



# Solar hybrid

## power generation system for rural applications

**Chem Nayar** explains how smart hybrid energy systems, which link renewable energy technologies with diesel generators, inverters and batteries, can provide cleaner and more cost efficient grid quality power to remote locations.

There are two general methods of supplying electricity to remote areas: grid extension (which can be very expensive) and the use of diesel generators (often the most viable option).

However, remote areas with relatively small communities generally show significant variation between the daytime peak loads and the minimum night-time loads. Diesel powered electric generators are typically sized to meet the peak demand during the evening but must run at very low loads during "off-peak" hours during the day and night, which results in poor fuel efficiency and increased maintenance.

Other problems stem from the high cost of electricity due to increasing fuel and transportation cost, and air and noise pollution.

During the past decade, diesel prices have more than doubled which has translated into tremendous increases in the cost of energy generation.

By contrast solar and wind power technologies are clean, affordable, readily available, sustainable and can replace or supplement generators in both residential and commercial applications.

Hybrid energy systems integrate these renewable energy technologies with diesel generators, inverters and batteries to provide grid quality power in remote areas not connected to a utility grid. Such an isolated grid is known as Remote Micro-Grid and is widely recognised as the remote area electrification technology for the 21st century. A 21% increase in capacity for the remote micro-grid market is forecast by 2017, from 349 MW to 1.1 GW with a projected total revenue of more than \$10 billion.

A conventional diesel generator consists of an engine connected directly to a synchronous alternator to produce electricity. As the electricity must be produced at a fixed frequency, normally 50Hz or 60Hz, the engine must rotate at a constant speed (typically 1500 rpm for 50Hz or 1800 rpm for 60Hz), no matter what the power demand is. Previous Hybrid Power Systems were based on constant speed diesel generators in combination with battery storage, bidirectional inverter/charger, solar panels or small wind generators coupled either to the DC side using charge controllers or to the AC side using grid feeding solar inverters.

Using this concept Regen installed one of the largest solar hybrid power systems in Western Australia at the 'Eco Beach Wilderness Resort'

near Broome. In the turn-key solution Regen Power was responsible for the design, engineering and project management of the 48kWp renewable power installation generated by rooftop photovoltaic (PV) system with a diesel generator backup. Commissioned in April 2009 at a cost of \$1.2 million, the installation is innovative in that the PV system is AC-coupled to a mini-grid via grid-feeding inverters.

### Capturing solar power in the Maldives to Vietnam, Singapore and more

Two years earlier Regen was involved in the design, engineering and installation of solar installations on three remote islands in the Republic of Maldives.

Regen Power has come up with an innovative solution to save fuel in a diesel generator by running the engine at variable speeds in response to the variation electrical load demand. Two types of variable speed diesel generator systems marketed as HybridGen were developed: one using a Doubly Fed Induction Generator (DFIG) system, and the other a Brushless Alternator.

HybridGen, which maintains constant voltage and frequency while adjusting the engine speed to power demand, can benefit such applications as: staff accommodation on oil, gas and mineral exploration sites; construction sites where electrical demand fluctuates day and night; remote villages, islands, houses, cabins, and mobile telecom towers.

Some of the recent projects undertaken by Regen Power using Hybridgen are: Telecom BTS projects implemented in India, Sri Lanka, Vietnam and Singapore; Remote Micro-Grid Test Bed Facility in Pulau Ubin Island off Singapore; and in WA a 6 kWp Solar/Diesel Hybrid Power Supply - Meentheena Station Veterans Retreat; also Solar Hybrid system for the 60 kilometres of haul road between BC Iron Nullagine Iron Ore project and FMG's Christmas Creek.

*Regen Power director Prof Chem Nayar has more than 30 years extensive experience in remote area renewable energy electrification.*