

# Air Flow Effect on the Temperature of a Building Integrated PV-Panel

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## Abstract

One of the primary energy expenses in buildings is the electrical power used. Photovoltaic (PV) materials can supply a part or all of the consumed electrical power and are thus increasingly being incorporated into the construction of new buildings and are used to replace conventional building materials in parts of the building envelope such as the roof, skylights, or facades. Also photovoltaic systems may be retrofit - integrated into existing buildings.

This study examines the effect of the air flow on a building integrated PV-panel. To formulate the heat exchange process between a fluid flowing between the PV panel and the building wall time-dependent, partial heat transfer differential equations (PDEs) are used. These equations can be found either ready built in COMSOL Multiphysics® modules or can be modified accordingly. COMSOL Multiphysics® is an excellent, state-of-the-art software for the easy solution of these equations through numerical techniques based on the finite element method for the spatial discretization.

It is shown that in summer, the maximum temperature of a PV-panel of 3 m in height, is observed on an east facing surface early in the morning. The maximum temperature for a south facing panel is lower by about 25°C and that for a west facing surface by about 20°C. The air velocity in the air-gap between the PV-panel and the building wall is an important factor. It is shown that for an air gap width of 0.02 m, an air velocity of 0.5 m/s can lower the mean temperature of the panel by about 40°C allowing for a significant increase in its efficiency. Finally the air-gap width is varied keeping a steady velocity and its effect is studied in respect to the temperature of the PV-panel.