



## Faculty of Engineering, Fayoum University



### Electrical Engineering Program

### Senior student graduation project 2018

### Design and fabrication of grid-tied pv inverter

- Supervisors**
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#### 1- Introduction

Egypt's energy strategy for the next fifteen years targets renewable energy to contribute 20% of the national power generation by 2020 (NREA, 2013). Wind energy alone is intended to provide 12% of the target percentage. While the government has recently offered incentives to attract national investors to the RE sector to realize this strategic goal, such projects as well as those undertaken by NREA, the National Renewable Energy Authority, center on importing solar power plants and wind energy farms. Local manufacturing in RE has been totally absent except for some recent efforts, which can at best be described as very few with focus on research and development for small wind and solar plants.

DC-AC inverter is an essential component for grid-tied PV solar systems. There are two main requirements for solar inverter systems, to harvest available energy from the PV panel, and to inject a sinusoidal current into the grid, in phase with the grid voltage. In order to harvest the energy out of the PV panel, a Maximum Power Point Tracking (MPPT) algorithm is required. Moreover, interfacing to the grid requires solar inverter systems to abide by certain standards given by utility companies. These standards deal with power quality, safety, grounding and detection of islanding conditions. Using intelligent Microcontroller with integrated DSP capabilities (Digital Signal Controller (DSC)) enables a fully programmable and flexible inverter design and solution.

This senior-student graduation project is part of a funded research project from the ASRT which aims to develop and manufacture grid-tied PV solar system inverters as described above. Partners (Fayoum University, Electronics Factory from the AOI, and Arab Renewable Energy Company (ARECO) from AOI) will collaborate on this work.

## 2- Tasks and outcomes:

Recruited students will participate in the following tasks:

Task	Title	Description
1	Design and implementation of switching power circuit and control circuits	Design and procurement of power electronics components to implement basic DC-AC power conversion with the specified ratings. Design will follow two stages: (1) DC-to-DC boost converter with Maximum Power Point Tracking and, (2) DC-to AC inverter
2	Design and implementation of the intelligent power management and embedded systems.	Microcontroller and embedded digital control to implement the following functions: (1) All power conversion algorithms, (2) Maximum Power Point Tracking, (3) Digital Phase-Locked Loop and grid synchronization, (4) System islanding and fault handling.
3	System integration and validation	(1) Validation and testing of the conceptual design to meet required technical specifications and power ratings, (2) PCB design.
4	Fabrication of designed inverter	(1) Manufacturing of the approved HW circuits and PCB design, (2) Testing and validation of the fabricated PCBs, (3) Testing and validation of the intelligent digital controller firmware, (4) HMI and communication protocol design.

## 3- Student recruitment strategy:

- Two groups of students, one from Electrical power and machines section and another from electronics and communication section, will be recruited.
- Students from each department shall apply as a group of 4 to 5 students (no individual application)
- Good knowledge in electronics, embedded systems, and control is highly required. Power electronics elective course is a plus.
- Applicants shall show high motivation and strong will to work in a team.
- If more than one group apply, selection will be based on an interview whose date will be announced later.

**If you are interested, please send an email with the following information**

To: [aae00@fayoum.edu.eg](mailto:aae00@fayoum.edu.eg), [hassanm@fayoum.edu.eg](mailto:hassanm@fayoum.edu.eg)

**Subject:** SSGP2018

**Body:** Names of the students in the group.

**Please also attach CV for each individual.**