powerstar

VIRTUE

POWERSTAR VIRTUE

PRODUCT SPECIFICATION

25kVA output power

100KWh capacity

DESCRIPTION

Powerstar Virtue is an energy storage system which allows for greater control and flexibility of electricity usage, enabling energy stored during periods of low demand to be utilised when required.

As a result the system is beneficial for a number of different organisations, including:

- Large consumers of electricity; such as commercial and Industrial sites
- Distribution Network Operators
- National Grids

Powerstar Virtue allows companies to save and store electricity locally and switch to this stored supply at any time. On site renewable generation can be integrated with Powerstar Virtue to provide the maximum cost benefit, this includes:

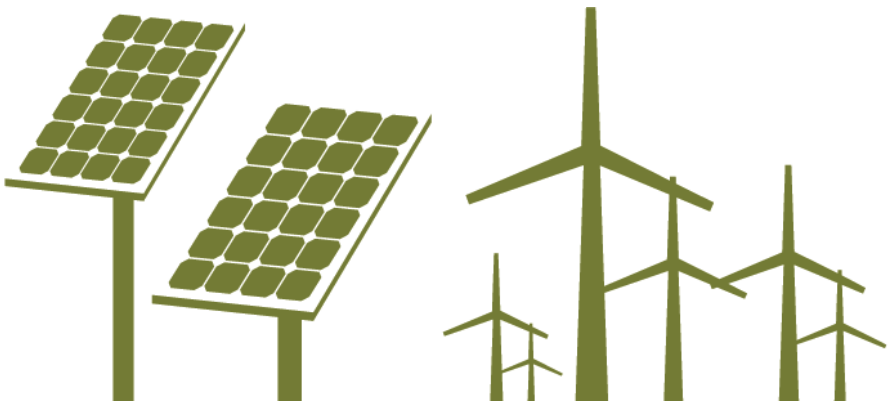
- Eliminating the need for inverters on renewable.
- Reducing the cost of initial renewable installations
- Increasing the ROI levels of renewable installations
- Storing energy generated by on-site renewable technologies

FEATURES

- Can be used with existing renewable infrastructure
- Suitable for any commercial or industrial building where voltage optimisation is installed
- Universal design, suitable for use globally
- Durable design for most environments and climates
- Integrated data logging
- Outdoor enclosure
- Emergency power mode
- **Full UPS site support capability up to 2 hours (reserve)**
- Fully electronically regulated voltage output
- Phase balancing
- Harmonic reduction
- Power factor improvement

BENEFITS

- Maximise savings by storing electricity locally
- Reduce costs by coming off grid at times of high tariff
- Eliminate risk of network interruption
- Guarantee stable and reliable power at all times
- Make your facility grid independent at any time
- Integrate with onsite renewables to maximise cost benefits
- Eliminate use of inverters on renewables
- Reduce cost of renewable installations
- Reduce the need for diesel generators
- **Become a Virtual Power Station (VPS) and participate in National Grid incentive schemes (STOR, EDR & FDR)**
- Reduce maintenance costs of onsite electrical equipment



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BATTERY MODULES

The Powerstar Virtue Energy Storage System contains modular architectures based on identical power modules which can be interchanged and connected in parallel, inside the battery enclosure. Power modules will be equipped with control and self diagnostic circuits (Battery Management System), in order to easily identify the faulty module and the specific failure inside it.

Each battery drawer will contain 24 batteries with nominal 12.8Vdc, connected to five other battery modules in the rack to give 76.8Vdc. These racks are then series connected to give 620Vdc, with each rack separated by a system of series of contactors, allowing battery packs to be bypassed remotely.

In this way when a battery drawer is removed from the cabinet there are no dangerous voltages for the user (dangerous DC voltages are bigger than 100VDC as indicated in the EN60950 standard). The modularity of the Powerstar Virtue Energy Storage System allows the user to increase the back-up time on site, by simply adding battery drawers.

The upgrade will not require factory modifications and will not need dedicated special tools. The load will be shared between all power modules in each phase. In this way, during normal run, no power module is inactive or in standby. In a redundant configuration, if one module fails all the others ones will take the relevant load without any interruptions or transfer time at the output of the Powerstar Virtue Energy Storage System.

