



# Hybrid Off-Grid Solar Solution

For Telecom Applications



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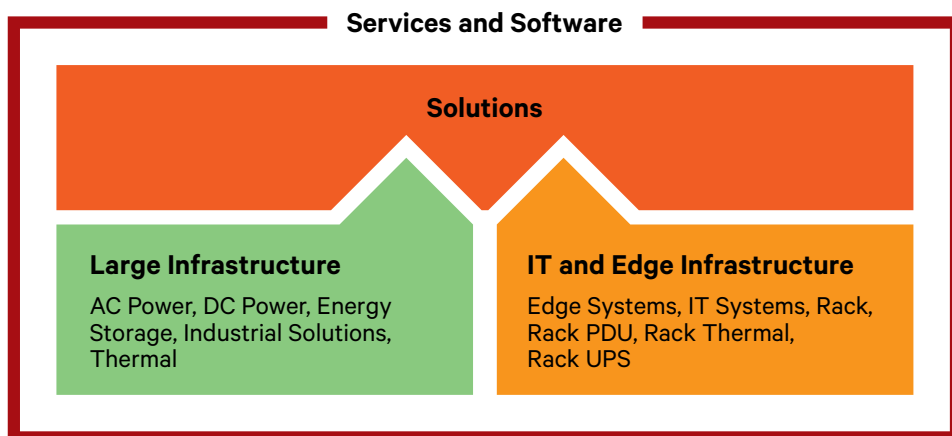
Vertiv (NYSE: VRT) brings together hardware, software, analytics and ongoing services to ensure its customers' vital applications run continuously, perform optimally and grow with their business needs. As Architects of Continuity™, Vertiv solves the most important challenges facing today's data centers, communication networks and commercial and industrial facilities with a portfolio of power, cooling and IT infrastructure solutions and services that extends from the cloud to the edge of the network. Headquartered in Columbus, Ohio, USA, Vertiv employs approximately 20,000 people and does business in more than 130 countries.

For more information, and for the latest news and content from Vertiv, visit **Vertiv.com**.

## Vertiv

### Architects of Continuity™

With a unique combination of industry expertise, technology, and resources, our mission is to support and power mission-critical technologies that drive possibility.



## Chloride®

Our global industrial power solutions meet the most demanding technical specifications and provide safe, reliable power- no matter the challenge

## Liebert®

Our global power and thermal management solutions are some of the world's most efficient and reliable power and cooling technologies

## Netsure™

Our global intelligently engineered DC power systems deliver high availability, energy efficiency and scalability for converged networks



# Hybrid Off-Grid Solar Solution for Telecom

## Hybrid Off-Grid Solar Solution for Telecom

With the demand for network access and mobile broadband consistently growing, the telecom sector is now experiencing an increasing need to improve networks and expand services while maximising efficiency, reducing costs and ensuring reliable performance.

To serve this growing demand for connectivity, telecom providers are now expanding, more than ever, in remote regions, where the grid is absent.

### Stay on Top of Telecom Trends

In this environment, where conventional energy sources are becoming more expensive, there is a growing opportunity to make use of renewable energy. The solution is a **hybrid approach** that minimises the use of diesel generators, used only in case of emergency, while maximizes the use of solar power and batteries, boosting the performance stability and financial return required to operate a telecom business.

### Flexible Hybrid Solutions to Reduce OPEX and Ensure Optimal Performance

Technologies that minimise expensive energy consumption and enable flexible, reliable and responsive infrastructure have been developed in recent years and will continue to evolve.

This critical infrastructure can now be enabled through the use of intelligent energy solutions that allow the system to adapt as conditions change.

Off-grid hybrid solutions provide significant energy savings opportunities to the telecom infrastructure through:

- Simplicity in design and enhanced intelligent features;

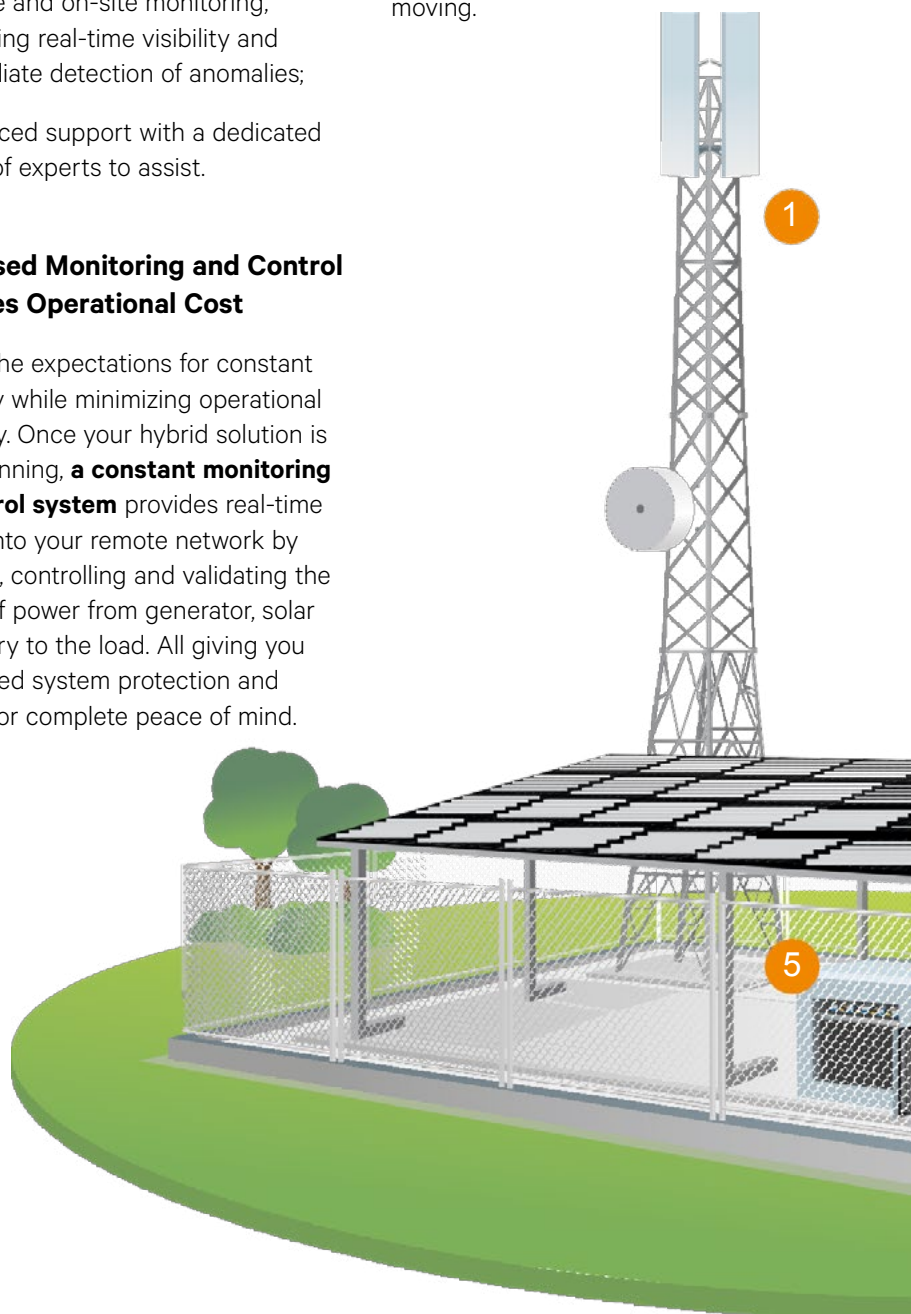
- Flexible to meet today's and tomorrow's needs;
- Reliable, resulting in improved uptime and lower maintenance costs;
- Holistic with power protection, monitoring to service;
- Cost effective, to contribute to the short, medium and long term energy saving objectives;
- Increased intelligence with 24x7 remote and on-site monitoring, providing real-time visibility and immediate detection of anomalies;
- Enhanced support with a dedicated team of experts to assist.

### Centralised Monitoring and Control Minimises Operational Cost

Meeting the expectations for constant availability while minimizing operational cost is key. Once your hybrid solution is up and running, **a constant monitoring and control system** provides real-time visibility into your remote network by managing, controlling and validating the delivery of power from generator, solar and battery to the load. All giving you unparalleled system protection and support, for complete peace of mind.

### Tailored Support for Off-Grid Telecom Installations

In this hyper-connected, technology dependent world, you can't afford for your critical network infrastructure to go down. The success of your business depends on it. Our team of experts brings together global reach with local knowledge to take on your most complex challenges, creating solutions that keep your Hybrid Off-Grid Solar Solution running—and your business moving.



