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The Role of State and Local Government, and the Private Sector in the Development of Renewable and Alternative Energy in America

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Mr. Chairman:

Thank you for this opportunity to address you and the Subcommittee on Energy and Mineral Resources on the important topics of renewable and alternative energy. My name is Kent Hoekman. I am Executive Director of the Division of Atmospheric Sciences at the Desert Research Institute (DRI). DRI is a separate, autonomous research branch of the Nevada System of Higher Education (NSHE). The entire system comprises 8 institutions: UNR, UNLV, 4 Community Colleges, Nevada State College, and DRI.

DRI conducts basic and applied research in a wide variety of environmental science topic areas related to air quality, climate, land use, water resources, and ecological systems – all of which are relevant to energy issues. In efforts to develop and promote use of renewable energy, it is important to involve not only governmental bodies, business organizations, and consumer groups, but also independent, neutral, research institutions like DRI. Such institutions can help bring together multiple stakeholders to collaboratively address issues of concern, while enhancing the credibility and acceptability of the research findings.

One current, positive example of this is the Nevada Southwest Energy Partnership, abbreviated NSWEP. This partnership began in 2003, with funding from the U.S. DOE that is managed by the National Renewable Energy Laboratory (NREL) in Golden, Colorado. In addition to DRI and NREL, participants in this partnership include UNR, UNLV, and the Nevada State Office of Energy.

Over the past 3 years, NSWEP members have conducted a variety of renewable energy research, development, demonstration, and deployment (RDD&D) activities in Nevada – many in collaboration with private firms. During this period, most UNR projects have focused on geothermal energy, while most UNLV projects have focused on solar energy and energy efficiency in buildings. DRI's efforts have been focused on two broad areas – wind energy and hydrogen systems – which I'd like to discuss in a bit more detail.

- Wind Energy

Nevada has considerable wind energy potential that could be utilized in commercial applications. However, the distribution of wind energy is not at all uniform in space and time. To justify the financial investments for commercial wind power development in the State, it is necessary to understand long-term wind conditions (including turbulence) at different locations. Existing surface level wind measurements are sparse and generally inadequate for this purpose. Through the NSWEP program, DRI is developing long-term, continuous records of wind conditions in appropriate locations, and is improving computer modeling techniques to enable accurate determination of wind conditions at other locations where there are no measurements. Combining this type of information with other critical data such as locations of roads and power lines, land ownership, and accessibility, will enable commercial wind developers to optimize their investments.

- Hydrogen Systems

In the area of hydrogen systems, DRI is currently pursuing two lines of work. The first involves development and deployment of a small, off-grid system to produce electrical power from renewable energy sources. Within the State of Nevada, it is estimated that there are over 10,000 off-grid locations requiring electrical power. Most of these are residences or ranches that are too far away from power lines to justify grid connection. Many of these locations currently produce power by means of a generator fueled by liquefied petroleum gas (LPG). The off-grid system developed by DRI utilizes photovoltaic arrays and small wind turbines to generate electricity from the sun and wind. During periods when excess electricity is produced, an electrolyzer is used to generate hydrogen. During times when insufficient electricity is produced, the stored hydrogen is used as a fuel (along with LPG) to power the generator. This system will soon be deployed at a residence near Reno to obtain operational data in a real-world application.

The other hydrogen research area being pursued by DRI focuses on use of hydrogen in transportation applications. Part of this involves investigation of the codes and safety considerations in setting up a hydrogen testing facility, a vehicle refueling station, and in operating hydrogen-fueled vehicles. We're also beginning to work with the Washoe County Regional Transportation Commission (RTC) to assess vehicle performance and emissions from small buses before and after retrofitting to operate on hydrogen-containing fuel.

The current focus of all NSWEP partners is in developing Renewable Energy Centers (RECs) to better coordinate the disparate research activities of the institutions, and to facilitate greater education and outreach activities. DRI and UNR are now in the process of planning joint RECs to be located on the Redfield Campus in South Reno.

Another reason to include independent research institutions in the deployment and assessments of renewable energy is to provide a more holistic view of the total impacts of energy production, distribution, and use. The term "renewable" is often taken to mean "clean," or "environmentally benign." But this is not necessarily the case. When assessing the impacts of energy systems it is important to consider the complete life-cycle of the systems. For example, in the case of transportation fuels, life-cycle processes include the following steps:

- Extraction of energy resource (oil, coal, gas, agricultural activities, solar, geothermal)
- Transportation of energy feedstocks (pipelines, ships, trucks, power transmission lines)
- Production of fuels (refining, gasification, fermentation, distillation, electrolysis)
- Storage, distribution, and marketing of fuels (tanks, pipelines, compressors, transmission lines, retail outlets)
- Vehicle fueling and use

Factors to consider on a life-cycle basis include costs, energy consumption, emissions (including greenhouse gases), environmental impacts, ecological impacts, and health effects.

Simply saying that hydrogen is a clean fuel is overly simplistic, and possibly misleading. When considered on a complete life-cycle basis, hydrogen may or may not be regarded as clean, depending upon the processes used to produce, distribute, store, and use it.

Another example to illustrate the complex interplay of factors when considering renewable energy involves utilization of forest waste biomass. Due to aggressive fire prevention and suppression measures, the forests surrounding Lake Tahoe have become dangerously overloaded with fuel. It is now recognized that the risk of catastrophic fire demands mitigation measures including removal of excess fuel. But what type of thinning and biomass removal techniques should be utilized to minimize impacts upon the hydrologic and ecologic systems? And what should be done with the biomass that is removed? Direct combustion may be simple and economically attractive, but more advanced gasification technologies would probably be more efficient and environmentally benign. Or maybe production of high-value chemicals from a biorefinery would be desirable. To develop optimum solutions, these complicated issues should be considered holistically, taking into account not just energy production and economics, but also environmental and ecologic impacts, health effects, public acceptability, and other factors. An independent research institute such as DRI can help in assessing the pros and cons

of different approaches, which could lead to greater consensus among the stakeholders.

Finally, I'd like to emphasize the concept of sustainability of energy systems. By sustainable I mean systems that provide adequate and convenient energy, having acceptable environmental impacts, at affordable cost, for at least 50 years into the future. Renewable energy can contribute to sustainable energy systems, and this contribution must grow as time goes on. But today, renewable energy contributes only 6-7% of total U.S. energy consumption. The use of renewable energy is growing rapidly, but so is the total consumption of energy. It is unreasonable to expect that in the near term, renewable energy will displace a significant amount of conventional energy, though it can dramatically slow the growth of conventional energy. No single action is sufficient to achieve a fully sustainable energy system in this country. Rather, a combination of many factors is required, including the following:

- Increased efficiency in the production, transmission, and storage of energy
- Increased efficiency in the use of energy
- Development of new energy sources
- Reduced total demand for energy

Renewable energy is an important part of the equation. Due to its abundant resources, Nevada is well positioned to benefit from development and utilization of renewable energy.