UTC Project Information	
Project Title	Interfacing major subsistence for resilient electric charging facilities for rural areas
University	University of Idaho
Principal Investigator	Hebert Hess
PI Contact Information	hhess@uidaho.edu
Funding Source(s) and Amounts Provided (by each agency or organization)	University of Washington PacTrans $40,00 University of Idaho $ 40,000
Total Project Cost	$80,000
Agency ID or Contract Number	69A3551747110
Start and End Dates	March 16, 2022-June 30, 2023
Brief Description of Research Project	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 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 working prototypes of each subsystem, we will build the necessary interface electronics and software, coordinate the communications and controls, and debug the combined result.

Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	Energy capture: We have the solar panels to facilitate capture of energy as planned. We sponsored a group of three students to design and build an energy management system. It uses solar panels to capture the energy. It has electronics programmed to manage the energy as it moves from solar panels to storage medium. Because the motor was not ready by the end of the project, we substituted lithium iron phosphate batteries temporarily. Energy storage: We rewound the motor-geenrator to repair damage that it sustained in earlier tests. This is now nearly complete with delivery scheduled for November 2023. Managing energy storage was the greatest advance in this project. We succeeded in developing control programs to manage this energy safely and efficiently. We completed sensing for fourof our machine's six axes. We proved the sensor for position works to specification. We developed programming within our Speedgoat control architecture to control the machine's energy storage and its addition/distritbution of energy. Energy dispensing : Our Speedgoat energy management framework was programmed to dispense energy on control. Simulations showed positive results. We can manage the in and out of energ on our system. We await the return of our motor to validte our simulations and partials experimental verifications. We have designed appropraite energy management ideas with local utilities for dispensing energy upon demand. When the system gets assembled in the next round of work, we will be able to show that our systems works as designed and gain ideas to imporove it.
Impacts/Benefits of Implementation (actual, or anticipated)	We finished short of implementing the whole energy management system. We have developed subsystems that have performed as specified. We have also spun off technology to other projects. Our data collection subsystem is an example of a working implementation. 3E can gather data from the FESS sensors, process it within our Speedgoat controller, and observe waveforms that indicate successful implementation. We have spun off motor technology onto a project to create a new motor for automobile propulsion. As our "inside out" motor-generator gives us efficient energy, collected on demand and distributed on demand. This topology lends itself nicely to wheel hub propulsion motors, inside-out and with shaftless topologies. The spun off motor is current under design with an implementation date in 2024. We anticipate that this FESS will provide an alternative enrgy storage mechanism for electric refueling systems in remote locations. Instead of a battery, this flywheel storage performs under temperature extremes that make batteries ineffective.

Web Links • Reports • Project Website	None.