## Challenges

## Consequences

## Opportunities

### Fuel expense is high due to:

- Frequent generator operation
- Theft and quality/dilution
- Site accessibility

High operating cost

- Strategically blend power from batteries, solar and other sources to achieve lowest possible energy cost
- Actively manage sites to ensure proper battery health, optimal generator maintenance, clean solar panels, and tracked fuel quality and level

### Deployment speed slowed by:

- Infrastructure not in place
- Complex supply chains
- Availability of installation experts

Consumers choose competing carriers

- Ensure site readiness by selecting a single coordinator for all site infrastructure and installation
- Managed integrated supply chain with a common objective for schedule and delivery

### Operation and maintenance costs impacted by:

- Improper hybrid dimensioning
- Lack of site visibility post installation
- Calendar-based maintenance dispatch

Increase maintenance staff

- Engineer the hybrid site solution for the desired balance between capital and operational cost
- Leverage smart hybrid technologies to minimize maintenance dispatch and achieve maximum ROI, even as operating conditions change

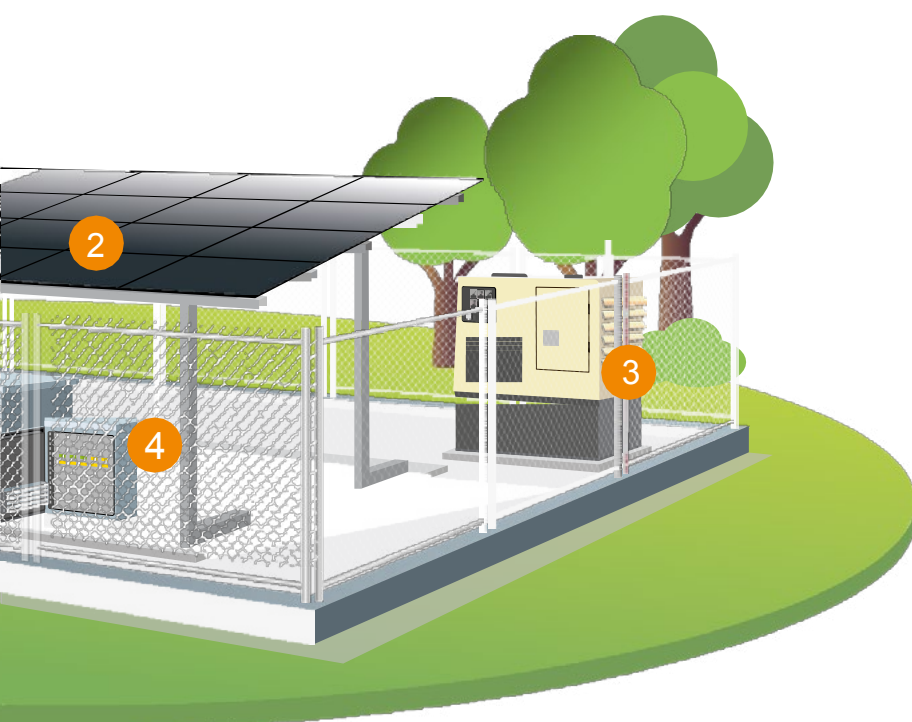
### Site reliability impacted by:

- Use of consumer system or parts not designed for unattended operation
- Integration of discrete parts not validated to work as one solution

Increase downtime and increase maintenance cost

Use of unplanned funds to keep site operational

- Validate vendor focus on the technologies and skills associated with deploying operating energy and passive infrastructure.
- Keep vendor engaged in site performance post deployment



- 1 Radio antennas
- 2 Solar pv array
- 3 Standby generator
- 4 NetSure™ Power System
- 5 Vertiv 2V Solar BatteryBox

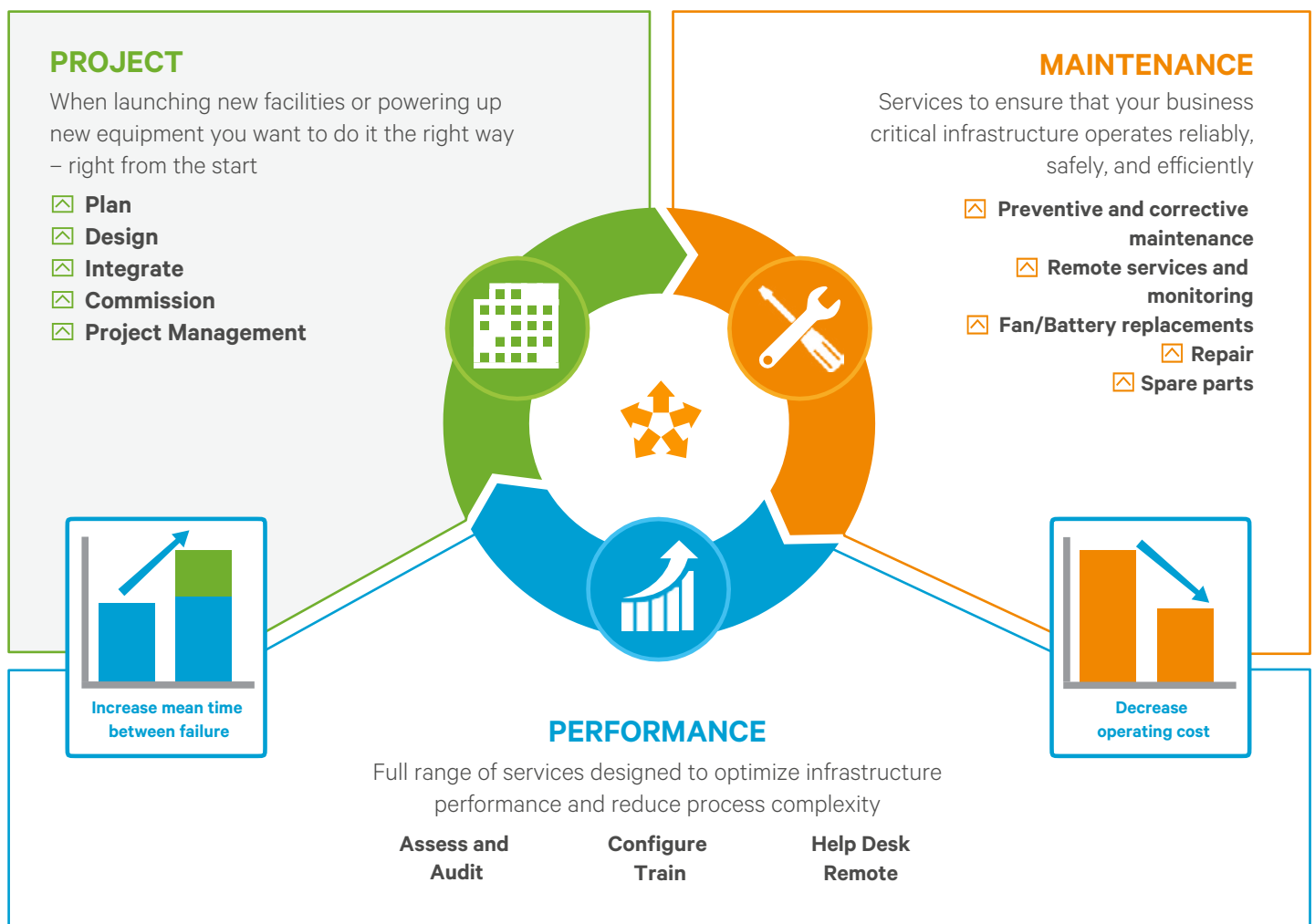
# Hybrid Off-Grid Solar Solution for Telecom

## Dedicated Services for Off-Grid Telecom Sites

No two situations are alike. Vertiv supports its customers with an **extensive service offering**, enhancing network availability and ensuring total peace of mind 24/7. With the broadest, most comprehensive service presence in the industry and more than **600 Customer Engineers** dedicated to servicing **Asia Pacific**, Vertiv ensures that your business is protected 100% of the time and that assistance is close by whenever needed.

When evaluating a hybrid solar installation, you should look for a solution that offers the most comprehensive support options and a partner that can walk you through the design and testing as well as offer support and training even once the equipment is installed.

To maximise the potential of your installation, our Telecom Professionals will also provide you and your staff with **On-Site Training services**, which include installation, operation and maintenance of the solution, to help you understand the full power of your hybrid solar station. And with the addition of a dedicated Help Desk, you can always get direct access by phone to our experienced support team 24/7.



## Take Control of Your Network.

### Monitoring System

As your network expands, the demand to get your system under an Energy Operating Center grows. With all the user-friendly convenience and power of a computerized system, monitoring systems improve your network's reliability and availability, reducing operating and maintenance costs.

Vertiv EMS provides a unified management environment for remote sites to monitor the elements that could hinder the delivery of services.

Via remote connection, the supervisory system gathers a continuous stream of vital health parameters and equipment alarms at the site, while our Customer Support Center professionals are also on hand 24 hours a day to provide multilingual assistance in real-time.

Functioning as a master system that collects and stores power-energy data, Vertiv EMS can provide you with the KPIs suited best for your business and assist you in improving the performance and lower the cost of your operation.

