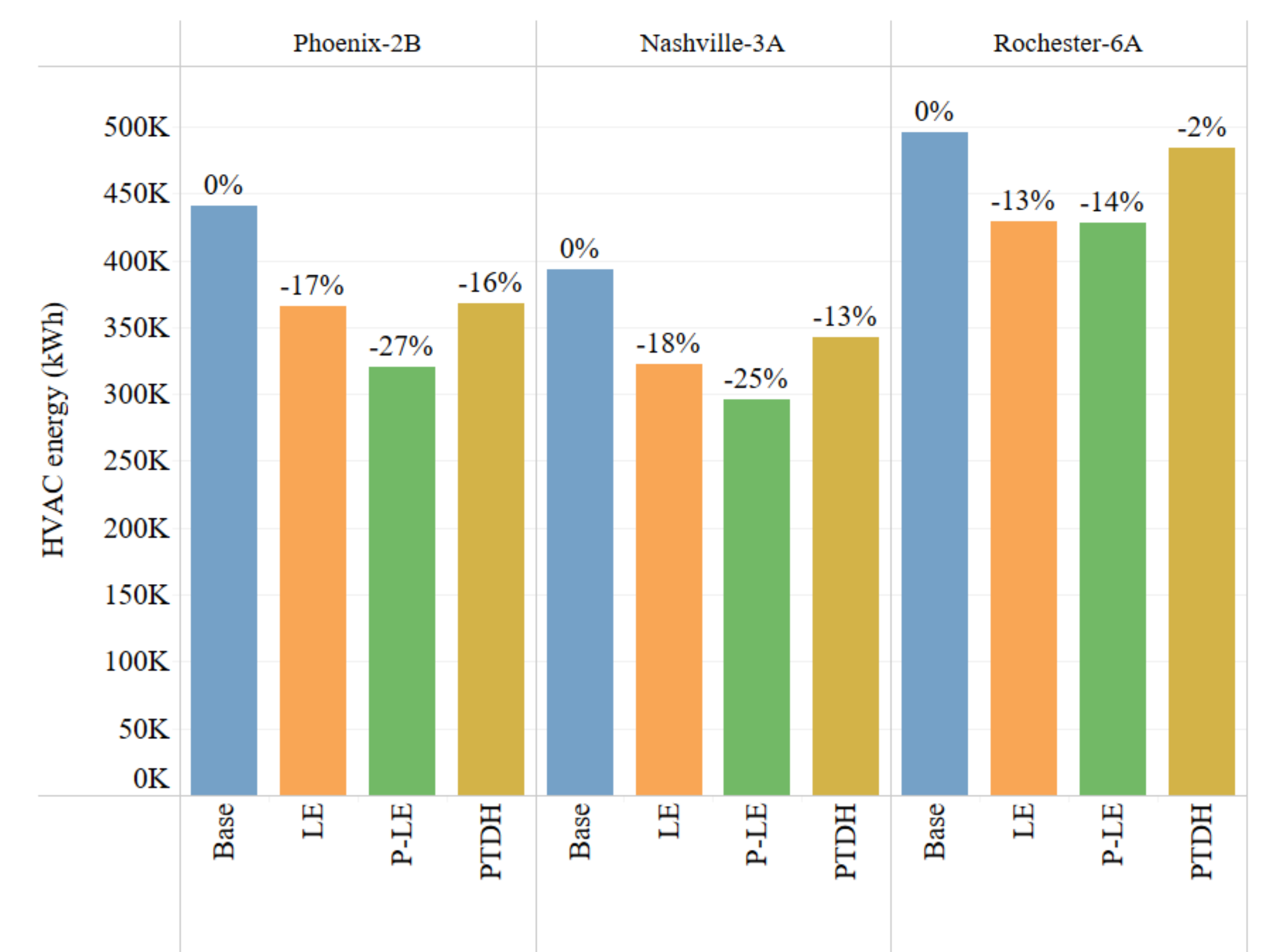
Diagram of PTDH geometry and test location



PTDH installed in south-facing window



Whole-building energy simulation



HVAC energy savings for three climates