BI-DIRECTION GRID TIE INVERTER

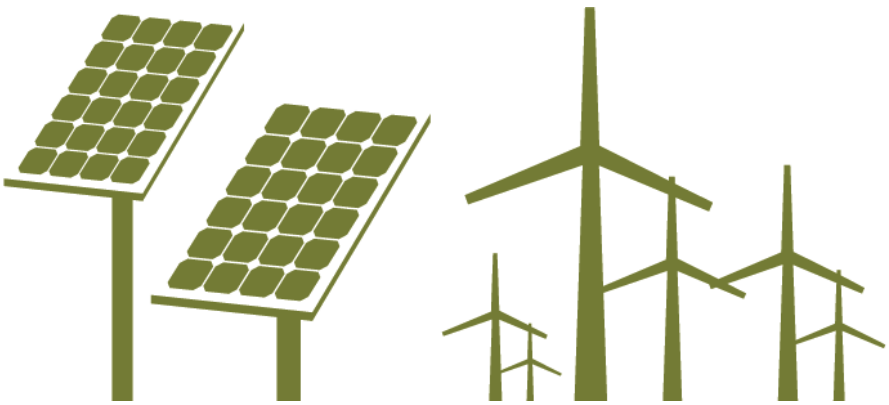
The bidirectional power conversion device used in the Virtue system has the following basic functions:

- Enabling grid power to be converted to DC
- Charging the batteries in a controlled manner
- Enabling battery power to be “inverted” to AC to feed the grid

Given the nature of the semiconductor devices that rapidly switch on and off to create alternating current, a big part of the design includes measures to reduce harmonics, producing as close to a pure sine wave output as possible. The PCS (Power conditioning system) is able to synchronise with the grid frequency and provide a stable output – appearing to the grid to be a synchronous generator.

It responds to changing conditions, providing energy at a controlled ramp rate, but also injects power quickly to correct short term frequency fluctuations. The unit has the capability of dynamically controlling power factor by supplying the grid with the requested amount of real or reactive power on demand, over a wide range. Inside the PCS, phase modules plug into a rack system to form a com-plete inverter stack.

Modules are easily accessible, and can be changed in the field with minimal equipment. Refrigerant cooled modules can be changed without requiring a cooling system charge, thanks to no-leak quick break fluid connectors.

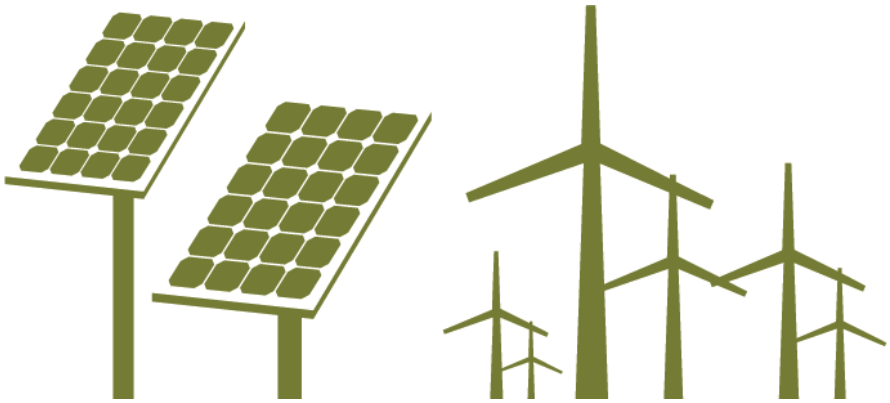


INTERNAL VISUAL INSPECTION

- Internal Layout of a typical 100kWh – 25kVA Virtue Unit. Based on the dimensions of a 10ft cont

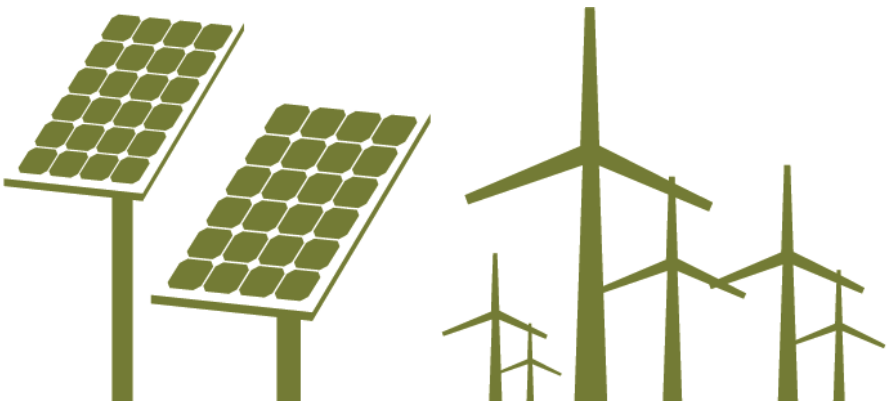
EXTERNAL VISUAL INSPECTION

- Commissioned Powerstar Virtue – at the company headquarters during cycling tests.



