# Photovoltaic-Thermal System to Minimize Electric and Air Conditioning Energy Consumption of a Typical Office in Beirut

Proposal Submitted By:

**Sami Karaki, PhD**
Principal Investigator
Faculty of Engineering & Architecture
Department of Electrical and Computer Engineering

**Kamel Ghali, PhD**
Co-Principal Investigator
Faculty of Engineering and Architecture
Department of Mechanical Engineering

**Abstract**

A combined photovoltaic-thermal (PV-T) panel produces simultaneously electricity and heat from one integrated component to utilize effectively the solar energy by achieving higher PV electrical efficiency and making use of the dissipated heat energy for heating applications. A transient mathematical model for the PV-T will be developed to predict its performance for a given environmental conditions and flow rate of ambient air that cools the PV-T panel. The model predictions of the exit air temperature and electrical output will be validated experimentally. The model will be integrated in a heating application for a typical office space (100 m2) in the city of Beirut to provide the office needs for electricity, heating during winter season, and dehumidification and evaporative cooling during the summer season. To minimize the yearly office energy (electrical and heat) consumption, an optimizer is developed for both the PV-T panel cooling air flow rate and the dehumidification regeneration temperature. The optimized simulation results for the office yearly energy consumption for both electricity and air-conditioning will be compared to the conventional case of using grid electrical energy.