### Benefits

- Improved availability
  - Minimize downtime
  - Solve problems faster with advanced alarm identification
- Optimized preventive and corrective maintenance
  - Diagnose problems remotely
  - Reduce on-site travel with advanced alarm identification
  - Perform remote battery tests
- Improved investment planning
  - Plant re-engineering - know the necessary resources (how much, where and when) ahead of time
  - Optimize spare parts inventory





# Hybrid Off-Grid Solar Solution for Telecom

## Key Features

- **Complete Solution:** Vertiv provides all of the matched pieces from cables to power to training, for ease of planning and execution
- **Flexibility:** off-grid energy solution utilizes common building blocks capable of supporting loads from 200 to 6000 W
- **Adaptability:** with the use of common blocks, this solution can change and adapt, providing investment protection
- **Simplicity on the Field:** applicable intelligence and effort up-front so as to reduce the cost of installation and maintenance teams
- **Efficiency and Resilience:** high efficiency from solar to load, with rectifiers and converters that provide full power up to +65°C
- **Support:** training to enable predictable, durable and reliable performance
- **Remote Management:** HTTP, TC/IP, IPv6, SNMP, Modbus and Vertiv's EMS monitoring system, the site can be efficiently managed remotely, reducing the need to visit and monitor the site
- **Remote Access and Communication:** HTTP/HTTPS, TCP/IP, IPv4/IPv6, SNMP V2/V3 and Modbus, plus GPRS/3G/4G modems
- **Value:** Demonstrated financial performance

*Vertiv's Off-Grid Energy Solutions are suitable for telecom applications – from microwave repeaters to large, remote cellular sites.*

## Vertiv's Off-Grid Solar Solution

Vertiv's off-grid solar solution offers a complete energy portfolio that provides reliable and efficient telecom service, supporting remote areas where grid access is not feasible and fuel delivery is prohibited. Built around a core of proven components, this solution can expand and adapt as required. The Vertiv off-grid solution includes:

- NetSure™ Hybrid DC Power system, available from 6kW up to 24kW, supports solar converters and 24V DC converters
- NetSure™ EPC Series: the a robust outdoor enclosure platform able to withstand the harshest environmental conditions; available in standard sizes or customized cabinets
- Solar panels matched to the solution to provide for best fit, endurance and efficiency from a proven global supply chain.
- Solar panels with proven quality, continuous supply and form factor
- Solar frames with clearance underneath for placement of equipment in the shade
- Cable sets that are colour coded with keyed quick connects and the elimination of a combiner box simplifies the installation; providing for increase speed of execution and reducing risk of errors.
- Partial State of Charge (PSOC) batteries and battery enclosure best suited for solar installations from 170 Ah to 7000 Ah

Available options include an open independent DC port for easy expansion of alternative energy sources, such as wind turbines, fuel cells or a DC generator. The system also supports an AC standby generator, such as a portable generator, for backup during maintenance activities or emergency responses. The NetSure™ DC power system and the Netsure™ EPC Series enclosures are available in a number of configurations, allowing the site operator to integrate customer equipment, inverters, +24V DC converters, extended distribution, load surge protection, and more.







## Hybrid Solutions

With 5G infrastructure on the horizon, telecom operators are faced with new challenges in their critical infrastructure. Not only do they require solutions to support next-generation technologies and ultra-fast broadband connection, they also need a cost-efficient approach to enabling 5G infrastructure. Renewable energy is fast becoming a viable option, especially in remote locations where stable utility power remains a challenge.

Vertiv's hybrid solutions for telecom sites are fully customizable, rugged and flexible to adapt to your different challenges. Our rectifiers and energy storage solutions support renewable energy sources such as solar and wind. Our hybrid solutions can be deployed virtually anywhere including network edge and remote telecom sites.

## Hybrid Solution Applications



### Poor Grid Hybrid Solar Solutions

Solar power as a main source during daytime, while batteries and genset as supplementary sources when grid is unavailable.



### Off-Grid Pure Solar Solutions

Solar as the primary energy source with long standby batteries and optional standby genset.



### Off-Grid Hybrid Solutions

Solar power option to reduce genset usage together with high discharge batteries without connection to the grid.

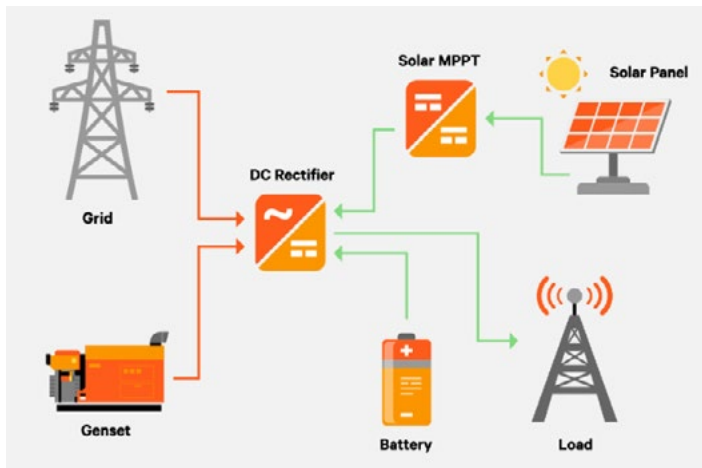


### Grid-Connected Hybrid Solutions

Solar power and standby batteries as power source reduces dependency on both the grid and generators.

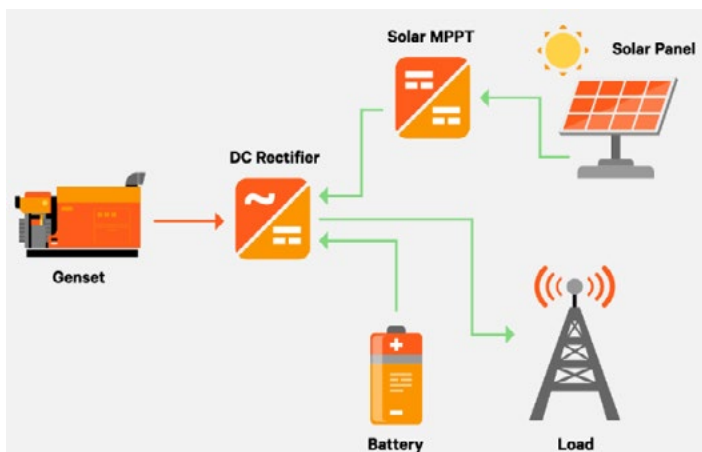
	Genset	Grid	Solar	Battery
Poor Grid Hybrid Solar Solution	●	●	●	●
Off-Grid Pure Solar Solution	—	—	●	●
Off-Grid Hybrid Solutions	●	—	●	●
Grid-Connected Hybrid Solutions	—	●	●	●

# Hybrid Off-Grid Solar Solution for Telecom



## Guidelines on Off Grid Pure Solar Solutions

- Suitable for rich solar resources area
- 100% Energy saving
- Environment friendly and no CO2 discharge
- Increase network coverage especially at remote area
- Easy to install, less maintenance, lower operating cost
- Improve power supply reliability and optimal safety
- Suitable for low power consumption application (<1kW)

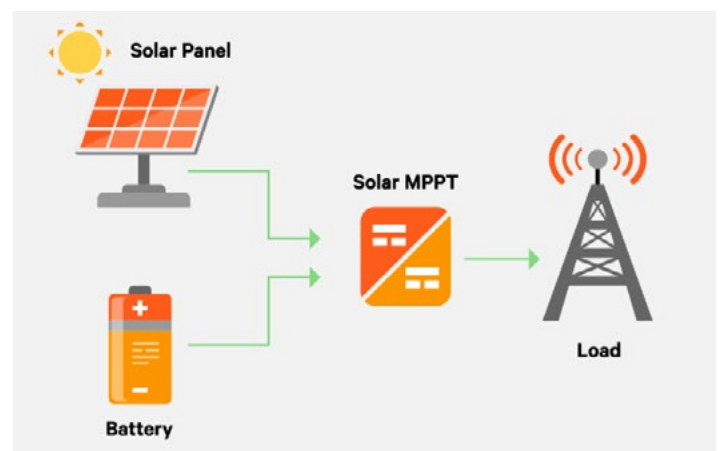


## Guidelines on Poor Grid Hybrid Solar Solutions

- Multiple energy sources
- Efficient supplement for poor AC areas, improve power system reliability.
- Solar mainly to support the load during the day, generator to support when grid is not available at the rest of the day
- Batteries supporting stressed cyclic demand and fast recharge
- Genset management, start the genset automatically based on the remaining capacity of the battery or a fixed daily working schedule.

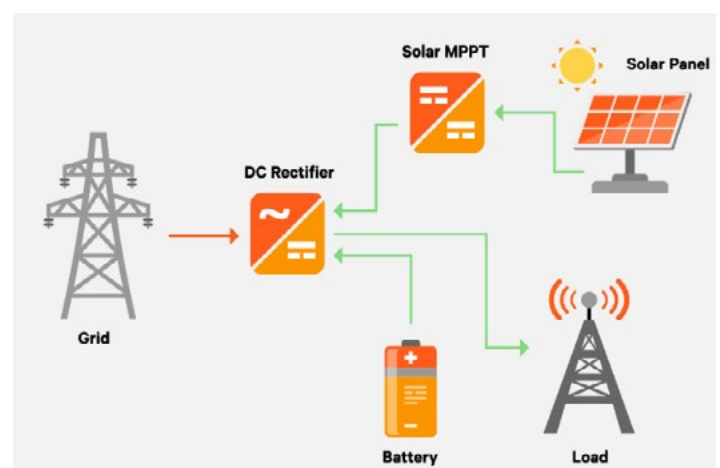
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## Guidelines on Off Grid Hybrid Solar Solutions

- Solar option to reduce generator running time and maintenance visits, reduce Genset OPEX
- Energy by priority: Solar -> Battery -> Generator
- Typically, Genset can reduced to run at around 3 to 4 hours daily as compared to normal CDC that runs for 12hrs daily
- DC Power controller starts/stop Genset automatically (time based or battery capacity based)



## Key Features

- The installation space and cost can be saved due to its small size and embedded installation
- Wide input voltage range (85–300VAC), strong ability in adapting power grid
- Rectifier working temperature range: -40~+30°C
- Supports ECO sleep technology, that optimises system efficiency
- Intelligent battery management system, which prolongs the working life of the battery
- Provide multiple communication ports such as RS232, Ethernet port, dry contacts, etc., for flexible networking to achieve remote monitoring

## Applications

- Power supply for LTE in-building solutions
- Power supply for FTTx broadband multi-solutions
- Power supply for macro station and outdoor cabinet

## Description

The Netsure™ 531 series from Vertiv is a fully-integrated DC power system consisting of a rectifier and controller that provides maximum efficiency for mobile communication applications such as LTE and FTTx deployments or macro stations. It is designed to meet the high-efficiency demands of mobile applications, with high reliability, high power density, and fully digital features.

