9. Hydrogen Production and Storage Using Wind and Nuclear Sources

Principle Investigator: Jerry L. Hudgins, Electrical Engineering
Co-Investigator(s): Sohrab Asgarpoo, Electrical Engineering
Dean Patterson, Electrical Engineering

http://ee.unl.edu/people/hudgins.html

Low-cost hydrogen production in a residential or small rural environment will help achieve DOE's cost and production goals, and further implementation of the hydrogen economy. Integration of power electronics sub-systems between a wind turbine and an electrolyzer, optimal tip speed control algorithms for low-power turbines, and low-cost electricity can provide the needed factors for successful realization of low-cost H_2 production. This project will coordinate with an ongoing NREL and Xcel Energy project, as well as develop cost and economic models for hydrogen production from any size renewable energy source.

The goal is to develop technologies that result in a net reduced cost of hydrogen (H2) production. To achieve this goal the following objectives must be accomplished:

1. Review and coordinate with the XCEL Energy Wind2H2 Demonstration Project.
2. Develop a H_2 cost model from small renewable energy sources on a residential scale (<10 kW turbines) using HOMER® (Hybrid Optimization Model for Electric Renewables).
3. Develop a cost model for the hydrogen from wind sources at all power levels.
4. Demonstrate a unique and new working system composed of a small wind turbine, power electronics converter and electrolyzer that optimizes wind tip speed under high dynamic wind speeds.
5. Utilize data from Cooper Nuclear Station on electrolyzer operation and maintenance costs to help facilitate extrapolation to all power scales.

Completion of this project is seen as a path by which the Nebraska Public Power District can utilize their renewable sources for providing H_2 fuel in a timely and cost-effective manner. It is expected that this project will coordinate technologies appropriate to NREL's wind/irrigation and wind/rural schools programs.