

# Hydrogen Filling Station and related renewable energy projects presentation

Center for Energy Research UNLV

# Hydrogen Filling Station



# Renewable Filling Station

- ▶ In a joint project with the U.S. Department of Energy, the Las Vegas Valley Water District, and Proton Energy Systems, the Center for Energy Research developed a refueling station for renewable hydrogen that was powered by solar energy.
- ▶ The Center for Energy Research and Proton Energy Systems worked together to:
  - Develop the requirements for the fueling system
  - Survey potential sites
  - Select a site located at the Las Vegas Valley Water District
  - Devise a site plan
  - Design the fueling system layout
  - Support the site permitting process
  - Analyze the system's performance
  - Complete the conversion of some vehicles to hydrogen fuel
  - Monitor various experimental performance parameters
- ▶ Initially, a conventional pressure (200 psia) electrolyzer was installed. This was followed by a high pressure (1200 psia) electrolyzer. Both of these systems have the capability of operating totally off solar-generated electricity (photovoltaics), totally from grid power, or some combination of both sources. After that, a larger unit was installed during the next phase of the project, driven by grid electricity.
- ▶ Due to curtailment of Federal funding for this type of work, the hydrogen filling station closed, effective July 1, 2010.

# Conversion of Vehicles to Hydrogen Fuel

As part of this project, the Center for Energy Research converted two utility vehicles to hydrogen fuel:

The vehicle pictured below on the left initially used a gasoline-fueled internal combustion engine, which was converted to use hydrogen. The direct-injection method was used to pump hydrogen into the cylinder of the engine.

A Ford pickup truck also was converted to use hydrogen as a fuel.



# Conversion of Vehicles to Hydrogen Fuel Cont.

- ▶ One vehicle -- initially all electric -- was converted to a fuel-cell/electric hybrid vehicle



# Hydrogen Generation

In addition, work was performed on various methods of hydrogen generation, including:

A **photo-electrochemical electrolyzer** cell to generate hydrogen

A **single-cell PEM electrolyzer** , developed to improve the performance of individual cells and cell stack by optimizing the fluid dynamics and heat transfer behavior inside the cell.

# Modeling Hydrogen-Based Systems

- ▶ The Center for Energy Research develops models of hybrid energy systems that use renewable energy as energy sources -- solar, wind, and hydro-electric power.
- ▶ This hydrogen-based system – which consists of an electrolyzer, storage tank, and fuel cell
  - ▶ can be used for seasonal storage of energy.
- ▶ In addition, short-term storage based on battery and super-capacitors has been studied.
- ▶ In related work, UNLV hosted a workshop on hydrogen safety and related codes and standards.
- ▶ This was followed by a road-mapping exercise to outline approaches to hydrogen development for the state of Nevada.

# Sponsors and Project Participants (1 of 3)

Entity	Responsibilities
U.S. Department of Energy (DOE)	<ul style="list-style-type: none"> <li>Grant &amp; review of Hydrogen Filling Station (HFS) Project</li> <li>Safety inspection</li> </ul>
University of Las Vegas, Nevada (UNLV)	<ul style="list-style-type: none"> <li>Research &amp; development</li> <li>Data collection and analysis,</li> <li>Financial management</li> <li>Equipment installation, operation and maintenance,</li> <li>Vehicle conversion and testing.</li> </ul>
Proton Energy Systems and Air Products and Chemicals, Inc.	<ul style="list-style-type: none"> <li>Design of the HFS</li> <li>Equipment supplier</li> <li>System Installer</li> <li>Operation and maintenance</li> </ul>
Las Vegas Valley Water District	<ul style="list-style-type: none"> <li>Engineering design</li> <li>Design of electrical system for the HFS</li> <li>Fleet services</li> <li>Maintenance</li> <li>HFS user.</li> </ul>





# Sponsors and Project Participants (2 of 3)

Entity	Responsibilities
<i>Springs Preserve Las Vegas, NV</i>	<ul style="list-style-type: none"><li>• <i>Public information</i></li><li>• <i>Vehicle use</i></li></ul>
<i>Green Valley Electric Henderson, NV</i>	<ul style="list-style-type: none"><li>• <i>Electrical system installer for the HFS</i></li><li>• <i>Some portion of the Solar Electrical System subcontract with Arizona Public Service (APS)</i></li></ul>
<i>Southern Nevada Water Authority (SNWA)</i>	<ul style="list-style-type: none"><li>• <i>Energy management</i></li><li>• <i>Project management</i></li><li>• <i>Engineering</i></li><li>• <i>Project engineer for the solar photovoltaic (PV) system.</i></li></ul>
<i>Arizona Public Service (APS)</i>	<ul style="list-style-type: none"><li>• <i>Design and installer of the solar PV system</i></li></ul>
<i>Colorado River Commission (CRC)</i>	<ul style="list-style-type: none"><li>• <i>Maintenance of the solar PV system</i></li></ul>



# Sponsors and Project Participants (3 of 3)

Entity	Responsibility
NV Energy	<ul style="list-style-type: none"><li>• Renewable energy incentives</li></ul>
Kell's Automotive & Marine (KAM) Las Vegas, NV	<ul style="list-style-type: none"><li>• Internal combustion engine conversions</li><li>• Testing</li></ul>



# Contact Information

## ► For More Information

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