The built-in high efficiency R48-2000e3 rectifier also provides an ultra-high efficiency of up to 96%, significantly improving the energy efficiency.



Netsure™ 531 A41



Netsure™ 531 A91

## System Configuration

Configuration		Netsure™ 531 A41	Netsure™ 531 A91
System Capacity		8kW	18kW
Controller		M221S / M222S / M830B	
Rectifier		Max: 4 × R48-2000e3	Max: 9 × R48-2000e3
AC Distribution	Input	1×63A/2P	1×63A/4P
	Output	1×16A /1P	
Battery Capture		2×63A/1P	2×125A/1P
DC Distribution	BLVD	2×16A/1P	5×63A/1P, 5×32A/1P, 8×10A/1P
	LLVD	2×63A/1P, 2×32A/1P	
Lightning Protection		C-level lightning protection at AC side, D-level lighting protection at DC side and signal side	
Dry Contact		3 alarm inputs, 4 alarm outputs (8 alarm outputs is optional)	
Optional		Top Cover, Temperature Sensor, Battery Rack	



# Hybrid Off-Grid Solar Solution for Telecom

## Rectifier

Configuration	Model
Efficient Module	R48-2000e3
Electric Parameters	Description
Input Voltage	85VAC~300VAC
Power Factor	≥0.99
Efficiency	>96%
Output Voltage	-42Vdc~-58Vdc
Nominal Voltage	-48Vdc
Rated Voltage	-53.5Vdc



R48-2000e3

## Controller M221S / M222S / M830B

Model	M221S	M222S	M830B
Display	LCD with 8×16 characters		128×160 pixels TFT LCD
Communication Interface	RS232, Ethernet	RS232	RS232, RS485, Ethernet, USB
Protocol	HTTP, SNMP, YDN23	YDN23	IPv4, IPv6, HTTPS, EEM, SNMP V2/V3, SocTpe, Rsoc, Modbus
Inputs	Analog	1 battery currents, 1 bus voltage, 1 battery voltage, 2 temperatures, 4 midpoint battery voltage	
	Digital	2 load fuses, 4 battery fuses, 1 bi-stable contactor status, 4 user inputs(Optional, need extra board) load fuse and battery fuse can be configured as midpoint battery voltage, load fuse and battery fuse	
Outputs	1 LVD mono & bistable contractors, 1 LVD mono contactor, 8 user relay outputs (Optional, need extra board)		3 LVD mono & bistable contractors



M221S



M222s



M830B

Mechanical Parameters	NetSure™ 531 A41	NetSure™ 531 A91
Structure	19 inches(W), 4U(H)	19 inches(W), 8U(H)
Dimensions (W × D × H) mm	483 × 310 × 178	483 × 310 × 356
Weight (kg)	≤25 (exclude rectifier and controller)	≤40 (exclude rectifier and controller)

## Key Features

- Easily Adaptable - Tolerates a wide range of input voltage, i.e. from 85 to 305 VAC
- High Efficiency - 96.3% efficient eSure rectifier delivers optimized total cost of ownership
- ECO Mode - Embedded with an advanced energy optimisation technique that enables significant savings, even at low load operation
- Advanced Battery Management
  - Automatic battery tests in conjunction with battery midpoint monitoring (optional) ensures early detection of battery problems
- Multiple Communication Interface: Built-in communication ports such as RS 232, RS 485, USB, and Ethernet enable flexible remote controlling & monitoring

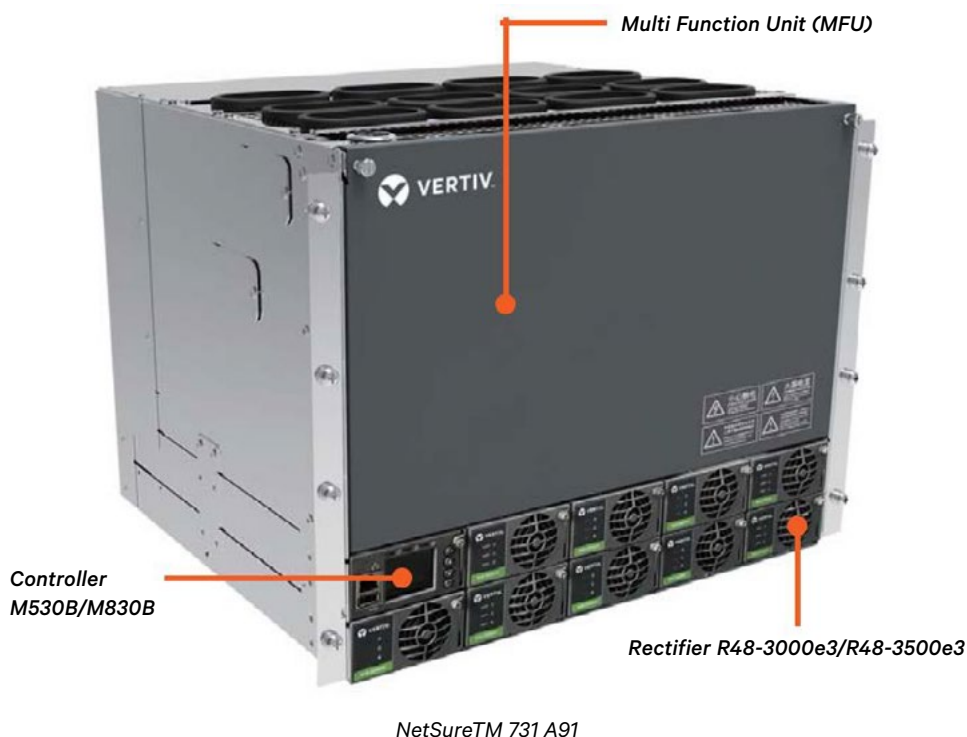
## Highly reliable, uninterruptible cost-effective power systems for telecom installations

### Description

The NetSure™ 7100 series, a compact -48 VDC power solution, features an intelligent controller, a high-efficiency rectifier, and multiple distribution options to meet a variety of application demands. .

The NetSure™ 7100 series provides both reliable DC output power and low total cost of ownership. The 3500W eSure rectifier delivers peak system efficiency above 96%. Maximum efficiency is achieved by an advanced energy optimization function known as ECO mode, enabling significant energy savings even at low load operation.

Standard remote monitoring and software upgrades are available through ethernet. Remote access via RS485 (Modbus), as well as GPRS/3G/4G modems are available as options.



### Applications

The NetSure™ 7100 series is ideal for telecom access and network edge applications requiring reliable, high power density up to 540 A at -48 VDC. The system is available as a subrack for integration in an outdoor enclosure or existing cabinet, mounted on top of a battery rack.

# Hybrid Off-Grid Solar Solution for Telecom

## Technical Specifications

Model	NetSure™ 731 A91-S1	NetSure™ 731 A91-S2	NetSure™ 731 A91-S3
Capacity	540 A	540 A/450 A	450 A
Rectifier	R48-3500e3, Max 9 numbers	R48-3000e3 / R48-3500e3, max 9 numbers	R48-3000e3, Max 9 numbers
Controller	M 830B	M 530B	M 830B
Input Voltage	3P + N + PE / 380 -415 VAC		
Input Frequency Range	45 to 65 Hz		
Input Voltage Range	85 VAC to 305 VAC (output derating below 176 VAC)		
Input Power Factor	≥0.99		
Rectifier Efficiency, Peak	R48-3500e3: 96.3%; R48-3000e3: 95.5%		
Output DC Voltage	-43.2 to -57.6 VDC		
DC Power Distribution	BLVD	63A/1P×2MCB;32A/1P×2MCB;16A/1P×2MCB	
	LLVD	63A/1P×3MCB;32A/1P×3MCB;16A/1P×2MCB	
Battery MCB	4 × 125 A/1P		
Lightning Protection	The AC side of the system is equipped with Class C lightning protection and the DC side is equipped with class D lightning protection		
Weight	≤60 kg (Including Rectifiers & Controller)		
Dimensions (H×W×D) mm	352 × 483 × 400		

