



Photos: Phocos AG

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# Off-grid in India

**Telecom applications:** Phocos AG, a German manufacturer of solar charge controllers and components for off-grid solar systems as well as energy-saving DC appliances, on its telecommunications projects in India.

Telecommunication markets worldwide are experiencing rapid growth. In developing countries, wireless services are the preferred choice of the users. This requires significant infrastructure investment to ensure the wide availability of wireless telecommunication networks in urban and rural areas alike. As more and more telecommunication sites are built away from the grid, providing reliable power for their continuous operation becomes increasingly challenging for the operators. These sites are often shared by several telecommunication companies (so called co-siting). As such, additional intelligent power modalities and remote monitoring functions have to be provided. A successful telecommunication project in India using the Phocos Modular Power Management (MPM) shows how these challenges can be met efficiently and reliably by using a hybrid photovoltaic power solution that combines PV modules and diesel generators. It's all based on an integrated energy control system: the intelligent Phocos Modular Power Management supervises and

reports the energy requirements of the complete telecommunication site and helps the user to get the most efficient system design. The flexible hybrid system can be extended to include additional energy sources such as wind and hydro generators and many more.

### Wireless communication in India

With its large population and enormous development potential, India currently has one of the fastest growing telecom networks, of which the largest part is in mobile telecommunications. Statistics published in April 2011 by the Telecom Regulatory Authority of India show that of the approximately 861.5 million telephone subscribers in the country, the vast majority of 827 million are using wireless services, with 227 million new wireless subscribers alone registered in the twelve months between March 2010 and March 2011. This enormous growth requires considerable logistical effort to establish an efficient wireless telecommunication network all across India – a network based on existing telecommunica-

tion sites, which has to be expanded to include more reliable, lucrative, and environmentally-friendly hybrid power solutions.

### Off-grid challenges

An Indian telecom systems integrator is installing telecommunication towers across Northern India, in the Assam and Bengal regions and in the mountainous Himalayan terrain. To ensure continuous network availability, these towers often have to be built in remote areas far away from the power grid, which are difficult to access. In the past, power for these towers was usually provided by diesel generators. This involved several challenges:

Diesel generators can be costly, in installation as well as in operation. They have to be serviced often and fuel has to be refilled regularly, requiring many trips to the location for service and refueling tasks. In remote locations, fuel logistics can be a real challenge due to difficult roads. In some rural regions, such as the Himalayan Mountains, challenging weather and geographical conditions



In India, telecommunication sites are generally built and operated by state-owned enterprises.

make it virtually impossible to provide regular service or fuel to the systems. In addition, diesel is a limited energy resource compared to solar and wind power. In the past, the systems were not supported by remote monitoring. Therefore, operators were often not informed about on-site bottlenecks in time, which led to inconvenient downtimes, requiring immediate trips to the location.

In India, telecommunication sites are generally built and operated by state-owned enterprises, who then sell their services to several mobile network providers. In order to keep installation costs and the number of towers required as low as possible, sites and towers are often shared by several providers. This requires the operator to measure individual consumption and distribute costs accordingly among the providers. The systems used in the past were not able to provide the necessary modalities.

Faced with these challenges, operators were looking for better and more cost-efficient, flexible, and especially reliable solutions for powering remote off-grid telecommunication sites.

### Hybrid off-grid power

With the help of system integrators in India and component producers such as Phocos, operators of telecommunication sites have developed new hybrid off-grid systems to ensure the reliable availability of power for their equipment in any weather and season. As a first step, solar modules and diesel generators have been combined to form a hybrid system. Energy generated by the solar modules powers all the telecom equipment as well as the required infrastructure. For back-up, a diesel generator can be used. The switching between the two power sources is controlled automatically by the intelligent Modular Power Management (MPM) system from Phocos. The system consists of a Modular Central Unit (MCU), five Modular Current Sensors (MCS) with shunts, and a GPRS modem providing a remote monitoring connection.

The Modular Central Unit: The MCU is the central control unit, the brain of the Modular Power Management (MPM) system. It also features an integrated data logging memory, priority load management based on user-adjustable voltage thresholds as well as control or alarm functions via an integrated relay control output. It enables the synchronization of up to

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four power modules within the MPM system (MPPT/MPS). Thanks to the MXI communication interface and wireless modem, the MCU can also provide complete system monitoring (voltage, current, and system status). And thanks to its flexibility, the system enables the assignment of specific functions and responsibilities to the individual components.

