

Graduation Design Project Proposal Form

Project #E8

Project Title: Design and Implementation of a Roof-top Grid-connected Photovoltaic (PV) System to partially power a typical household in Riyadh in accordance with the small-Scale Solar PV Systems Regulation issued by ECRA

Professor(s) Name(s): 1. Professor Abdulrahman M. Alamoud
2. Professor Mohammed A. Alturaigi

Number of Students: Two

Students Qualifications: EE404 (concurrent)

Statement of Problem:

In view of the latest laws issued by the “Electricity and Cogeneration Regulatory Authority (ECRA)” spelling out steps the consumer has to follow to install a “Solar PV System” on the roof of his house, it has become a must to fully understand and act by ECRA regulations to obtain a permit. People in Saudi Arabia often complain of the high cost of their monthly electric bill. They also have the desire to install a small size emergency power supply to provide electric power for their essential needs such as refrigerators, water pumps, emergency lighting, and mobile phones chargers. One way to reduce their monthly electric bill and protect their investment of food supplies (meat, dates, and other items) is to install a 3-15 kW photovoltaic electric generator. Fortunately Saudi Arabia’s high concentration of solar energy makes it ideal for a vast number of applications such as generating electricity for home use. In addition photovoltaic module prices have been taking a nose dive for the past few years making them very attractive and competitive electric generators compared to the grid electricity. As such it is therefore a good idea to install a grid-connected photovoltaic (PV) electric generator for use in a typical household in Riyadh so as to lower the monthly consumption from the grid and to be used as an emergency electric source to power essential electric appliances such as refrigerators, water pumps, TV, phones, and lighting in critical areas in the house. The PV system may be installed on the roof of the house.

Brief Description of the Project:

The project is intended to teach students how to design a stand-alone photovoltaic (PV) system in accordance with the directions issued by the “Saudi Electric Company (SEC)”. In addition, they will acquire hands-on experience of installing a PV system for use in a household. The work will involve the disciplines of electronics, solar radiation, solar cells, and photovoltaic electric system design. A team of two students will work on the design and implementation, conditional of funds availability, of a small PV system.

Objectives:

The design objectives are as follows:

- (1) To put to use theory and tools the students acquired in previous electronic and physics courses.
- (2) To acquire experience in the design of a photovoltaic electric system.
- (3) To implement their design in practical grid-connected PV electric generator to be used in their houses provided funds are available for the project.
- (4) To gain practical experience in how to install and connect a household PV system to SEC network taking all safety precautions as laid down by SEC.
- (5) To assess the experience of having a PV electric generator on the roof of their house.

Technical Approach and Expected Deliverables:

The work will involve two phases covering one semester each. In the first semester the students will learn the basic principles of solar energy such as solar radiation, p-n junction solar cell design and operation, PV modules, storage batteries, and other PV system components. The students will then learn PV system design techniques. They will then design a suitable stand-alone PV system. The students will take into account, in their PV design, the realistic constraints such as economic factors, safety, reliability, aesthetics, ethics and social impact.

In the second semester, the students will work on the implementation of a small-scale PV system of their design. The system will be designed so that it may be built on the roof of their house. Testing of the constructed PV system will commence to ensure a practical performance of their design. If the PV system performance is not found to be working properly, design fine tuning will be made. The expected deliverable is a small PV electric generator matching the available budget.