Controller	M830B	M530B
Display	128 x 160 Pixels TFT LCD	128 x 160 Pixels TFT LCD
Communication Interface	RS 232, RS 485, Ethernet, USB	RS 485, RS 232, 10/100Mbps Ethernet, IPv4 & IPv6, CAN
Protocol	IPv4, IPv6, HTTPS, SNMP V2/V3, EEM Soc Tpe, Rsoc, Modbus	HTTP, SNMP, YDN23
Inputs	Analog	2 battery currents, 1 load current, 1 bus voltage, 2 battery volt-ages, 3 temperatures, 1 fuel level sensor and much more with additional interface boards
	Digital	3 battery current, 1 bus voltage, 3 AC voltages, 3 AC currents, 9 battery current, 1 DC energy meter-voltage, 3 DC energy meter-current
		1 input for status of surge protective device auxiliary contacts, 12 load fuses, 6 battery fuses, bi-stable contractor status
Outputs	3 LVD mono & bistable contractors	20 load fuses, 4 battery fuses, 1 SPD alarm
		2 Mono Contactors

Rectifier	R48-3500e3	R48-3000e3
Input Voltage	85 to 305 VAC (output derating below 176 VAC)	
Input Frequency	45 Hz to 65 Hz	
Power Factor	>0.99 for 50% to 100% load	
Efficiency, Peak	96.3%	95.5%
Maximum Input Current	22 A	
Output Voltage	-42 VDC to 58 VDC	
Maximum Output Current	73 A @ -48 VDC	62.5 A @ -48 VDC
Operating Temperature	-40 to +75°C (-40 to +167°F)	-40 to +70°C (-40 to +158°F)



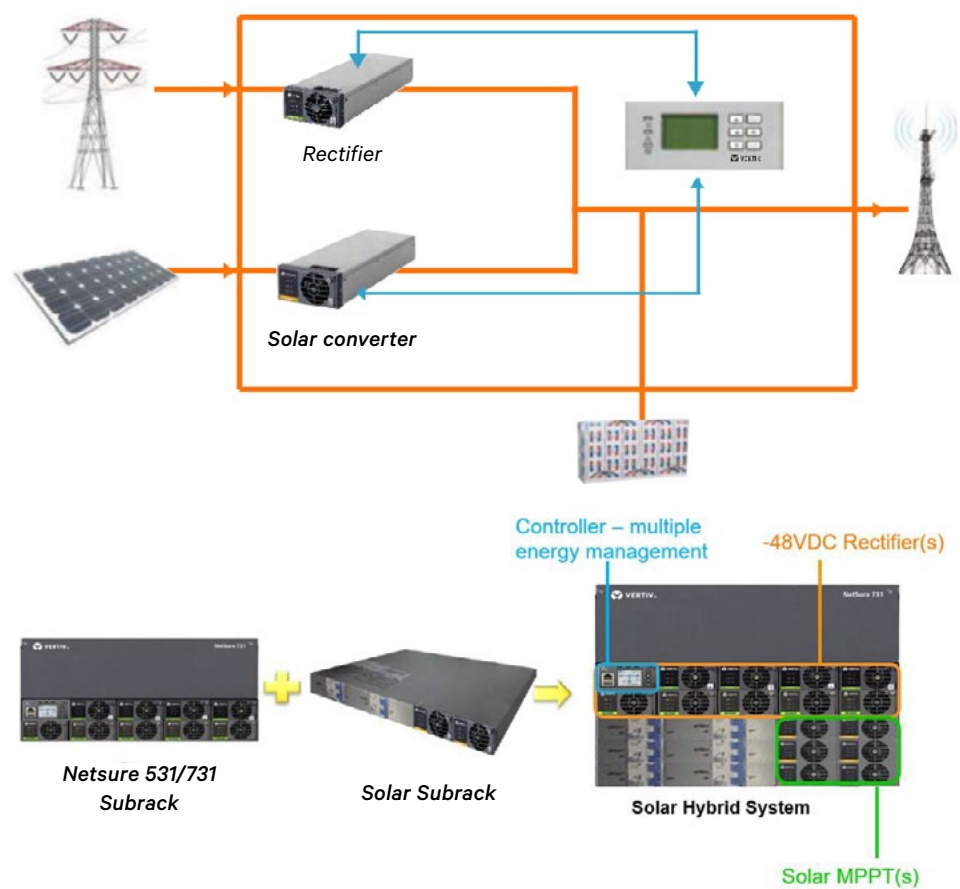
## Key Features

- Seamless integration with the legacy DC power system
- Compact, modular, hot pluggable solar subrack
- Interruption free installation
- Equipped with an MPPT charger providing a maximum power track precision of up to 99.5%
- Delivers an ultra-high efficiency of up to 98%
- Supports soft scalable technology
- Integrated protection from external lightning surges
- Full front access for easy operation & maintenance
- Safety: CE certified and complies with EN60950 and EN62109 standards
- Flexible to pair with NetSure™ 531/731 series to form a hybrid system

## Description

The HSS 48 series solar sub-rack provides an easy, interruption-free and economical solution to upgrade a legacy DC power system. This ultra compact, modular sub-rack brings an alternate solar energy source for access and transmission networks. Its fast and precise MPPT (Maximum Power Point Tracking) algorithm provides real-time power tracking and improves power harvesting. By leveraging the solar power at telecom sites, operators can substantially reduce their operational expenses.

## Typical System Architecture



## Applications

- LTE in-building solutions
- FTTx broadband multi-solutions
- Macro station and outdoor cabinet

# Hybrid Off-Grid Solar Solution for Telecom

## HSS series MPPT 50A, 100A Solar Subrack Parameters

Model Name	HSS4850/XMX-1	HSS48100/XMX-1
Rated power	3000W	6000W
MPPT converter	S48-3000	
Solar Input	58 to 150 VDC	
DC Output Voltage	-42 to 58VDC	
Efficiency	≥98.2%	
Subrack configuration	1 × MPPT module + SPD + Input & output distribution	2 × MPPT module + SPD + Input & output distribution
Interface from solar array	2 × 16 mm, rear connected	4 × 16 mm, rear connected
Interface to -48VDC power system	2 × 16 mm, rear connected	4 × 16 mm, rear connected
Dimensions (W×H×D) mm	440 × 355 × 44	
Weight	≤13kg	≤16kg
Communication alarm interface	RS232 communication, input & output dry contact	Output dry contact



HSS4850



HSS48100

## HSS series MPPT 60A Solar Subrack Parameters

Model Name	HSS4860/XSX-1
Rated power	4000W
MPPT converter	S48-2000e3
Solar input	200 to 300VDC
DC Output Voltage	-42 to 58VDC
Efficiency	≥96%
Subrack configuration	2 × MPPT module + SPD + Output distribution
Interface from solar array	2 × M5 Screws, rear connected
Interface to -48VDC power system	2 × M8 Screws, rear connected
Dimensions (W×H×D) mm	440 × 355 × 44
Weight	≤10kg
Communication alarm interface	Output dry contact



HSS4860

## Solar MPPT Converter Parameters

Model Name	S48-2000e3	S48-3000
Rated power	2000W	3000W
Input voltage range	120 to 420 VDC*	58 to 150VDC
Output voltage range	-42 to 58 VDC	-42 to 58 VDC
MPPT Precision	≥99%	≥99.5%
Conversion efficiency	≥96%	≥98.2%
Dimensions (W×D×H) mm	84.5 × 41.4 × 252.5	41.4 × 132.3 × 287
Weight	≤2kg	≤3kg



S48-2000e3

S48-3000

## Key Features

- Houses a centralized power supply system, cooling system, environmental monitoring, and battery backup system among others
- Large space for flexible application: the user equipment and battery chamber can share the same space, which can be flexibly adjusted based on the user requirements.
- Highly reliable temperature control system: the system integrated various temperature control units include a heat exchanger, air conditioner, and heater which can be flexibly configured according to the on-site environment. The temperature in the cabinet can be adjusted in an intelligent way.
- High degree of protection (IP55)
- The cap of the cabinet adopts a bevel design, eliminating accumulation of rain water and snow; the base adopts an extensional design, facilitating system installation & maintenance.
- Comprehensive ECCUP environment monitoring system applications: the system performs monitoring and alarm uploading for the power supply system, temperature control unit and all environmental variables; provides different environment variable detection data to meet the practical user requirements.
- Integrate different communication interfaces including RS232/485 and TCP/IP, etc. and helps realize system alarm uploading and remote monitoring.
- CE certified.

## Description

The EPC 48300/2900 Series is a compact and flexible enclosure solution for housing electronics, distribution, and battery backup equipment in outdoor telecom networks. To provide maximum protection for your equipment investment, the EPC 48300/2900 Enclosure is designed and tested to withstand the most severe environmental conditions. Thermal management is achieved through use of heat exchanger or air conditioner cooling which keeps electronics from exceeding their optimal temperatures, yet never introduces outside air and pollutants into the equipment chamber. The EPC 48300/2900 series cabinet is extremely flexible, and a modular approach is taken wherever possible so the cabinet can be quickly configured to meet your exact requirements.

## Application

This cabinet can economically house a variety of next generation electronic equipment including telco backhaul, fiber distribution, and radio equipment for wireless applications.



