

CASE STUDY: MINI-GRID/ OFF-GRID



HYBRID POWER SYSTEM

TIRTONADI BUS TERMINAL, SOLO, INDONESIA

Hybrid power supply system for a large bus terminal
[PV + GRID + Diesel Generator]

The Case

The largest bus terminal in the city of Solo, Indonesia was being modernized and a commercial area was being built. It had to be powered by renewable energy to showcase the Indonesian government focus to reduce dependence on fossil fuels.

The Challenge

The commercial area was not open for business yet, so actual power requirements were just an estimate, therefore the system had to be powerful enough to accommodate future growth and requirements increase. Furthermore, it had to be redundant in order to provide consistent and reliable power during periods of bad weather and/or grid outage.

The Solution

IPS designed, built and commissioned a custom hybrid system Exeron CM integrating Solar, Grid and Diesel Genset energy sources and a battery string for storing unused energy. During the day and peak hours the power generated by the PV solar modules is powering the load and recharging the batteries. Evening consumption is supplied by energy stored in the battery. During periods of cloudy weather and when the battery is discharged, power is drawn from the grid. For emergency situations, a backup diesel generator is available with automatic start/stop control by the Exeron system.

Monitoring and Control Unit (MCU) and Distribution Board

MPPT Solar Charge Controller Modules

Rectifier Modules



Monitoring and Control Unit (MCU) and Distribution Board

Inverter Modules

The IPS Configuration

Turnkey Solution

System Requirement	Exeron CM Configuration
PV system 120 kWp polycrystalline	60 x 2 kWp MMPT charge controllers SML2000
DG / Grid input 120 kW	60 x 2 kW Rectifier modules ML2000
Total output power 132 kW [3-phase]	33 x 4 kVA inverter modules I4000B
Battery 48V / 10000Ah	

Optimal System Performance

The system is performing as expected, reliable and consistent power is supplied by the hybrid Exeron solution. With a battery sized to supply most of the nighttime consumption grid usage is reduced to a minimum and only for periods of cloudy weather. Annual OPEX savings are close to 46% with a payback period of 5.8 years. The carbon footprint [CO2] is reduced by over 200 t/year.

The Exeron System



Battery Bank



Solar PV Array



SAFARI LODGE

TIMBAVATI RESERVE, LIMPOPO, SOUTH AFRICA

Hybrid mini-grid system for a lodge (PV + GRID + Diesel Generator)

The Case

A remotely located luxurious hotel required a hybrid solar mini-grid system providing and guaranteeing a reliable electricity supply 24/7. The main electricity off-takers in the safari lodge include air conditioning units, fans in the guest rooms; freezers, fridges and ovens in the kitchens, laundries as well as leisure facilities such as the swimming pool pumps.

The Challenge

The major challenge was the unreliable grid supply at the lodge and its remote location. The client's requirement was to secure system operation 24/7/365 with good quality and 100% reliability.

The Solution

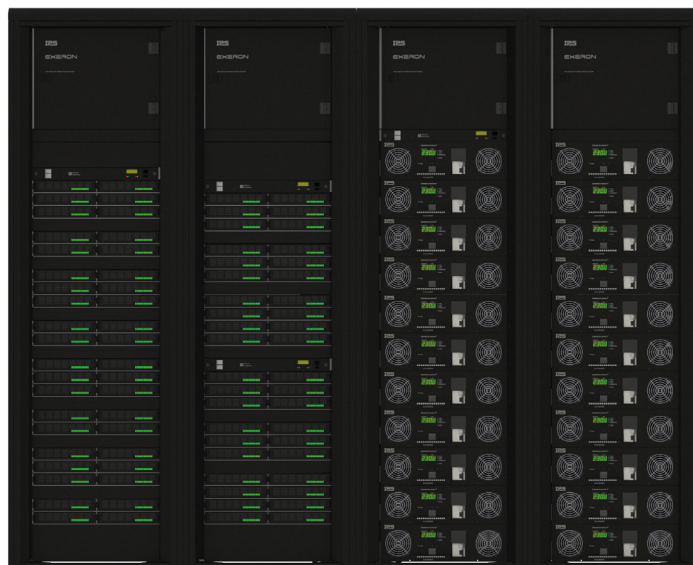
IPS designed, built and installed the integrated, custom made, indoor power conversion system Exeron. The operation logic of the system is as follows: during the day the generated power from the PV modules is used for powering the load and charging the batteries. At evenings or in days without enough sunshine the load is powered by the energy stored in the battery. The battery is sized for a long back-up time.

