

Warren Wilson College – Diesel to Electric Truck Conversion

Case Study Follow-up visit on 6-20-14

NC DENR, Division of Air Quality



“EV” (pronounced “EE-vee”), the diesel-to-electric short haul truck. Once owned by Warren Wilson’s Forestry Crew, it now serves as an auto shop crew vehicle and educational tool.

Site Overview

Warren Wilson College (WWC) is an independent liberal arts college located about 10 miles east of Asheville in North Carolina’s Swannanoa River Valley. The college has about 1,000 enrolled students from 45 states and 20 countries. Its facilities include 45 buildings, 300 acres of farm land and gardens, 600 acres of forest, and 25 miles of hiking trails. WWC has received praise from the Fiske Guide to Colleges, Sierra magazine, Newsweek, Barron’s Best Buys in College Education, and various other sources.

The Auto Shop

At the WWC Auto Shop, educational opportunities can range from learning how to perform routine car maintenance to diagnosing and repairing major vehicle malfunctions. Students learn to evaluate cars and their mechanical condition while becoming familiar with many different engines and systems. They also learn computer analysis of engines, solving problems of mechanical apparatuses, welding and small-job metal fabrication. All resident students are required to log 15 hours of work in the shop per week during the school year and may choose paid internships over the summer as well.

Implementation

In 2013, WWC was awarded a Mobile Source Emission Reduction Grant (MSER) that went toward the auto shop’s purchase of a 2012 HPGC AC-75 electric motor, 48-volt controller, pedal assembly and 12 heavy duty 8-volt batteries. Over the course of the year, the 12-student crew and auto shop supervisor Jonathan Unger amassed the remaining electric components needed for the project and removed the diesel parts from the truck, a 1986 Chevrolet 6.2 Detroit Diesel M022660 engine, transmission and 30-gallon diesel tank. They and installed brackets and adapters, mounted the batteries and electric features, finished the electric wiring, and returned the now fully electric truck to its service duties.

EV, the name bestowed by the student crew and short for Electric Vehicle, has led to the following benefits and impacts:

- Savings of 126.5 gallons of fuel used per year (while only getting 8 mpg) and fuel-related expenses.
- Elimination of all idling emissions, including nitrogen oxides (NO_x), fine particulate matter (PM_{2.5}), carbon monoxide (CO) and other forms of air pollution.
- The project has been featured in the WWC newspaper, on the WWC Facebook page, and in a local magazine.
- EV has been featured in WWC’s annual Work parade and, being a student-made electric camo pick-up truck with teeth on the grille, received a lot of student body excitement and support.
- EV is used as a campus-wide educational model of sustainability beyond its auto shop duties.
- EV has increased the crew’s interest in taking on more electric vehicle projects, which will add depth to the auto shop work program and will better prepare students for the future of electric vehicle systems.

N.C. Division of Air Quality

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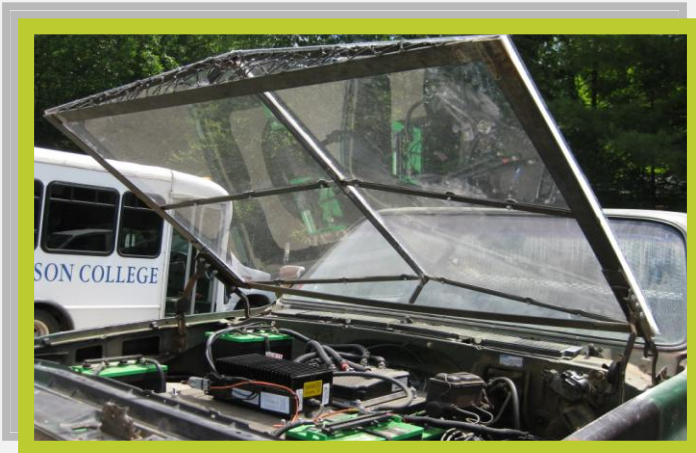
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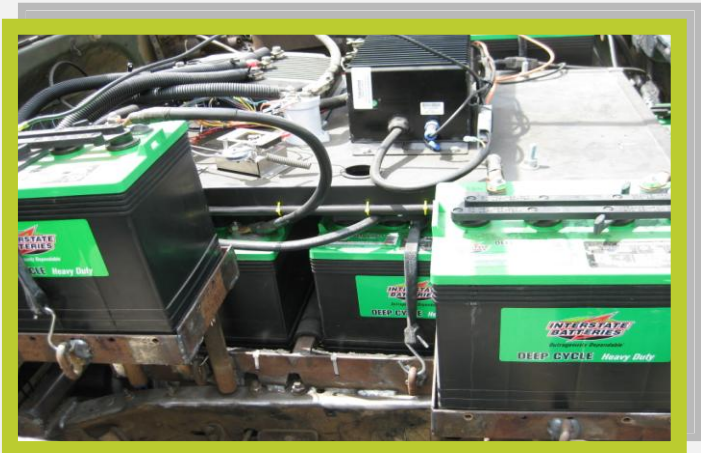
Adjustments and Conclusion

The Warren Wilson College Auto Shop did encounter some problems during the conversion process. The auto shop needed more parts than originally anticipated, so the final cost of the project was a little over the original budget. On a personnel level, only Jonathan Unger and one other student crew member had knowledge of how electrical systems work. There was a lot of on-the-job training for the other students, which slowed progress. Also, Jonathan Unger left his shop supervisor position after the 2013 spring semester while the project was still being completed. This forced the student crew to focus on jobs that wouldn't require extensive experience and a professional level of mechanical skill, which in turn forced "EV" to become less of a priority and further slowed progress.

Despite the various challenges and setbacks, the new and returning students that came through the auto shop work program were able to finish the project and even go above and beyond expectations. Since the completion of the diesel-to-electric conversion, EV has had additional work done to its body, such as the additions of a front nose, bumper, headlights and hood. EV also became a key point of interest for Jansen Bowman, the new WWC Auto Shop supervisor as of June 2014. Previously a tank mechanic with a great deal of electrical experience, he is open to the idea of undertaking similar emission reduction projects in the future.



The hood is made of Plexiglas and allows one to observe the electric system's motor, batteries and components, opening the door for many conversations promoting electric vehicles.



A few of the heavy duty 8-volt batteries (green and black). Resting on top of the central batteries is the 96-volt battery charger (black).

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- Jansen Bowman, Auto Shop Supervisor

Emission Reductions

Nitrogen Oxides (tons/yr)	Fine Particulate Matter (tons/yr)	Carbon Monoxide (tons/yr)
0.0069	0.0009	0.0044

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