Senior Design Project Description – COE Department Project

Department Name	Electrical Engineering	Date Submitted	2015 (resubmitted 9/27/17)
Project Title	Solar Panel Companion Inverter (SPCI) (UNCC_SPCI)	Planned Starting Semester	Spring 2018

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project. 250 hours are expected per person.

Complete the following table if this information is known, otherwise the Senior Design Committee will develop based on the project scope:

Discipline	Number	Discipline	Number
Mechanical		Electrical	2
Computer	2	Systems	
Other ( )			

Project Overview:

The Solar Panel Companion Inverter (SPCI) is a novel photovoltaic inverter topology invented at UNC Charlotte that uses a collection of relatively simple, low-cost electronic pulse modulators to synthesize an AC signal from an array of DC solar modules. The approach promises highly efficient energy conversion at low cost, and could enable more extensive roll-out of solar power.

The overall project goal will be to develop and field test a prototype SPCI solar array.

Rivegy is a UNCC spin-off company funded by the NSF to commercialize this technology

Project Requirements:

The project team will build a 6-panel SPCI solar array that can perform at >95% of theoretical DC-AC conversion efficiency. Each of the 6 SPCI "modules" should fit within a maximum 15 cubic inch box, affixed to the back of each solar panel.

Expected Deliverables/Results:

1. Reconfirmation of the SPCI array principle of operation via simulation. (This has already been done, but the team will become familiar with the switching algorithm through this exercise)
2. Design and specification of a breadboard model for a single SPCI unit, including selection of microcontroller

3. Translation of SPCI switching algorithm into a form addressable by the selected microcontroller
4. Construction of a breadboard realization of a single SPCI unit, along with testing the ability to address its microcontroller to perform simple switching activities
5. Construction of a breadboard realization of a 3 SPCI array, tested in conjunction with 3 PV panels to implement synthetic DC-AC inversion
6. Design and test of a communication scheme across multiple SPCI units
7. Thermal and lifetime modeling of SPCI unit
8. Design of a 6 module solar array utilizing SPCI
9. Design and specification of an integrated circuit board model for a single SPCI unit compatible for a 6 module solar array system
10. Package design for the integrated circuit board SPCI
11. Fabrication and testing of the integrated circuit board SPCI (and test one unit with one module).
12. Fabrication of the remaining 5 integrated circuit board SPCI
13. Construction of the 6 panel solar array with SPCI
14. Performance tests on the 6 panel solar array with six units of SPCI
15. Thermal testing and accelerated lifetime testing of the SPCI

Disposition of Deliverables at the End of the Project:

Hardware developed is the property of the Industry Supporter. Please specify what disposition you would like for the hardware developed by the Project team. Typically the work product is displayed at the last Expo then immediately handed over to the supporter unless arrangements have been made to deliver at a future date.

Project can be displayed at Expo and handed over to industry supporter.

List here any specific skills, requirements, knowledge needed or suggested (If none please state none):

AC circuits
DC circuits
Electromagnetic Devices (ECGR 3142 at UNC-Charlotte or equivalent)
Microcontrollers
Programming Languages
Practiced with Inductors, Capacitors, Resistors, Voltage Source, Electrical Connections, Printed Circuit Boards
Wireless Communications
Power Line Communications