

Off-Grid Vehicle Charger

Senior Design Project Proposal

Sponsor: University of Idaho Sustainability Center

Background

The University of Idaho Facilities has acquired three electric utility trucks from Miles Electric Vehicles of Santa Monica, CA (www.milesev.com, 310.390.4890). The university would like to explore methods of recharging these vehicles using off-grid energy sources. The goals are to reduce the university's carbon footprint by reducing the load on the electric grid, and to establish a precedent as an environmentally sustainable campus. Such a charging system might also make electric vehicles practical in remote areas where electric power is expensive or unavailable. Possible energy sources for charging are solar and wind.



Vehicle Description

ZX40ST Electric Truck
Max speed: 25 MPH
Range: 50-60 miles

Battery System

Advanced sealed, absorbed glass mat (AGM), valve regulated lead-acid battery.
Battery voltage: 12 V
Capacity: 150 Ah
Estimated battery life: 25,000 miles
Number of batteries: 6
On-board charger connects to 110V AC source

More details at: <http://www.milesev.com/#zx40st.swf>

Project Parameters and Constraints

Budget: TBD

- Vehicles must be available for service during the normal 8-hour per day work week
- 100% off-grid charging is not a requirement, however it is required that the vehicles be charged at any time. Automatic switching between renewable sources (when available) and the utility grid are a possibility.

Some Technology Factors to Consider

- The batteries require a DC charging source. A system that converts the power directly from the renewable source, bypassing the conversion to AC required for the grid, should be considered.
- A store-and-transfer system should be considered, i.e. using supercapacitors to collect energy, when is then transferred to the vehicle batteries.
- Energy efficiency options should be considered, such as regenerative braking

Project Phases

Discovery

1. Understand the current vehicles
2. Use patterns
3. Energy requirements
4. Battery system characteristics

Feasibility Study

- Basic energy analysis
- What are the patterns for solar, wind, etc., in Moscow?
- What are the demands of the vehicles?
- Model scenarios to estimate costs and benefits from off-grid charging
 - Investment cost
 - Operating cost
 - Waste and disposal costs/environmental analysis

Conceptual Design

Final Design and Demo

- Possibly a laboratory mock-up with instrumentation and data collection, not in the vehicle at this stage