

Solar-Electric Recycling Vehicle Conversion

Basic Organizational Information

The Environmental Center is a student-run, student-funded organization that strives to reduce the impact that CU has on the environment. It encompasses many environmental issues from education to recycling to sustainability. This particular project will progress the Environmental Center's recycling and sustainability agendas. The vehicle will be used by the CU Recycling Program, which exists as a partnership between UCSU, Facilities Management, and Housing. CU is recognized nationally for its successful recycling program, as this project will further enhance the educational and functional aspects of the recycling operations on the CU campus.

Primary Contact People

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Project Description

The goal of the project is to transform an existing recycling vehicle into an educational, solar-electric vehicle that will continue to collect recyclable materials. This conversion will decrease our environmental impact by reducing carbon emissions and use petroleum based fuels. This vehicle will also serve to promote sustainability on campus, acting as a working model of sustainable transportation. The Recycling Center on campus currently owns a Mitsubishi Mighty Mits that is used to collect recyclable materials from special events, such as football games and student move-in. We will convert it from a gas-powered vehicle to a solar-electric vehicle. As a part of this project, a solar panel will be installed on the roof of the vehicle to produce a portion of the electricity needed for operation. The vehicle will also have a plug-in option for events in which the vehicle will be used for longer periods of time or for days of inclement weather. The current capabilities of the vehicle, such as horsepower and weight hauled, will be maintained with the new 72-watt electric motor system.

Project Scope and Timeline

The goal of the project is to have it completed by May 2008, in time for use over the summer and for the next football season. The project will be divided into two stages. The first is the conversion from a gas motor to an electric motor. The second stage is the solar panel installation.

The project will include the coordination of several departments and companies. The vehicle is operated and maintained by Facilities Management. Within Facilities Management, the Recycling Center and the Sheet Metal Shop are the departments that will be involved. The Recycling Center currently operates and maintains the vehicle. The Sheet Metal Shop will make and install a stainless steel frame in the bed of the vehicle to hold the solar panels. In addition, the Denver Electric Vehicle Coalition has been involved in development and design aspects and will continue to be involved throughout electric motor conversion stage. Other companies for the conversion of the motor and the solar panel installation will be hired as we find reliable mechanics and engineers.

Stage One: Gas to Electric Motor Conversion

1. Find a reliable automobile mechanic who has experience in these types of conversions. Decide on the design and components needed. Order the required parts by December 2007.
2. Remove current gas motor and corresponding components by February 2008.
3. Install electric motor and corresponding components by March 2008.

Stage Two: Solar Panel Installation

1. Find a reliable solar energy engineer. Decide on design and components needed. Order the required parts by February 2008.
2. Install the steel frame in the bed of the vehicle by April 2008.
3. Install solar panels by May 2008.

Detailed Project Budget

Gas to Electric Conversion	
Drive System (DC Motor, Controller, etc.)	\$ 2,230.00
Battery System (Batteries, Charger, etc)	\$ 2,230.75
Instrumentation	\$ 165.00
Safety	\$ 67.00
Materials and Electronics	\$ 1,000.00
Labor	\$ 4,500.00
<i>Total</i>	<i>\$ 10,192.75</i>
Solar Panel Installation	
Solar Panels (\$5.50/watt @ 600 watts)	\$ 3,300.00
Steel Frame for Panels (includes labor)	\$ 1,200.00
Labor	\$ 500.00
<i>Total</i>	<i>\$ 5,000.00</i>
Total Project Completion	\$ 15,192.75

Budget information provided by:

Mike Bachand of the Denver Electric Vehicle Council
Zach Tyler of Classic Electrics
Zeke Yewdall of Sunflower Solar
EV Parts.com

Environmental Impact

The environmental center, in the Blueprint for a Green Campus, has committed to “improving and encouraging sustainable alternatives” in transportation and converting “25% of university-owned fleets to high efficiency and alternatively-fueled vehicles and begin offsetting remaining emissions.” In addition, Chancellor Peterson signed the President’s Climate Commitment in June of 2007, which commits CU to monitoring and reducing carbon emissions by setting short, medium and long term goals. Converting the Mighty Mits to an electric vehicle would progress these goals by bringing the carbon

emissions from the vehicle itself to zero. It would eliminate the use of petroleum products (gasoline and engine oil) needed to run a gasoline motor. Installing the solar panels would further reduce the carbon emitted to run the vehicle by reducing the amount of electricity used from the grid. The vehicle would also set an example for other CU departments to implement sustainable transportation.

The solar powered electric vehicle will provide an educational platform for sustainability. Another goal outlined in the Blueprint for a Green Campus is to “improve outreach, advertisement and education to increase awareness of sustainable transportation practices.” This vehicle is used at large events (i.e. football games, student move-in) that would allow students, staff, faculty and the public to view an alternatively powered vehicle. The exposure would promote sustainable transportation and show CU’s commitment to being at the forefront of environmental progress.

Lastly, by converting an old vehicle, rather than buying a new one, we are staying true to our legacy of reuse before recycling. This conversion will extend the life of the vehicle and eliminate the energy and materials involved in buying a new one.

CU Quality of Life

A solar powered recycling vehicle can improve the staff and students' experience at CU. The new vehicle will improve air quality at football games, student move-in and other special events by eliminating the exhaust that is released by gasoline engines. The electric engine will also be much quieter than the gasoline engine. The cleaner and quieter environment will improve the enjoyment of these special events.

This conversion can improve the educational experience at CU as well. After the conversion is completed, we plan to create a presentation that illustrates how to do the conversion, the benefits of the conversion and the problems that we encountered. We can then present our project to classes in interested departments such as Environmental Studies and Electrical Engineering.

Saving Money

The university will save money by eliminating the gasoline use for this vehicle and reducing the maintenance required. The vehicle will be plugged into the grid sometimes, but the solar panels will substantially decrease the energy cost of the vehicle. Electric engines require less maintenance than gas engines as well.

By doing a very rough estimate of current gas use and the cost of the project, we estimate that the conversion will take less than fifty years to pay back. This is based on the estimated current gas use of 120 gallons per year and assuming that gas prices will remain on average at \$3 per gallon. Gas prices, however, are expected to rise. This estimation also does not take into account the money saved on buying a new vehicle and the ability to transfer the new equipment to another used vehicle when the Mighty Mits sees its last days.

Project Longevity

The solar powered electric vehicle can be used for many years after the conversion. The installed equipment will increase the longevity of the vehicle because it will replace the old engine and remove many old parts, such as the radiator. Repairs and improvements made to the body of the vehicle are easier and cheaper than repairs to the

internal components. The installed electric drive system, instrumentation and electronics are expected to last fifty years or more. The battery system has the shortest lifetime expectancy of five to ten years. However, the battery system can be replaced without consequence to the other aspects of the electric vehicle system. The solar panels have a twenty year full coverage warranty with Sunflower Solar and are expected to last up to sixty years. In the event that the equipment outlasts the body of the vehicle, the electric motor system and solar panels can be transferred to another vehicle.

A preventative maintenance inspection has not been conducted as of yet on the vehicle. The vehicle is slated for replacement in 2009, but will not be replaced if it is in working order. The conversion is pending on this inspection, however, there is no known issues with the vehicle that would prevent the solar eclectic conversion. It is expected to last beyond this date due to the current functionality of the vehicle and the minimal miles that are put on it.