EPC48300/2900-M2



EPC48300/2900-M21



EPC48300/2900-F2



EPC48300/2900-H2



EPC48300/2900-A2



# Hybrid Off-Grid Solar Solution for Telecom

## Technical Specifications

Model Name		EPC48300/ 2900-M2	EPC48300/ 2900-M21	EPC48300/ 2900-H2	EPC48300/ 2900-F2	EPC48300/ 2900-A2
Power supply system (optional)		Vertiv 19 inches NetSure™ Power system				
AC user socket		10 A single-phase AC socket				
Temperature control	Equipment Chamber	Heat exchanger: 80W/K	Forced ventilation: 1500W	Heat exchanger: 150W/K	Forced ventilation: 1500W	Precise air-conditioning: 1500W cooling, 1200 heating, Standard emergent ventilation
	Battery Chamber	Precise air-conditioning: 300 W cooling, 600W heating; emergent ventilation, (optional)		Natural ventilation		
	Heater (optional)	Equipment chamber 600 W		Equipment chamber: 600W; Battery chamber: 600W	600W or 1200W	600W
Environment Monitoring	Standard	LED lighting, access control switch				
	Optional	ECCUP (optional temperature and humidity sensor, smoke sensor, flood sensor vibration and inclination)				
Reserved space		36 U flexible 19 inches space shared by power system, batteries and user equipment				
Protection class		IP 55				
Optional parts		Network interface board, AC distribution unit, heater component, rectifier module blank panel, cabinet base cover plate				

Mechanical Parameters		EPC48300/ 2900-M2	EPC48300/ 2900-M21	EPC48300/ 2900-H2	EPC48300/ 2900-F2	EPC48300/ 2900-A2
Dimensions (W×D×H) mm	Cabinet	700 mm(W) × 700 mm(D) × 2030 mm(H), including base and cap				
	Battery Chamber	610 mm(W) × 580mm(D) × 330mm(H) each layer				
Weight		≤235 kg (excluding module and battery)	≤210 kg (excluding module and battery)	≤215 kg (excluding module and battery)	≤ 185 kg (excluding module and battery)	≤ 240 kg (excluding module and battery)

## Key Features

### Complete with Flexibility

- A comprehensive portfolio focusing on high value and efficiency
- Each panel is supported by the same structure, cabling and protection for a universal fit

### Efficient and Resilient

- High-efficiency panels (+18 %) available
- Vertiv is committed to pass forward continuous gains in performance, while maintaining backwards compatibility
- Third-party certificates demonstrate survival under environmental stress

### Value

- Global supply and delivery, including the EU, and thus providing one global solution to reduce planning and support costs
- 60 to 156 mm cell panels, ideal for availability and transport
- Guarantees durability with leading-industry warranty from a company that has been a provider for 20 years

### Reliable and Durable

- PID resistant
- 2400 Pa wind load
- 5400 Pa snow load
- 35 mm hail stones at 97 km/h

### Comprehensive certificates

- IEC 61215/ IEC 61730/ UL 1703/ IEC 61701/IEC 62716
- 1000V UL/1000V IEC certified
- ISO 9001: Quality Management System
- ISO 14001: Environmental Management System
- ISO 14064: Greenhouse Gases Emissions Verification

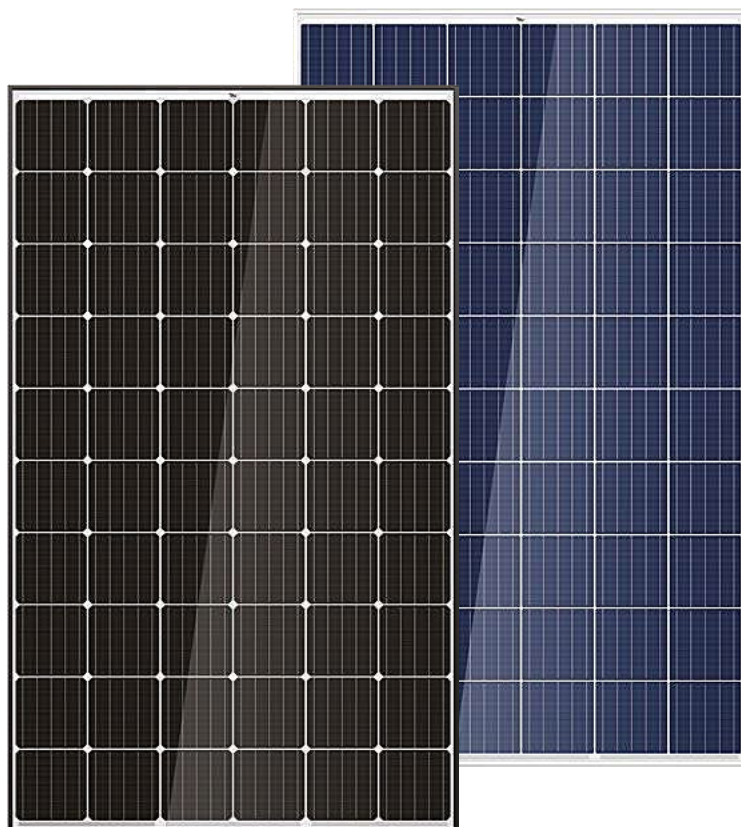
*Vertiv™ solar panels for telecom applications provide supply and support with leading manufacturers at a global level who have demonstrated quality and efficiency.*

In a dynamic market of supply where manufacturers quickly rise and fail, Vertiv has chosen to work with Trina Solar, a leader who has demonstrated a global supply chain that has delivered quality and efficiency for 20 years.

## Application

Whether used to support loads in a bad-grid environment or to provide the supporting energy source in an off-grid solution, solar panels represent an investment that demonstrates a commitment to reducing and managing operating cost.

Vertiv solar panel solutions offer an efficient and comprehensive portfolio with easy installation, high value and implementation of best practices to maximize power-energy while using the smallest space possible. These solutions not only reduce green house gas emissions, but they also provide reliable service that minimize your demands on expensive energy.



# Hybrid Off-Grid Solar Solution for Telecom

## Technical Specifications

### Mono-Crystalline Solar Panel – Allmax Plus Framed 60 Cell Module

Rated Power WP	275	295	300	315
Power Output Tolerance (%)	0/+5			
Maximum Power Voltage - Vmpp (VDC)	31.4	32.5	32.6	32.9
Maximum Power Current - Vmpp (I)	8.76	9.08	9.19	9.46
Open Circuit Voltage - Voc (VDC)	38.7	39.7	39.8	40.5
Short-Circuit Current - ISC (I)	9.24	9.68	9.77	9.72
Module Efficiency (%)	16.8	18.0	18.3	19.2
<b>Temperature Coefficient</b>				
Pmax (%/K)	-0.39	-0.39	-0.39	-0.39
Voc (%/K)	-0.29	-0.29	-0.29	-0.29
Isc (%/K)	+0.05	+0.05	+0.05	+0.05

### Mono-Crystalline Solar Panel – Tallmax Plus Framed 144 Half Cell Module

Rated Power WP	385	400
Power Output Tolerance (%)	0/+5	
Maximum Power Voltage - Vmpp (VDC)	40.1	41.1
Maximum Power Current - Vmpp (I)	9.61	9.74
Open Circuit Voltage - Voc (VDC)	48.5	50.4
Short-Circuit Current - ISC (I)	10.03	10.18
Module Efficiency (%)	18.9%	19.7%
<b>Temperature Coefficient – VOC</b>		
Pmax (%/K)	-0.37	-0.37
Voc (%/K)	-0.29	-0.29
Isc (%/K)	+0.05	+0.05

### Common Data

Operating Temperature: -40 to +85C

30 Panels per Pallet

840 Panel per 40' Container / 660 Panel (385-400W) per 40' Container

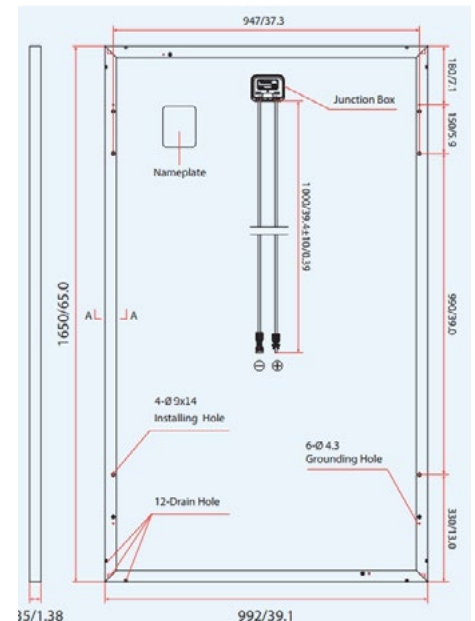
Product Workmanship Warranty: 10 years

Linear Power Warranty: 25 years

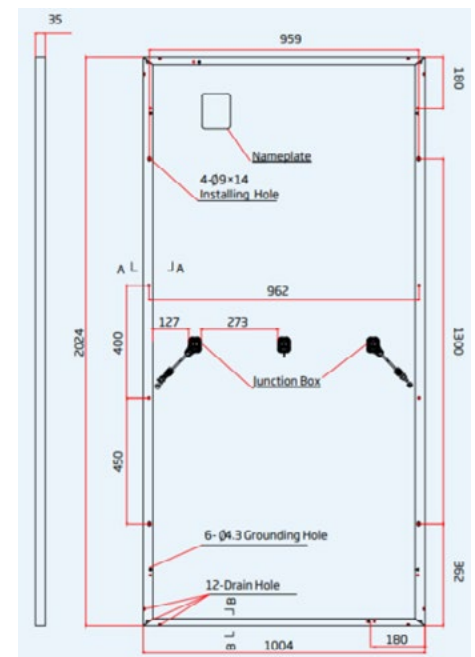
**Trina**solar

Warranty provided by Original Manufacturer, Changzhou Trina Solar Energy Co, Ltd. All reported values reflect STC: 1000W/m<sup>2</sup>, Cell Temperature 25°C. Performance values for panels that are planned and un-released are left blank.

