We introduce a low-cost and low-maintenance wind-catcher duct system design addition to BIPV systems that increase airflow velocity and decrease air temperature resulting in increased performance of the PV system electricity output. The results of our work demonstrate the design can further enhance energy performance by utilizing the increased airflow from the duct system to naturally ventilate an attic. Similar benefits were observed for different variations of the design under a parametric analysis finding the most optimal configuration to increase airflow velocity and decrease temperature. Building integrated photovoltaics (BIPV) is becoming more popular and widely used to increase sustainability and decrease overall energy costs. Improving (BIPV) efficiency will benefit a widerange of applications in architecture and mechanical engineering. (BIPV) provides savings in electricity costs, lower pollution, and reduce material costs by utilizing renewable energy. BIPV functions as the outer layer of a structure, and therefore influence the heating and cooling loads of a building due to the change in thermal resistance. A BIPV ventilation air-gap system and its effects on heating and cooling loads are presented in this thesis. We use a computational fluid dynamics (CFD) model to analyze various ventilation strategies in the BIPV air-gap, and as well as the impact of using that air to naturally ventilate the attic for better building energy performance.

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The public is welcome to attend.