REQUEST FOR PRELIMINARY PROPOSAL (RFPP): Remotely Accessible Portable Solar Charging Evaluation System (RAPSCES)

I. Introduction

Lafayette College ECE department is requesting a preliminary proposal (**RFPP**) for a portable solar battery charging system with remote access for performance and environmental conditions monitoring. The system should provide a standard AC 110V 60Hz output voltage compatible to a standard residential wall outlet with load capability meeting or exceeding the nominal 20 amps. The solar charge storage is to be a "12V" battery system, and utilize an inverter to power convert from 12V DC to the required 110V AC output. The system will include a panel solar tracking feature that can be set at a fixed angle, or run in a user defined path mode, or a solar feedback tracking mode. A primary goal in this project is to acquire environmental, directional, and electrical performance data from the charging system and positioning system by wireless transmission of this data to a remote computer, tablet, and/or phone. This telemetry system must provide for the user define panel path programming and for panel position readback in solar feedback tracking mode. The system must be configured to be portable and accommodate various but reasonable terrain.

II. Background

This solar charging system is expected to be electrically output equivalent or exceed the power output capabilities of a Honda EU2200i portable generator. The basic specifications for this generator is a dry weight of 47 lbs and a fuel capacity of 0.95 gallons of unleaded gasoline. Its run time is 3.2 hours at the rated continuous load of 15 amps and 8.1 hours at ¼ rated load.

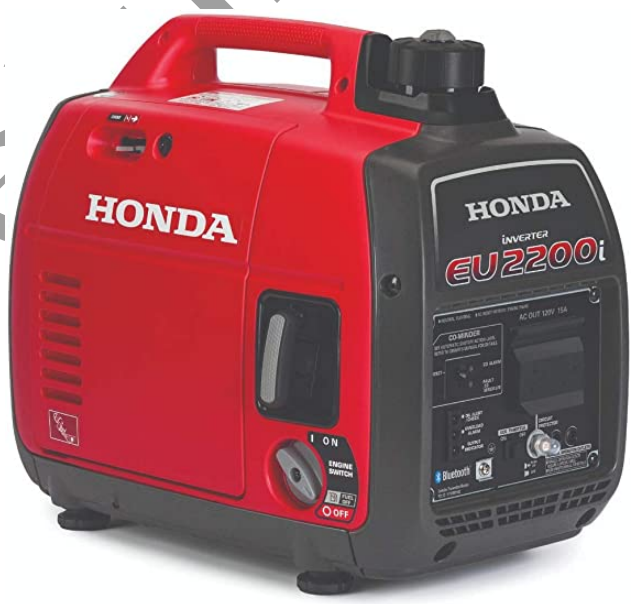

Figure 1. Honda EU2200i Portable AC Generator

Preliminary

The target application of this proposed solar charging system is for research into optimizing the charging system under different environmental conditions for recreational applications. These applications would include the operation of common residential appliances that work on a 20A AC outlet. These appliances include typical kitchen devices – mixers, coffee makers, microwaves, small refrigerators, etc. Loads may also include other appliances such as portable air conditioning units. Specific examples for your proposal can be the Ninja BN701 Pro Series Blender and the Serene Life SLPAC10 10,000BTU portable air conditioning unit. The preliminary proposal should include runtime comparison studies of the solar charging solution versus the Honda generator based on load and agreed upon reasonable operating assumptions.

III. Basic Solar Charging Requirements

The solar charging system should include all components to make it load compatible to the Honda generator with the exception to charging and run times. Several vendors provide systems with all the needed components such as the one from ExpertPower shown in Figure 2.