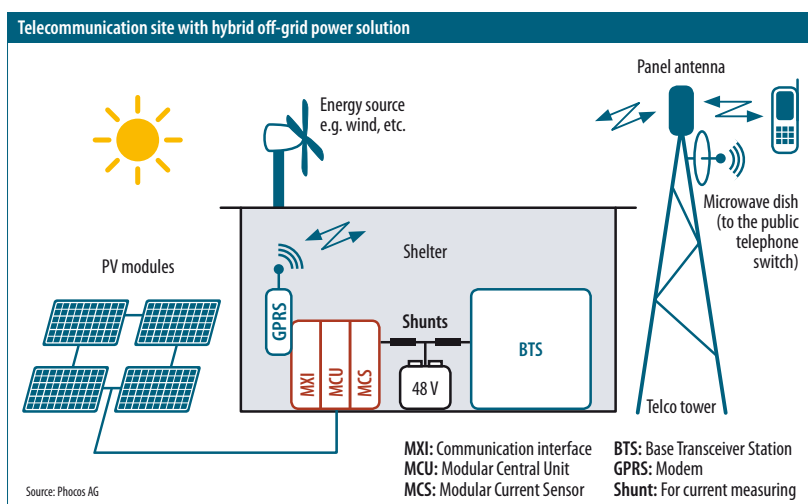
The Modular Current Sensor: The MCS works in combination with the MCU within the Modular Power Management system. It measures the system current flowing in and out of the battery, information not otherwise collected by other MPM units. This could be charge current from a diesel or wind generator or load current used by an inverter. Equipped with a current shunt, the MCS measures currents from 50 to 800 ampere and reports the results to the MCU for data logging, system analysis, and monitoring purposes. The MCS enables full flexibility in the design of dedicated PV hybrid systems and excellent expansion possibilities.

### Project status quo

Up to now, 300 telecommunication sites powered by hybrid solar/diesel systems have been installed in the North Eastern Indian regions of Assam and Bengal. Another 700 installations are planned. The operator will also be looking to use wind and hydro generators in future hybrid systems, if these energy sources are available at the site location. Power requirements per site are between five and ten kilowatts depending on the size and the functions assigned to the sites by their operators and users. The market potential for this solution is currently estimated in the thousands.

All sites are operated by Modular Power Management (MPM) systems that enable flexible and convenient remote monitoring from, for example, a main office far away from the location of the system. Data is collected and sent to a central server via modem. With the aid of a personalized login, the technical staff of the telecommunication companies can check their individual energy generation and consumption data.

Thanks to the intelligent charge controllers and integrated shunts, the MPM system allows the individualized measuring of consumption data per tower user – an intelligent solution developed by Phocos and further developed in cooper-



ation with customer engineers to exactly meet user needs. An innovative software program controls the individual charge controllers.

In the near future, system integrators will also be able to make use of other energy sources such as wind, hydro, and more, while diesel generators can be used as back-up. Thanks to the Modular Power Switch (MPS) system, users can be flexible in their system design and incorporate a wide variety of different energy sources.

The Modular Power Switch: MPS is an innovative multi-functional power switching module for stand-alone solar, wind, micro-hydro, or hybrid power applications.

It can be configured to operate as a charge controller, load controller, or diversion controller by simply toggling DIP (Dual Inline Package) switch settings. A single MPS unit can control up to 80 ampere of current at 12, 24, or 48 volts. Switching can be set for pulse-width modulation or two-point series switching. When configured as a diversion controller, the MPS can also control a diversion load for wind and micro-hydro turbine systems. As a load controller, it offers an integrated and adjustable low voltage disconnect, while as a solar charge controller, it offers sophisticated overcharge protection. Multiple MPS units can be operated together with the help of the MCU modular control unit. This allows for multiple strings of solar inputs to be used to charge the same battery bank at an aggregated charge current of up to 320 amperes. When used as load controllers, multiple MPS units can control up to 200 amperes of total load current.

Site operators are very satisfied with this new, efficient energy solution. It offers a range of attractive advantages, including the following.

### Advantages of the MPM system

Operators can count on excellent system reliability thanks to the range of energy sources that can be used as back-up systems and the fact that all components are designed and housed to withstand extreme climate conditions.

The Modular Power Management system is flexible and expands to meet the individual power needs of the sites – which may differ considerably in size

### PHOCOS AG

Phocos devices are designed to meet demanding requirements in a wide range of off-grid power applications. Phocos charge controllers come with an extensive selection of features, for example weatherproofing against humidity and temperatures up to 60 degrees Celsius, remote monitoring and controlling options, data logging, intelligent timer functions, and advanced battery protection. For off-grid use, Phocos also offers a range of energy-saving DC appliances, such as lamps or cooling/refrigerating devices.

Phocos, with headquarters in Ulm, Germany, has sales offices in Eastern Europe, the U.S., South America, Africa, and Asia. Phocos partners with international providers of off-grid photovoltaic systems and system integrators. Eighty percent of the company's turnover is generated outside of Europe.

[www.phocos.com](http://www.phocos.com)

and in the number of users. Single components can be easily integrated into the system as needed.

Thanks to new billing modalities, towers can easily be shared by several telecommunication companies, decreasing costs and making the investment even more attractive.

System integrators may have the opportunity to benefit from solar and wind project subsidies in many regions.

Remote monitoring enables early identification of system constraints via modem.

The Modular Power Management system supports the use of natural energy sources, which helps companies in their efforts to become more independent from limited sources such as oil-based fuels, especially in remote locations where fuel logistics can be challenging. Companies will also benefit from these eco-friendly energy solutions in their communication with customers.

Systems can be optimized to provide all desired functions with the existing system components, requiring no additional parts. The system offers individ-



In remote locations, solar energy is the power source of choice. Due to difficult roads, fuel logistics for diesel generators can be a real challenge.

ual functions beyond mere charge controlling.

The Modular Power Management approach is increasingly being used in a large number of hybrid and stand-alone off-grid applications, where the reli-

able availability of power is important. Thanks to their modular construction, they are easy to adapt, work together perfectly, and guarantee fully automatic operation in any weather. ♦

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