UNIVERSITY TRANSPORTATION CENTER
RESEARCH BRIEF

Interfacing Major Subsystems for a Resilient Electric Vehicle Charging System for Remote Locations

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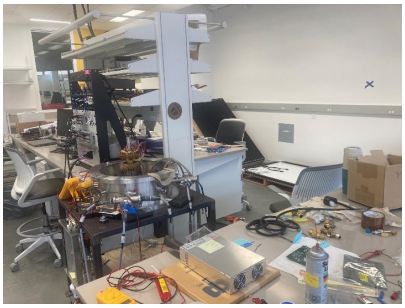
Background

Over the past several years, our research group has developed major subsystems for our stand-alone vehicle charging station for remote locations. These address major elements of such a complex system: energy capture, energy storage, and energy dispensing. Photovoltaic panels capture the energy. A field regulated reluctance machine (FRRM) stores the energy and makes it available for charging a vehicle battery. A secure cyber physical control system arranges for dispensing the energy to an electric vehicle, providing billing and reliable, secure delivery. Each of these pieces is either complete or nearing successful development. What is now necessary is an interface based on power electronics to assemble the pieces into a functional vehicle battery charging unit for remote, off-grid locations typical of much of the rural Pacific Northwest. In this project, we propose to do this deceptively difficult task of interfacing this larger interconnected system. Beginning with prototypes being developed of each subsystem, we will build the necessary interface electronics and software, coordinate the communications and controls, and debug the combined result.

Research Project

This project builds on projects that created the major pieces of our remotely located, renewable energy based, charging system: solar energy collection and conversion, field regulated reluctance motor-based flywheel energy storage, battery charging electronics, and brokered dispensing of electrical energy. Each of these pieces is at NASA Technology Readiness Levels (TRL) from TRL 1 to TRL 4. In this project, we propose to interface this work to advance more closely toward an integrated whole. This interfaced system will provide a testbed for future experiments and will advance us significantly toward realizing a portable, resilient, and billable vehicle charging station for remote locations of the Pacific Northwest. To achieve this goal and make realizable advances toward a practical, resilient charging station for remote locations in the Pacific Northwest, we propose the following set of tasks:

- Obtain the flywheel energy storage system based on the FRRM when it is ready at the end of its current development later in the upcoming calendar year 2022,
- Complete a small array of solar panels to capture energy at the input to our remote charging system,
- Design an instrumentation system to gather data on performance,
- Document and report performance in appropriate publications,
- Translate our findings into recommendations for improving performance, advancing closer to manufacturing, and solving the problem of optional grid interface,
- Provide recommendations appropriate to help design a more practical and resilient unit.



ABOUT THE AUTHORS

The research team consisted of Herbert Hess of the University of Idaho.

ABOUT THE FUNDERS

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EXPECTED DATE OF COMPLETION

March 2023

FOR MORE INFORMATION

https://depts.washington.edu/pactrans/research/projects/interfacing-major-subsistence-for-resilient-electric-charging-facilities-for-rural-areas/