## Dimensions of Modules (mm)



275-315W Panel



385-400W Panel



## Key Features

### Complete with Flexibility

- Providing full support for Vertiv™'s Hybrid Solution from 2kW to 24KW
- Mounted onto concrete.
- Open space under the array designed to locate and shade telecom equipment
- Support sample layout drawings with documentation illustrating best practices for layout, site management and installation
- Training available to instruct and demonstrate best practices and installation
- Efficient Arrangement defined to minimise losses associated with shadows, walls, fences, tall grass, etcetera.

### Reliable and Durable

- Structural analysis and reports at 45 m/s wind loads
- Steel Frame, Hot Dipped Galvanized

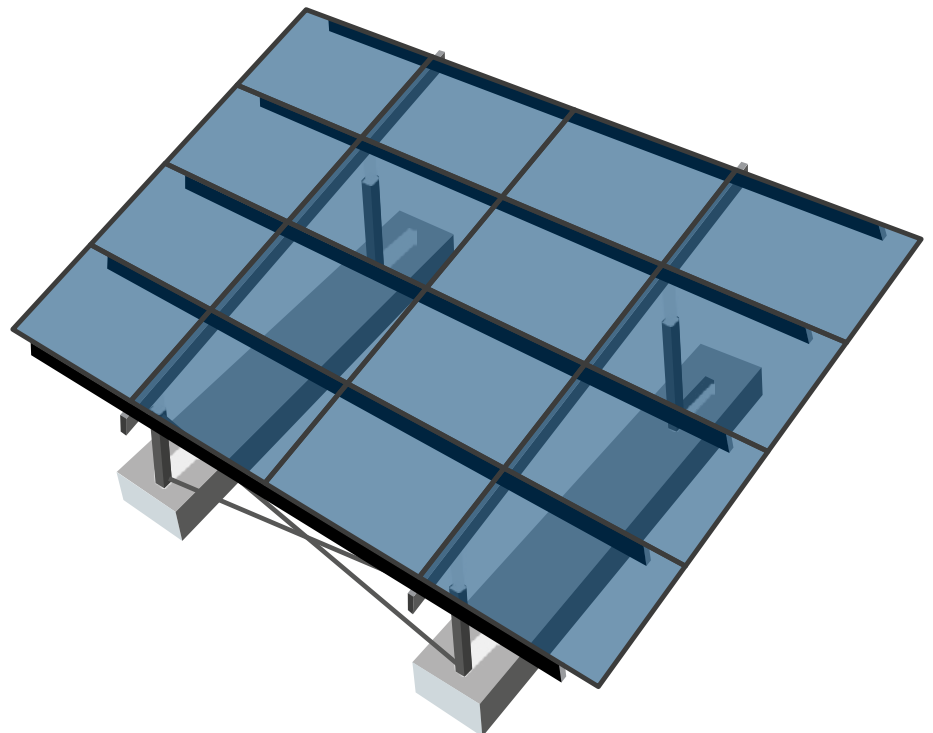
*Standard set of solar arrays allowing for ease of planning, selection and delivery.*

A solution that focuses on the tools, skills and practices that are readily available at remote telecom locations.

Not all solar array solutions for residential and utilities work well with telecom. The use of utility pile / screw posts requires impractical machinery for installation or demands soil conditions not present to place posts 2+m into the ground; while designing discrete solutions from residential units does not scale for efficient roll across a telecom network.

Our solution maintains the principles of providing a solution for telecom that addresses efficiency, ease of planning and simplicity of execution.

This simplicity has been achieved by a set of 2 KW and 2.5 KW “brick” solutions. With these common building blocks, a full portfolio with supporting documentation that addresses ease of planning and efficient use of land is available.



## Technical Specifications

Common Building Blocks Available in	
Standards tilts, as defined by country	12°, 22°, 32°
Heights (at front edge)	1.2 m, 2.0 m,
Array size building blocks	2kw, 2.5kw

*\*Replacement parts are available*

Accessories	
Anti-theft liquid metal – Loctitie (to seal bolt heads)	
Anchor bolt kits	

Common Features	
Mounting Method	Onto Concrete
Material	• Foundation posts, profiles and rails Steel, hot-dip galvanized
	• Fasteners Steel, hot-dip galvanized or high-grade steel
Maximum acceptable slope	10° EW and NS
Wind load	45m/s ASCE 07
Product workmanship warranty	5 Years

## Key Features

### Flexible portfolio

- Vertiv provides a comprehensive hybrid solutions that range from 2kW to 24kW
- Supporting the NetSure™ 2.5 kW blocks that allow for expansion based on current needs, without having to rewire what is there or over-invest in future infrastructure

### Comprehensive support

- A part of the complete solution, with reference wiring and site drawings
- Equipped with terminal blocks and label kits, enabling low-risk installation

### Efficient wiring

- Specifically designed and defined for solar array connections

### Reliable and durable

- No sacrifices or substitutes come, with an IP55 protection level box

### Added value

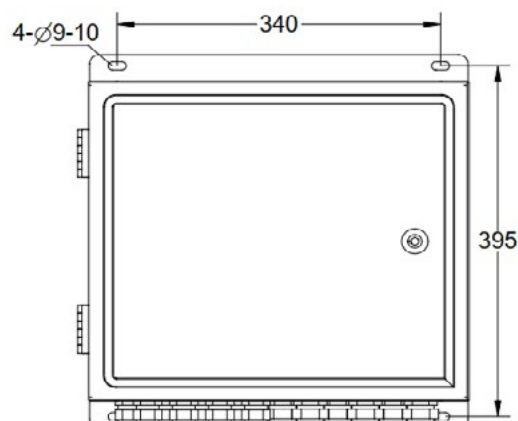
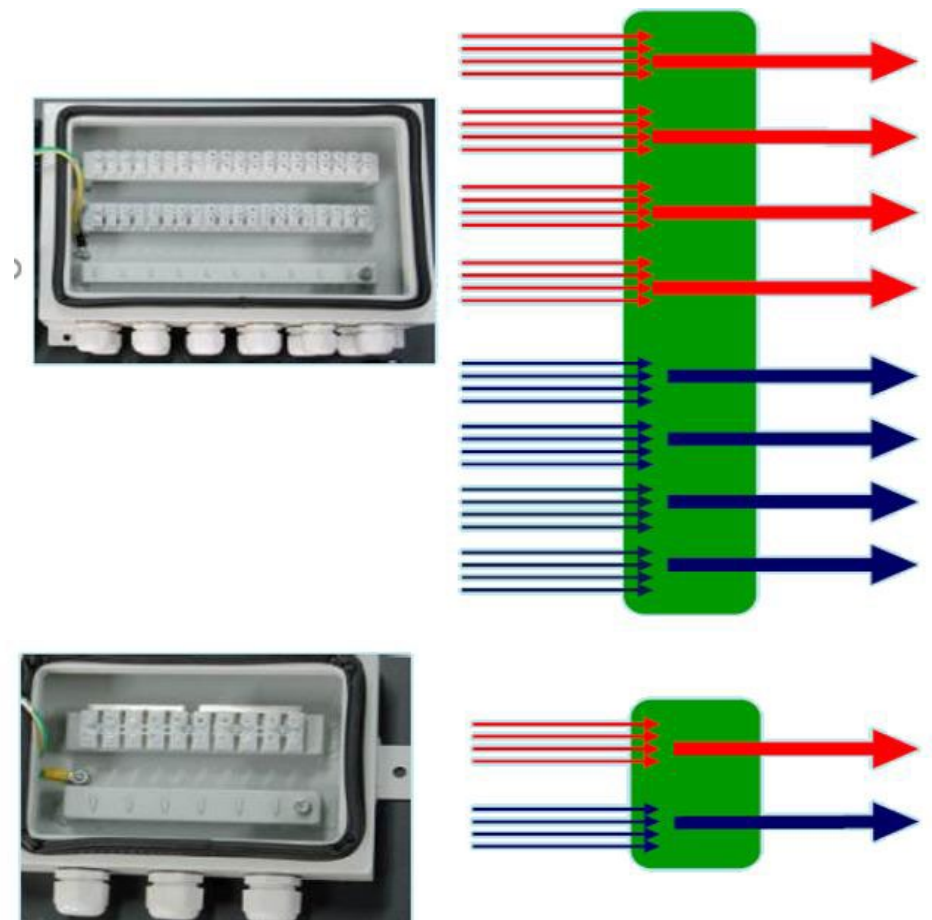
- Eliminate the need to a source separate combiner boxes and open spool wire
- Quick keyed connectors for rapid installation

*In support of ease and speed of execution, Vertiv™ provides the cables and protection with our solar arrays.*

In providing the full solution from array to power, Vertiv provides cables, circuit breakers and protection proven to support durable telecom applications.

