

## Quarterly Progress Report

**Project Title:** EVERmont Renewable Hydrogen Production and Transportation Fueling System

**Project Period:** October 1, 2004 to June 30, 2006

**Date of Report:** July 29, 2005

**Recipient:** EVERmont, Inc.

**Award Number:** DE-FC36-04GO14237

**Working Partners:** Northern Power Systems, Proton Energy Systems

**Cost-Sharing Partners:** Northern Power Systems, Proton Energy Systems, Air Products and Chemicals, Inc.

### Contacts:

Harold Garabedian, EVERmont, 802-241-3849, [harold.garabedian@state.vt.us](mailto:harold.garabedian@state.vt.us);

Nick Borland, Northern Power, 802-496-2955 x315, [nborland@northernpower.com](mailto:nborland@northernpower.com)

**DOE Managers:** Matt Kauffman, Jill Gruber

**Project Objective:** Develop advanced PEM electrolysis fueling station technology. Build and test a validation system in Vermont that utilizes renewable energy from wind and is capable of providing fuel to vehicles. Procure, operate, and maintain a hydrogen-fueled vehicle for testing and validation of the station.

**Background:** The purpose of this project is to test the viability of hydrogen for use as a transportation fuel in a cold climate with hilly terrain and rural settlement patterns. Specifically, the project addresses the challenge of building a renewable energy capable system – creating hydrogen through electrolysis. Proton Energy Systems is building a cold-weather capable advanced electrolysis system. Northern Power Systems is responsible for procuring the hydrogen compression, storage and dispensing system from Air Products and is also managing the site installation. Prior to project signing, EVERmont and Northern had tentatively selected Burlington Department of Public Works in Burlington, Vermont as an appropriate location for the site. Burlington Electric Department, the electric utility provider for the area, also tentatively agreed to contribute renewable energy credits for their wind turbine adjacent to the proposed site at DPW.

### Status:

#### Acronyms:

BED – Burlington (VT) Electric Department

CAD – Computer-Aided Design

CNG – Compressed Natural Gas

DPW – (Burlington, VT) Department of Public Works

kW – Kilowatt, or 1000 watts  
NEPA – National Environmental Policy Act of 1969  
NPS – Northern Power Systems, or Northern (subcontractor to EVermont)  
PDC – Pressure Dynamic Consultants (compressor manufacturer)  
PDR – Preliminary Design Review  
PEM – Proton Exchange Membrane  
PES – Proton Energy Systems, or Proton (subcontractor to EVermont)  
PSI – Pounds per Square Inch  
REC – Renewable Energy Credit

**Major progress this quarter:**

- Proton received compression, storage and dispensing system (task 4.2)
- Proton ordered and received the buffer tank and cooler (task 4.1)
- Northern ordered and received a Toyota Prius that will be converted to hydrogen over the next two quarters (task 4.3)
- Proton completed pad layout drawings (task 3.1)
- Northern contracted with a civil engineer to create civil site drawings, assist with permitting and oversee construction (task 3.1/3.2)
- Northern purchased and configured an industrial computer to monitor the hydrogen production

**Detailed Status:**

***Component procurement and fabrication***

A representative of Proton attended the factory acceptance test for the Air Products compression, storage and dispensing system. Hydrogen compression was observed up to 6250 psi, and dispensing hydrogen into a receiving tank at 5000 psi was also observed. All equipment functioned properly at the factory.

Proton received the compression system, storage tanks and dispenser at their facility in Wallingford, CT on June 24<sup>th</sup>, 2005. They were placed on a staging pad in the same arrangement as they will be on the final site, and they will be interconnected and commissioned temporarily for testing early next quarter. See figure 1 for an image of the equipment on the staging pad at the end of Q2. The dispenser is not shown, as it was still crated at the end of the quarter.

The base electrolyzer was almost ready to be turned over to the Proton design team for cold-weather customization at the end of June (the transfer happened prior to writing this report in July). The controls cabinet assembly was 80% complete by the end of Q2. A 200 psi buffer tank and the thermal control system (cooler) were delivered in June, and Proton engineers worked on integrating them into the system.