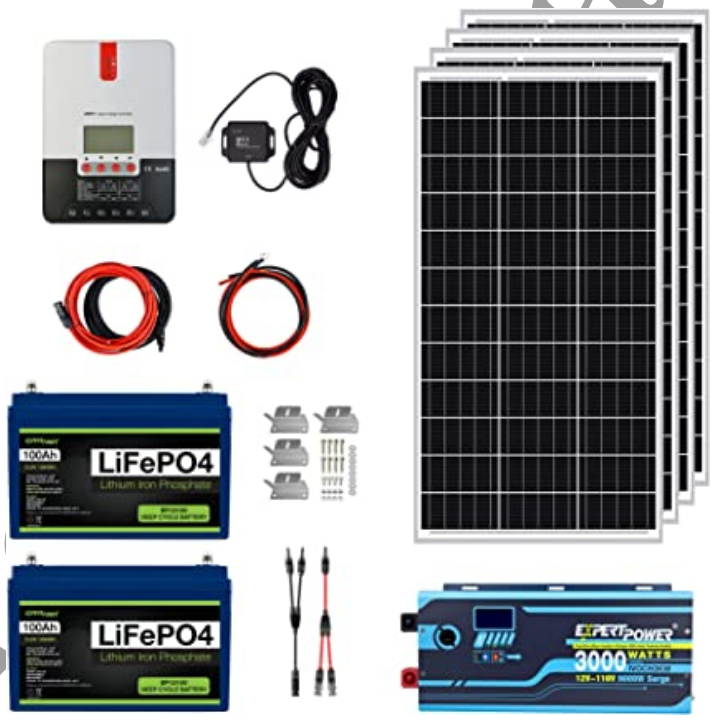

Figure 2. ExpertPower 2.5kWH system

The system you propose should have the same fundamental components: solar panels, battery, inverter, and charge controller. Since the system is to be portable, you need to consider the solar panel mounting stand, size and weight. You can separate the overall system into more easily transportable units. It is anticipated these units should not exceed 100lbs. Putting them on wheels for mobility is anticipated. The system will be transported across challenging rolling surfaces such as stone and grass, so design appropriately. Any enclosures of the batteries and inverter should be non-conducting and the proposed design must include a safety analysis before any design will be accepted.

Preliminary

IV. Custom Design Requirements

A. Autonomy - The charging system, if on, must be fully functional without communication to a remote device. All electronics related to the sensing units and wireless transmission must be locally powered by the solar charge storage 12V battery system. DC power management circuits must be designed to provide appropriate power levels for all sensing circuits, MCU and MPU's.

B. Sensing Requirements
   a. Environmental – Temperature, Pressure, Humidity, Wind
   b. Voltage and Current – Charge controller input voltage, Charge controller input current, Charge controller output current, Battery voltage, Inverter input current, Design Specific Electronics currents.
   c. Battery temperature.
   d. Panel orientation – relevant rotation and pitch angle
   e. Relative solar measurements – photoresistor, etc.
   f. Others as negotiated.

C. Electronic Systems Requirements
   a. A hardwired local system display will be required which can report the specified measurements as well as confirm proper electronic operation from a built-in self-test at power on.
   b. Power conservation is key. The design must adopt low power techniques for all aspects of the design. It should include both low and zero power draw modes from the battery. Manual disconnects should be provided for transportation and storage.

D. Wireless Data Interface
   a. The system must wirelessly transmit data to be received by a smart device application for monitoring of real time measurement variables with constructive visualization if appropriate. Additionally, the software must provide for measurement data to be logged to a convenient file type (text, .csv, etc.) over a user defined start time and duration for more extensive computer data analysis. This data collection process must include a user activated interrupt feature with data written to this point preserved.

E. Panel Solar Tracking Operation
   a. The solar panel mounting apparatus should provide for an open-loop electronically user- controlled position thru the wireless interface – need for compass, leveling.
   b. The solar panel mounting apparatus should provide for a closed loop tracking of the sun thru appropriate sensing and control techniques. Feedback of position information to wireless system.

Preliminary

F. Operating Manual, Safety Considerations, and Cost
   a. A proposal submission in response to this RFPP must include a preliminary operation manual including mock-up of proposed software GUI's.
   b. A proposal submission must include a description of safety considerations for both the system development process and final design.
   c. The proposal should provide a reasonable order of magnitude (ROM) estimate for the hardware costs. Development costs (NRE) will be tracked but not included in this budgetary estimate.

V. Ownership of Work and Expected Documentation in Project Deliverables

All work product developed under an accepted proposal will be jointly owned by the development team and Lafayette College. This requirement includes, and is not limited to, mechanical drawings, electrical schematics, systems diagrams, software, and hardware definitions. All functional circuits/units (eg. sensing units) shall include a behavioral diagram with succinct theory of operation, interface definition, calibration and/or programming instructions, troubleshooting guide, and clear references to supplied schematics, PCB designs, CAD designs, and mechanical installation instruction. All system and subsystems documentation will include full bill of materials, mechanical and assembly drawings, and a library of mechanical and electrical parts datasheets. All electronic subsystem designs must include a simulation and test plan to demonstrate compliance with the target design specifications. All of these materials must be managed under a documentation control plan established by the design team.

VI. Summary

This document provides for the initial development target of a Remotely Accessible Portable Solar Charging Evaluation System (RAPSCES). All operating specifications not addressed in this RFPP are negotiable in the proposal submission process. The response deadline for your proposal is September 21st 2022. The proposal will be distributed within a well-maintained project website, set-up and run by the design team. Accepted preliminary project proposals will receive a Request for Final Proposal (**RFFP**) that will include the request for more detailed systems requirements and specifications, acceptance test proposal, Statement of Work, and specific budgetary information.

VII. Response to RFPP Questions

Questions in response to this RFPP are welcome and expected to enable your team's success in providing the requested preliminary proposal. BUT, all questions are to be provided thru a single point of contact for the entire team and those questions should be contributed by the team and known by all team members. All question responses, not addressed in-person with the team, will be provided to the single point of contact who will distribute them to the team. Most question responses will require a minimum of 1 business day.

Preliminary