When there is not enough sunshine, the battery is empty and in case the grid is missing the diesel generator is automatically started as a back-up source for powering the equipment and charging the batteries.

Monitoring and Control Unit (MCU) and Distribution Board

MPPT Solar Charge Controller Modules

Rectifier Modules



Monitoring and Control Unit (MCU) and Distribution Board

Inverter Modules

The IPS Configuration

Turnkey Solution

System Requirement	Exeron CM Configuration
PV system 136 kWp polycrystalline	68 x 2 kWp MMPT charge controllers SML2000
DG / Grid input 64 kW	32 x 2 kW Rectifier modules ML2000
Total output power 108 kW [3 phase]	27 x 4 kVA inverter modules I4000B
Battery 48V / 9000Ah	

Optimal System Performance

The Hybrid solar mini-grid system with Exeron as an energy conversion unit ensures unmatched reliability and uninterruptible power supply to the Safari lodge. The use of the Diesel Generator is optimized, with annual OPEX savings post hybridization of more than 50%. The avoided CO2 emissions are 194 t/year. The price per kWh is 0.33 \$/kWh. The payback period is 2.7 years.

Safari lodge, South Africa



EXERON system



Battery strings



Distribution board and battery fuses



HIGH-END RESIDENTIAL

CHALKIDIKI, GREECE

Hybrid mini-grid system for a luxurious villa (PV + GRID)

The Case

A luxurious villa, located in the sunny Chalkidiki peninsula of Greece is looking for harnessing the renewable solar potential at site. The owner of the villa desired to integrate renewable solar power as an energy source with the aim to decrease electricity bills as well as to have sustainable electricity generation.

The Challenge

The electricity prices in the region are very expensive which induced the demand for alternative energy generation sources integration for self-consumption. The solution had to be provided in an outdoor container, which incorporates the batteries and the energy conversion unit. The system had to be powerful enough to accommodate future growth and requirements increase. The maintenance free and hot-swappable feature of the system was very important for the owner.

The Solution

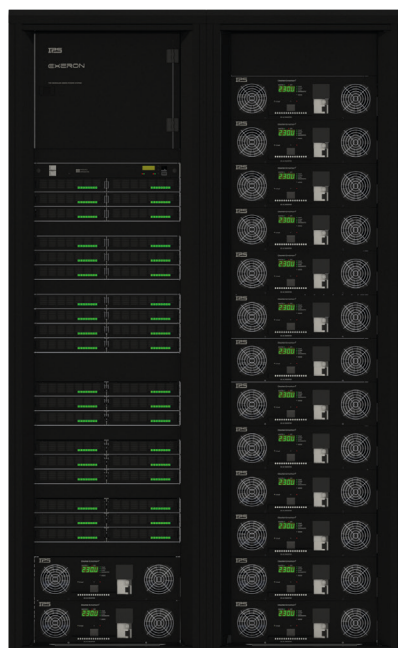
IPS designed, built and commissioned a custom hybrid off-grid system Exeron CM integrating Solar and Grid energy sources together with a battery for storing excessive solar energy. During the day and peak hours the power generated by the PV solar modules is powering the load and charging the batteries. Evening consumption is supplied by energy stored in the battery. During periods of cloudy weather and when the battery is discharged, power is drawn from the grid. The Exeron system together with the battery is housed in a custom made 20ft container.

Monitoring and Control Unit
(MCU) and Distribution board

MPPT Solar Charge Controller
Modules

Rectifiers ML2000

Inverter modules I4000B



Inverter modules I4000B

The IPS Configuration

Turnkey Solution

System Requirement	Exeron CM Configuration
PV system 30 kWp polycrystalline	15 x 2 kWp MMPT charge controllers SML2000
DG / Grid input 24 kW	12 x 2 kW Rectifier modules ML2000
Total output power 60 kW [3-phase]	15 x 4 kVA inverter modules I4000B
Battery 48V / 2000Ah	

Optimal System Performance

The Exeron hybrid system achieves the desired goal to reduce electricity bills through less reliance on the grid. The electricity generation is stable during all seasons as expected, covering the needs and harnessing the optimal PV power respectively. The use of the Grid and the diesel generator is managed to save maximum costs for the client. The annual OPEX savings post hybridization are 38%, the CO2 emissions avoided are 37 t/year and the price per kWh is 0.42 \$/kWh. The payback period is 4 years.

Luxurious villa, Greece



20 ft EXERON container



PV panel installation & EXERON container



Battery strings housed in the container