**Figure 1: Air Products storage (left) and compression (right) modules for the EVERmont project**

### ***Hydrogen Vehicle***

A 2005 Toyota Prius was purchased in May 2005 (see figure 2). Quantum Fuel Systems Technologies Worldwide, Inc. (Quantum) will be converting this vehicle to run on hydrogen fuel in Q3 and Q4 2005. As per Quantum's request, the vehicle was driven by EVERmont and Northern for about 3000 miles to work through any warranty or lemon law issues. There were no issues with the vehicle during that time period. Gasoline mileage was tracked, and was generally in the range of 42-49 mpg for most of the road conditions encountered. The vehicle is scheduled for delivery to Quantum in August and the conversion is scheduled to be complete by December 2005.



**Figure 2: the 2005 Toyota Prius that will be converted to run on hydrogen**

### ***Project site***

Representatives from Proton, Northern, EVermont and DPW met on April 21<sup>st</sup> to finalize the site chosen in Q1. DPW agreed that the site is appropriate, and that decision was mentioned to the DPW Commission in an informational meeting on May 4<sup>th</sup>. DPW did not compose a formal agreement as originally proposed for Q2; however such an agreement will be negotiated in Q3 before ground is broken on the project.

Northern and Proton presented information on the project to local and state fire officials and Burlington Electric Department (immediate neighbors of the site, adjacent to DPW's lot) in separate meetings on May 18<sup>th</sup>. Proton incorporated the fire marshal's input into the preliminary site drawings. Northern and EVermont also presented project information to the Transportation, Energy and Utilities Committee of the Burlington City Council, who appeared to be quite supportive of the project.

Northern hired a civil engineering firm to create site drawings, assist with permitting and oversee construction. Proton finished the preliminary site drawings and is collaborating with Northern, the City of Burlington and the civil engineer to ensure that the final site layout will allow the system to function properly and look attractive, while remaining as low-cost as possible.

Civil site plans are scheduled to be complete by the end of July. A NEPA application for categorical exclusion will also be submitted during this timeframe, as required by the contract. If all permits and the categorical exclusion are granted, site construction is scheduled for the end of August and equipment installation is scheduled for September.

### ***Data Monitoring System***

Northern procured an industrial PC and installed Northern's SmartView™ software and other appropriate software and drivers to allow communication with the electrolyzer and other devices on site. Initial attempts at communication indicated some minor problems, but it is expected that these issues will be resolved in the next quarter.

### **Plans for Next Quarter and Key Issues:**

- Hold final design review (FDR)
- Assemble and commission station temporarily for testing in Wallingford, CT
- Complete local permitting process
- Complete formal agreement with Burlington DPW (site owner)
- Submit NEPA documentation for categorical exclusion
- Hire site contractor
- Construct final site in Burlington, VT (pending NEPA approval)
- Assemble station on final site (may be Q4)
- Ship vehicle to California for conversion to hydrogen

**Patents:** Currently under investigation

**Publications / Presentations:**

Presentations were made to the following Burlington, VT groups, primarily for the purpose of explaining the project to local government officials and getting buy-in to streamline the permitting process:

- Department of Public Works Commission
- Fire marshal, Vermont regional fire manager and other fire officials
- Burlington Electric Department
- City Council Transportation, Energy and Utilities Committee

## Task Schedule

Task Number	Project Milestones	Task Completion Date				Progress Notes
		Original Planned	Revised Planned	Actual	Percent Complete	
1	Project Planning	12/31/04		12/31/04	100%	Complete.
2	Power Converter Development	5/1/05	6/15/05	6/30/05	100%	Complete
3	System Design and Engineering	6/1/05	7/29/05		90%	In-process; on schedule
4	Fabrication and In-house Testing	9/1/05	8/15/05		60%	In-process; on schedule
5	Installation and Commissioning	10/1/05	9/15/05		15%	Ahead of schedule
6	Testing, Monitoring, Analysis, Reporting	6/30/06	12/31/06		0%	Dependent on vehicle delivery and ambient temperature for testing