Vertiv continues to demonstrate its approach to provide the best solution from energy to load, with its set of Protection Boxes and quick connect cables, that eliminates the need to source discrete combiner boxes and spools of open wire.

The cable sets are connected to a combiner box which simplifies the installation; this leads to an increase in the speed of execution of a problem-free installation.



# Hybrid Off-Grid Solar Solution for Telecom

## Technical Specifications

### Solar Junction Box

Operating Conditions (under Array)	-15° C to +55° C
Environmental Protection	IP55, with transparent door for quick inspection
Safety Compliance	ROHS
Wire Entry	6 X 4 routes, every four input branches routes collected into one route
DC Input Voltage	36 – 96VDC
DC Input Current	Max 15A one input
DC Output	6 Routes
DC Output Voltage	36 – 96VDC
DC Output Current	Max 50° one output
Insulation resistance	DC circuit and earth is not less than 2MΩ
Protection Level	IP55

### Mechanical

Dimensions (W × H × D)	420 × 380 × 150
Weight	Less than 12kg

*\*All parts are compliant with ROHS Directive 2011/65/EU*

*When you order an array, Vertiv proposes –the basic (minimum) wire and protection box kit for standard layout. Or you can select in accordance to your own site plan.*



## Key Features

- Simplified user interface includes an installation wizard, graphical color display and user friendly web pages
- Backwards compatible with ACU, SCU, ACU+ and SCU+
- Supports encrypted (HTTPS) multi-browsers including Internet Explorer, FireFox, Chrome, Safari
- Ethernet connectivity via IPv4 and/or IPv6
- Dual Network port option which allows for permanent connection and available craft port for service PC simultaneously
- Modbus as monitoring option—communicates with energy devices and/or a supervisory computer (NOC)
- Battery management features include temperature compensation, thermal runaway management, recharge current limit, reserve time prediction, and optional midpoint monitoring
- Easily configurable file upload/download minimises installation time
- Supports six user-selectable languages
- Intelligent Load Management support for systems that include SMDU+ or SMDUH
- Delivers hybrid energy management, including control and management of generators and solar power

*The advanced NetSure™ Control Unit (NCU) from Vertiv™ takes remote monitoring and control to the next level with a user-friendly color interface, secure connectivity, data statistics and multiple communication options.*

## Description

The NetSure™ Control Unit (NCU) is an advanced controller designed for a wide range of DC power applications. The NCU enables remote monitoring and control of modern communication sites and is backward compatible with existing NetSure power systems. The controller is factory installed or can be added in the field to deliver data and control for all aspects of the power chain, including AC mains, DC power plant, battery backup, diesel generator and the local site environment. The addition of optional interface boards enables the user to access an even greater set of site parameters.

The NCU features advanced battery management for temperature compensation and boost charge control, prediction of remaining time and capacity, constant current testing, scheduled battery testing, and short duration battery testing. Thresholds for battery current measurement, detailed alarms, inventory management and three LVD levels can be programmed easily through the controller. Control of rectifiers (24V, 48V and 400V) and converters (24V, 48V, 400V and solar) is possible in this convenient pluggable module.

Expanded information and alarm data can be monitored or controlled via password protected and encrypted web browsers, including Internet Explorer, Firefox, Google Chrome, and Apple Safari. Network element management support for data communication is also available via standard protocols, such as SNMP version 2 and 3, and Modbus. In addition, Modbus device integration for many industry standard monitoring devices is now possible with the versatile NCU controller.

The new patent-pending Intelligent Load Management functionality displays current per fuse and circuit breaker and can measure each site rack's aggregated current in relation to rack capacity. This feature requires optional system distribution measurement devices for breaker or fuse positions.



M830B



M830D

# Hybrid Off-Grid Solar Solution for Telecom

## Technical Specifications

### General

Power Supply	19 VDC to 60 VDC
Power Consumption, Maximum	18 W
Temperature Range, Operating	-20°C to +65°C (nominal), -40°C to +75°C (extended conditions) / -4°F to +149°F (nominal), -40°F to +167°F (extended conditions)
Relative Humidity	0 to 90%

### Safety and Standards Compliance

Electrical	IEC 60950-1, EN 60950-1, UL 60950-1
EMC	EN 300 386, 2001 Class B; FCC Part 15, Class B
Environmental	CE; NEBS Level 3

Mechanical Data	M830B	M830D
Dimensions (H × W × D)	43.4 × 86 × 208 (mm) 1.65 × 3.41 × 8.33 (inches)	86.2 × 87 × 208 (mm) 3.41 × 3.42 × 8.33 (inches)
Standard Installation Methods	Hot pluggable in stand-alone or embedded power plants	
Weight	< 1 kg / 2.2 lbs.	

Inputs / Outputs	M830B	M830D
Display	128 × 160 Pixels TFT LCD	320 × 240 Pixels TFT LCD
Communication	RS232, RS485, Ethernet, USB	
Protocol	IPv4, IPv6, HTTPS, SNMP V 2/ V 3, EEM, SocTpe, Rsoc, Mod Bus	
Analog Inputs	2 battery currents, 1 load current, 1 bus voltage, 2 battery voltages, 3 temperatures, 1 fuel level sensor and much more with additional interface boards	
Digital Inputs	1 input for status of surge protective device auxiliary contacts, 12 load fuses, 6 battery fuses, bi-stable contactor status	
Outputs	3 LVD mono & bistable contactors	



NetSure™ Control Unit User Interface



Web Interface Home Page

## Ordering Information

Model	Model Number	Description
M830B	1M830BAXX	NCU3.0+ controller, 1 × 2 RU
M830D	1M830DAXX	NCU3.0+ controller, 2 × 2 RU

### Optional Interface Board

EIB	5 relay outputs, 8 DC voltages, 3 DC currents, 2 temperatures
IB1	4 relay outputs, 4 digital inputs
IB2	8 relay outputs, 8 digital inputs, 2 temperatures
IB4	1 additional Ethernet port

### Supervision Modules

SMDU	4 shunts, 1 voltage input, 20 fuse alarms, and 2 LVD controls
SMDU+	25 shunts, and 25 fuse alarms
SMTEMP	Temperature concentrator with up to 8 temperature sensors
SMDUH	20 Hall effect sensors to measure DC distribution load current from 0 A to 100 A

Click the image banners to learn more about Vertiv's Hybrid Solutions

## Visit the Website



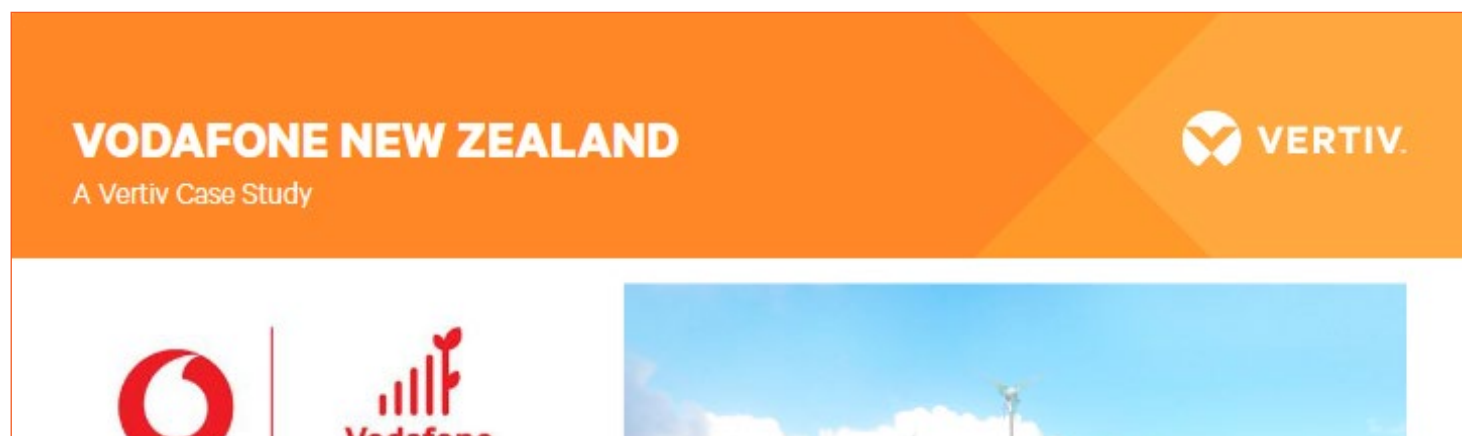
<https://www.vertiv.com/en-asia/solutions/hybrid-solutions/>

## Watch the Video



<https://youtu.be/aJbO1wCw7po>

## Readup on a Case Study



[https://www.vertiv.com/globalassets/documents/case-studies/vertiv-vodafone-cs-en-nz\\_199557\\_0.pdf](https://www.vertiv.com/globalassets/documents/case-studies/vertiv-vodafone-cs-en-nz_199557_0.pdf)