TECHNICAL SPECIFICATION

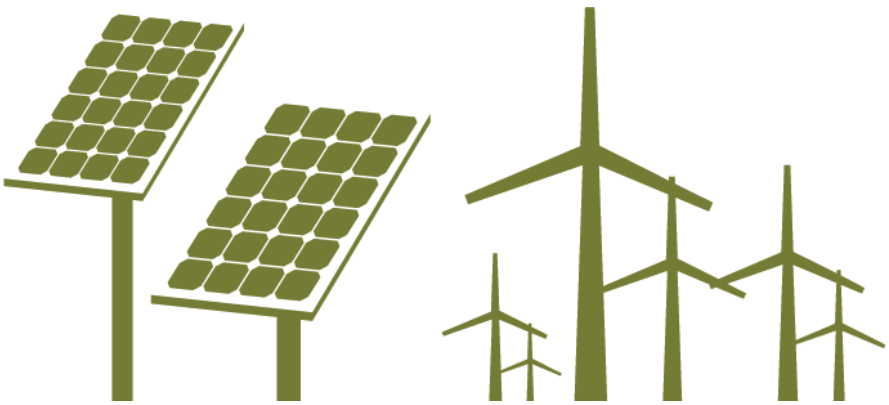
GRID INVERTER SPECIFICATIONS	
DC Input	
Input Voltage Range	380– 449 VDC
Overvoltage protection	Type 2 surge arrestor
DC Disconnection Method	Contactor or Circuit Breaker Options
Sure Protection	Type 2 surge arrestor
AC Output	
Output voltage range	380 - 480 VAC
Nominal power	25,000 VA
Active power	22,500 W
Power Factor Range	+/- 1.0
Overvoltage Protection	<3%
AC Circuit Breaker	65ka interrupt rating
Performance Data	
Efficiency (Max, estimated)	98.7%
Auxiliary and cooling system losses	0.15kVA typical, 0.23kVA maximum
Sensors and User Interface	
User Interface	10.4” TFT LCD Touch Screen
Monitored Internal Temperatures	Up to 112 – Including busbars, ambient, choke, IGBT’s e.t.c
External Auxiliary Supply	230V single phase or 380 three phase
Communications Options	Modbus TCP (Optional: Ethernet IP,CANopen, DNP3, EtherCAT & PROFIBUS)
Humidity Sensor	Included
Anti – condensation meters	Included
Ground Fault Monitoring/ protection	Bender™ ISOMETER® iso685
Environmental Ratings	
Ambient Temperature range	-20 to +55
Relative Humidity	0 – 100% condensing
Max. Altitude without de - rating	1000 meters/3281 feet
Corrosion Resistant Option	>600hrssalt fog per ASTM B117 - 11
Compliance and Standards	
North American Certifications	NFPA70, (UL1741 pending)
Harmonics	IEEE 519, IEEE 1547
European Certifications	CE: LVD, EMC, G5/4 & G59/1 (pending)



TECHNICAL SPECIFICATION

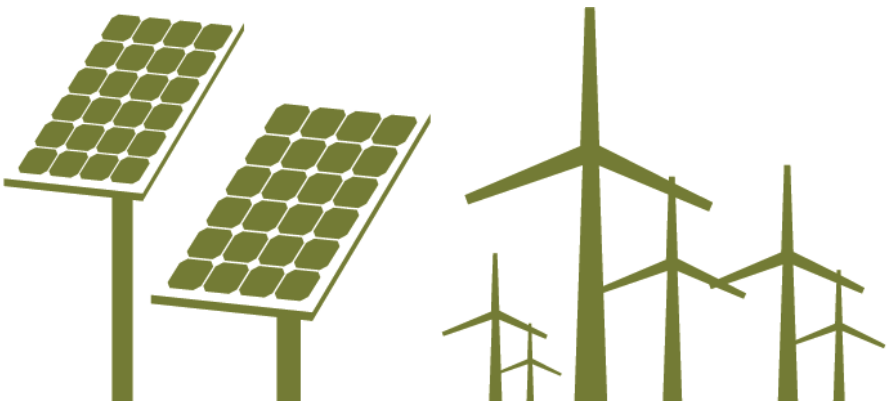
CONTAINER SPECIFICATION	
IP Rating	65
Internal Dimensions (W×HxD) (m)	2.99 * 2.59 * 2.43m
Dimensions (W×HxD) (m)	2.84 * 2.39 * 2.35m

