DRI Renewable Energy Center

Desert Research Institute

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The DRI Renewable Energy Center (REC) is an organizational umbrella under which all our renewable energy (RE) research is conducted. The current focus of DRI's RE research is on wind energy and hydrogen applications, with developing interests in bio-energy. Public outreach and education programs in RE are also included under the REC umbrella. A physical location for the REC is planned for development at DRI's Dandini location in Reno, Nevada.

NEVADA Southwest Energy Partnership

Creating Renewable Energy Centers in the American Southwest

The DRI-REC concept began within the Nevada Southwest Energy Partnership (NSWEP) Program. NSWEP is a collaboration among the Nevada State Office of Energy (NSOE), the U.S. Department of Energy (DOE), the National Renewable Energy Laboratory (NREL), UNLV, UNR, and DRI. NSWEP funding is provided by DOE, and is managed by NREL.

NSWEP-funded research at the DRI-REC includes projects on hydrogen applications and wind energy assessment.

HYDROGEN APPLICATIONS

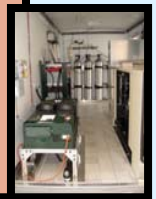
Hydrogen technologies are expected to play an increasing role in meeting future energy demands. Under the NSWEP Program, DRI is investigating H_2 systems and use in off-grid residential and transportation applications.

Hydrogen in Transportation

DRI is investigating practical aspects of H_2 production, storage and use in transportation applications. We are working with Washoe County Regional Transportation Commission (RTC) as they begin using H_2 fuel in their bus fleet. With Collier Technologies, we have converted one CNG bus to a H_2-CNG blend fuel (HCNG). Vehicle performance and emissions testing is now being conducted.

Chassis-dyno testing of the HCNG bus.

Vehicle computer software (called ADVISOR) is being used to model the performance and emissions of the baseline CNG and the HCNG converted buses. Results will be compared with actual test data to improve modeling accuracy. DRI is also investigating codes, standards, and other requirements for building and implementing H_2 infrastructure and operating H_2 vehicles.

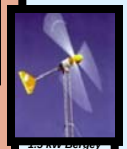


The H_2 RE system is housed within a trailer for portability.

Hydrogen in Off-Grid Residential Applications

DRI has developed a renewable energy system to help meet electrical power needs of Nevada's 10,000+ off-grid locations. The system utilizes RE sources (wind and solar) to supply electrical power to a residence. Excess energy charges batteries or produces H_2 through electrolysis. The stored H_2 (or a supply of LPG) is used in a dual-fuel internal combustion engine to generate power when the RE supply or energy storage in the batteries is inadequate.

WIND ENERGY

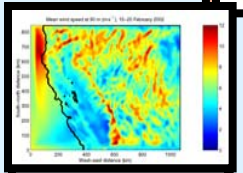


2.5 kW Bergey wind turbine at DRI

Some areas in Nevada have wind conditions suitable for utility-scale electricity production. Nevada's total wind resources have an estimated electricity generating potential of 55 million MWhr/year. However, the wind resources are highly variable in space, time, speed, and direction. Better understanding of wind profiles and the effects of windshear and turbulence on turbine performance and reliability is needed. Through the NSWEP Program, DRI is helping Nevada tap into its wind resource.

Wind Assessment

Four 50-m instrumentation towers have been erected in western Nevada to record high-resolution data of wind speed, direction and turbulence. Over 3-years' of data were used to verify wind fields and wind power density maps for all of Nevada and part of California. In addition, an 80-m communication tower near Tonopah has been instrumented with anemometers to measure elevated winds and turbulence. Mesoscale modeling for two annual cycles was performed to construct improved wind power density maps. This methodology will help promote wind energy development in Nevada by identifying candidate commercial sites.



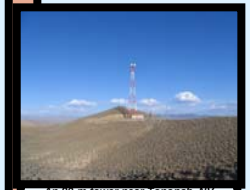
Model generated wind density map.

SODAR Profiling

Doppler SODAR (Sound Detection and Ranging) is potentially more accurate and lower cost than erecting towers with anemometers for determining wind characteristics. DRI has installed SODAR equipment at its existing 50-m towers and compared the wind data collected by these two methods. While some challenges remain (particularly in clear, dry air) the SODAR method shows promise as a useful tool for optimizing wind turbine siting.

SODAR sounders

Tall Wind Tower Deployment



An 80-m tower near Tonopah, NV instrumented with standard and sonic anemometers at three levels.

One 120-m and four 50-m towers in S. Nevada will be instrumented to capture wind shear and turbulence data across the typical area swept by wind turbine blades. An acoustic sounder to measure wind speeds at heights up to 200-m will also be collocated with each tower. DRI will perform mesoscale and microscale modeling including adaptive-grid predictions to investigate model accuracy while increasing horizontal resolution.

Other Activities

Additional programs under the REC umbrella include DRI's Green Power program for public outreach and education, and research in biomass energy and technologies.

GREEN POWER PROGRAM

The mission of DRI's GreenPower program is to *support and promote the use and development of green sources of energy in Nevada, with an emphasis on educating Nevada's K-12 population*. We are doing this by building modest solar arrays and wind generators at schools throughout Nevada.

Each school's installation includes internet-based monitoring software that students use to learn about renewable energy generated at their school. Energy-specific lesson plans accompany the display, to help satisfy science curriculum requirements established by the Nevada Dept. of Education.

The program is supported by voluntary contributions from ratepayers through their monthly utility bills. Currently 15 schools across the state participate in this program.

Roof installation at a school in Carson City, NV

BIOMASS RESEARCH

DRI is expanding its research in biomass energy through partnerships with other companies and organizations. We are participating in assessments of Nevada's biomass resource potential, and plan to investigate the environmental impacts of various biomass-to-energy systems. In participation with the Gas Technology Institute (GTI), DRI will investigate thermal conversion options for bio-refineries. We are also developing local partnerships to explore biodiesel fuel from algae, switchgrass as an energy feedstock, and novel applications of glycerin.

Algae ponds at Infinifuel in Wabuska, NV.

In the GTI project, DRI will be investigating a thermal conversion process by Changing World Technologies.