

Propane Makes Renewable DG Reliable

Hybrid technology provides sustainable power while enhancing environmental and cost benefits

As an on-site source of energy, distributed power generation (DG) technology can achieve higher efficiencies than traditional grid supply, which must deliver power over vulnerable, expensive, and unsightly transmission systems. On average, only 30 percent of the grid energy produced reaches end-users in the U.S.¹ DG's potentially high efficiency rates coupled with its low initial costs make it ideal for providing power to off-grid applications or to locations where electricity costs are high. However, relatively high operating and maintenance costs have challenged widespread adoption of this technology.

Renewable energy sources, such as solar and wind, can power DG technology with low operating and maintenance costs as well as the added benefit of zero emissions. Renewable technologies, however, tend to have significant upfront costs. Also, because solar and wind depend on specific weather conditions, they are not a consistent energy source and often require an additional source of power.

Propane is an excellent source of energy for renewable hybrid DG systems. The balance and intermittent quantity of electric power is provided by a very small, low-emission, high-efficiency propane generator or micro-combined heat and power (CHP) system. The right combination of renewables and propane DG technology generates power efficiently and maximizes the performance of renewables, resulting in sustainable power and potentially lower overall cost than other alternatives.

As a clean-burning fuel, propane also produces fewer emissions than traditional fuels, supporting the environmental benefits of using renewable energy. Its high energy density and portability makes it easy to transport and store for reliable use in remote or off-grid applications. Hybrid DG technology provides a premium market for propane where the value is in the performance of the whole power station.

Project Objectives

To continue to improve the reliability and effectiveness of propane/renewable hybrid DG systems, the Propane Education & Research Council (PERC) invests in research efforts focused on the development of solar/propane and wind/propane hybrid power systems.

Collectively, this program seeks to:

- Provide consumers with a reliable, renewable, and economical source of on-site power.
- Develop an optimized, packaged propane hybrid system.
- Improve reliability of electrical service to off-grid and edge-of-grid homes.

¹ U.S. Department of Energy, Energy Efficiency and Renewable Energy (EERE), 2006. *2006 Buildings Energy Data Book*. Electricity Generation, Transmission, and Distribution: Electric Conversion Factors and Transmission Distribution (T&D) Losses. 6-4, Table 6.2.4, September. <http://buildingsdatabook.eere.energy.gov>

Benefits of Propane/ Renewable DG Hybrid Technology

- Lower capital cost than solely renewable systems
- Lower operating cost than traditional DG systems
- Lower CO₂ and other emissions than on-site generators and grid-supplied power
- Reliable, continuous power
- Eliminates high cost of extending transmission lines



Photo courtesy of Sacred Power Corp., used with permission.

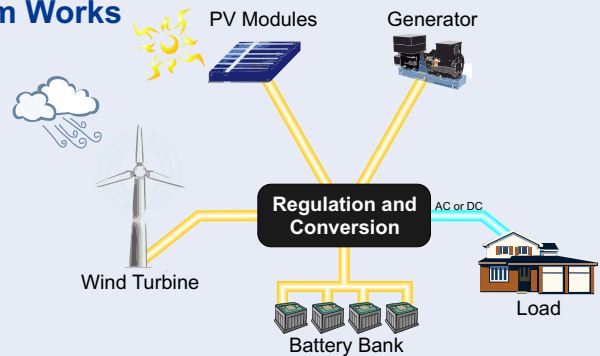
Propane/Solar Hybrid DG System



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How a Propane/Renewable DG Hybrid System Works

In a propane/renewable hybrid DG unit, solar and/or wind energy feeds electricity into a battery pack supplying AC electricity via an inverter. The propane-fueled genset activates when the battery pack charge falls below a minimum preset level or when the site electrical demand exceeds the renewables and battery pack power available. The propane-fueled genset also charges the batteries when solar panels or wind turbines cannot.



Ongoing Projects

The following projects are working to enhance the understanding and quality of propane/renewable hybrid DG technologies while expanding this promising market for propane.

Investigation of Propane-Genset Hybrid Power Systems for Rural Tribal Communities (Docket 12264)

This project is investigating the technical and economic viability of propane-genset hybrid solar and wind power systems for tribal community locations, which often struggle with high energy costs due to their remote locales. As a part of this project, which began in summer 2007, the service and installation requirements of propane-genset hybrid solar and wind power systems will be evaluated in a typical tribal community to determine the potential for an onsite demonstration.

Propane/Solar Hybrid Project for Urban/Municipal Applications (Docket 12074) The technical feasibility of a solar hybrid backup power system that utilizes propane fuel for powering Washington, D.C. traffic lights is being evaluated. Included in this project is the installation of a 2kW system composed of several solar photovoltaic panels, a propane-fueled generator, several standard-sized batteries, and a propane fuel storage cylinder.

NY Distributed Generation Propane Solar Power Station (Docket 11796) A prototype micro-power plant integrating a propane generator, solar cells, battery storage, and a power control system will be installed in an edge-of-grid New York residence. Because large areas of New York are rural with irregular to no electricity supply, this study will demonstrate the economic feasibility and power quality benefit to utilities and users of using energy storage technology at edge-of-grid to postpone costly grid upgrades and expansions.

Install Technically Advanced Propane Generator System at Denali Visitor Center (Docket 11795)

A collaboration with the National Park Service, this project involves the design and installation of an Onan heavy-duty propane generator system at Denali National Park and Preserve's Visitor Center (Alaska). The low-duty cycle requirements of the hybrid system allows the use of a low-cost genset, keeping overall operating and maintenance costs low. The results of this demonstration will provide baseline generator performance data and recommendations to improve performance.

Next Steps

As hybrid DG technology continues to grow, PERC plans to explore additional efforts, including:

- Development of a low-cost, longer-life, lower maintenance propane engine to be used in solar hybrid systems.
- Design of an optimized and packaged propane hybrid system.

Hybrid Controller

This grey box houses the hybrid system controller and inverters that regulate the flow of solar power (top) and propane genset power (right).



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