GRID TIE TRANSFORMER SPECIFICATION	
Power Rating	2500kVA
Supply Voltage	260Volt - 3 phase
Supply Frequency	50Hz
Output Voltage	415V No Load 3 Phase
Power frequency Withstand	3kV for 60 seconds. Winding to Winding and Windings to Earth/ Screen.
Maximum Ambient Temperature	40°C
Maximum Temperature rise of Windings	125°C
Insulation Class	H [180C]
No Load Loss	75W
Load Loss	500W
Standards	BS171; BSEN60076 -11; BS7806; IEC726



TECHNICAL SPECIFICATION

BATTERY	
Type	LiFeMnPO4 – Prismatic
Unit Capacity	60Ah
Nominal Battery Voltage	3.2VDC
Weight	2.0+/- 0.2kg
Self Discharge	<1% month
Charging/ Discharging Efficiency @ 0.5C	96%
Charge/ Discharge Cycles	3000 @ 80% DOD & 3500 – 7000 @ 70% DOD – All figures obtained @ 25°C +/- 2°C
Warranty	5 years
Safety Features	• BMS (Battery Management System) looks at temperature, voltages, impedance and discharge performance of individual cells. • Central pressure valve on every cell ensures that in the extremely unlikely event of a thermal runaway situation, the valve opens, reducing the chance of fire to zero. • In complete Virtue storage systems, individual battery packs can be taken in & out of circuit remotely. This insures that faulty packs can be removed without onsite maintenance. • LiFePO4 Chemistry produces minimal heat during charging and discharging, reducing the risks of thermal runaway events and internal short-circuits. • No Part of the battery is flammable.
Internal Impedence	0.7mΩ
Heat Output Per Cell @ 0.5C to 80% DOD	2.8W – 3.2W
Working Temperature	0 - 65°C
Storage Temperature	-20 - 65°C
Optimal Discharging	0.25C – 0.35C
Max Charging Current	60A (1C)
Max Pulse Discharging (10s)	600A (10C)
Max Discharging Current	180A (3C)
Standards	ISO 9001, ISO –TS 16949 & CE marking

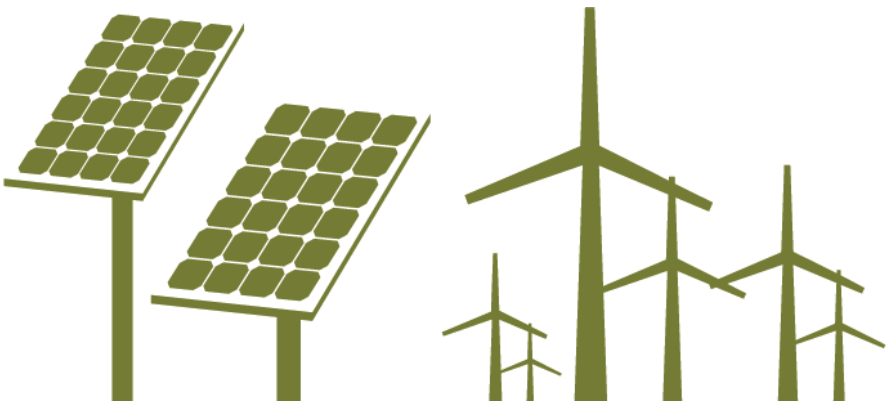


TECHNICAL SPECIFICATION

AIR CONDITIONING	
Power Source	400/3/50 (VAC/Φ/Hz)
Cooling Capacity	2.6 (0.50 ~ 3.6) kW
Heating Capacity	3.6 (0.50 ~ 5.30) kW
Input Power (Cooling/ Heating)	0.66 – 0.85 kW
Running Current	3.2-4.0A
Airflow Rate (High)	560m^3/h
Net Dimension H*W*D	0.540 * 0.660 * 0.215m
Refrigerant (Global Warming Potential)	R410A (1,975)
Sound Pressure (Cooling)	51/48/42/38 (H/M/L/Q)

ENVIRONMENTAL SPECIFICATIONS	
Noise level @ 1m	42 - 46 dBA
Working temperature range	From 0°C to +40°C
Stock temperature range	From -20°C to +50°C (excluded batteries)
Humidity range	20-80% not condensing
Protection degree	IP21

MECHANICAL AND MISCELLANEOUS	
Colour	RAL 7016
Technology rectifier/booster/inverter	IGBT
Communication Interface	2 serial port RS232, 1 logic level port, 4 Dry contacts port
Input/Output connections	3P + N + PE Connectors on omega bar
Number of Installed Power Modules	6 of 6700 VA
Standards	EN 62040-1, EN 62040-2, EN 62040-3



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