Elpower
power electronics

CLEANISLAND

PCS FOR ENERGY STORAGE SOLUTION



RENEWABLE SOURCES

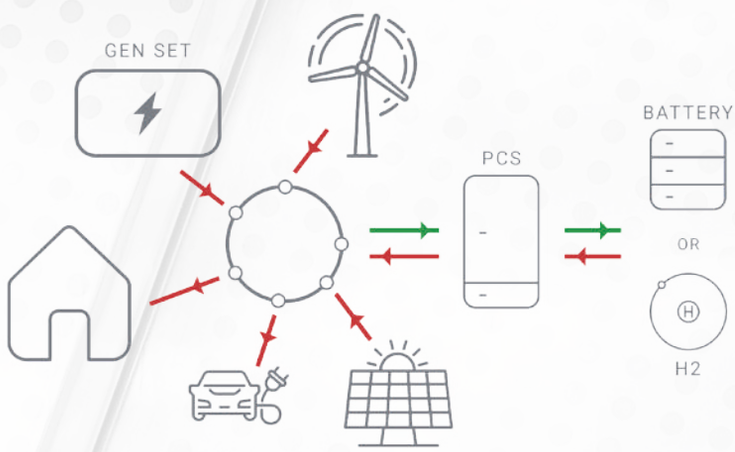
CLEANISLAND
PCS FOR ENERGY STORAGE SOLUTION

Starting from the experience gained in the field of production systems from renewable sources connected to the grid, Elpower has developed the family of PCS CLEANISLAND, for the management of the grid connected or off grid storage systems.
In the Industrial and Commercial scale in which Elpower operates, essentially two types of storage systems are provided:
- connected in parallel to a renewable source production plant (photovoltaic, wind, etc) on the a.c. side of the PCS; it is defined storage in a.c .. The PCS manages the charging and discharging of the battery and can be connected to the grid or to a micro-grid
- connected in parallel to a renewable source production plant (photovoltaic, wind) on the d.c. side of the PCS; it is defined storage in d.c.. The PCS manages the charge and discharge of a battery and the renewable source plant and usually it is connected to a micro-grid or it supplies off-grid loads

In any case, CLEANISLAND is able to operate both in "grid following" and "grid forming" mode, switching from one to the other without voltage drop.
CLEANISLAND can manage different types of batteries: Lithium Batteries, Redox Flow Batteries, Salt Batteries.

CLEANISLAND is a DSP (Digital Signal Processor) based converter system, specifically designed for energy storage application and basically present two working modes:

a) Grid Following – in this working mode the PCS is used as a grid tied inverter to connect the energy Storage system to the grid or micro-grid with the capability of charging the batteries and/or to support the grid in feeding the loads.
b) Grid Forming – in this working mode the PCS become the master grid generator; it feeds the micro-grid (allowing the operation also to the connected renewable energy system) or local loads taking energy from the batteries.





CLEANISLAND 100 KW

FEATURES

- Off Grid/Microgrid
- From microgrid to industrial power, Cleanisland gives you the power you need when you need it

- Grid forming and following
- Black start
- Ramp rate control
- Power factor correction
- Load and peak shaving

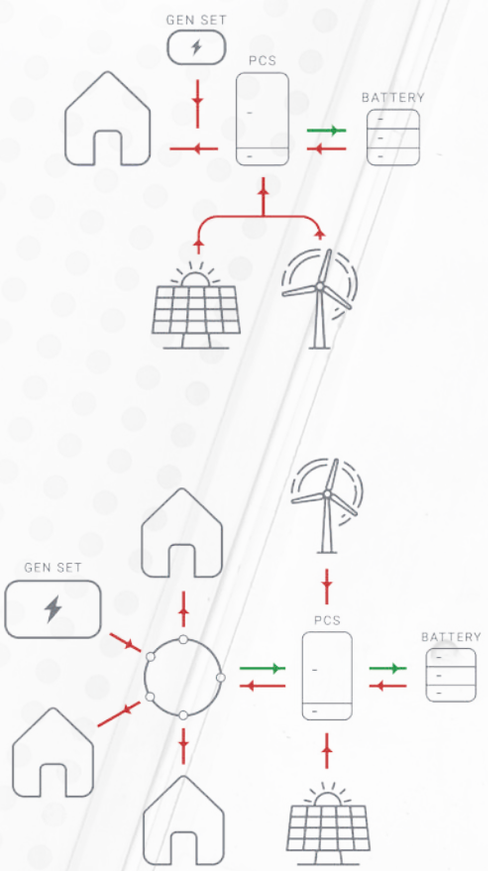
- On Grid/Grid Services

With ultra fast response bi directional 4 quadrant operation, Cleanisland offer Active and Reactive power services to both industrial and commercial operators

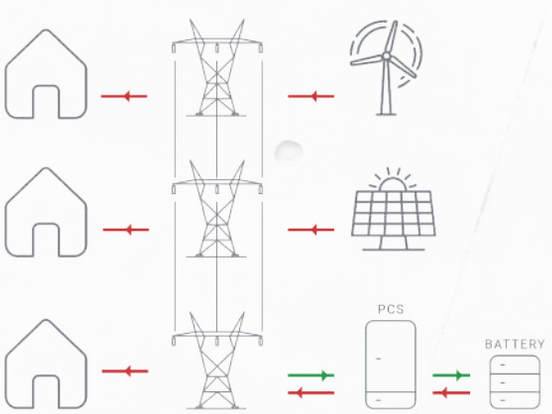
- Voltage control and droop
- Power factor control
- Reactive Power (VAR)
- Frequency regulation and response
- Peak shaving
- Load shifiting
- Accurate and fast ramp rate control
- Black start and EPS

THE PCS FOR ENERGY STORAGE
Power range 30 kW - 500 kW

FORMING / FOLLOWING (HYBRID GRID)



FOLLOWING (GRID - CONNECTED)
FORMING (WITHOUT GRID)



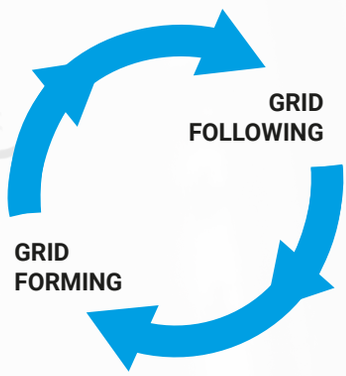
CLEANISLAND	30	50	100	250
Protection degree	IP20			
Temperature	(-20 ÷ +45 °C 50°C inside cabinet)			
Thermal protection	yes			
Humidity	0 ÷ 95% max (non condensing)			
Altitude	< 2000 m a.s.l.			
MAINS				
Voltage	400 V			
Frequency	50 Hz			
Rated power	30 kW (43A)	50 kW (72A)	100 kW (144A)	250 kW (360A)
Apparent power	33,3 kVA	55,5 kVA	111,2 kVA	278 kVA
Rated current	43A	72A	144A	360A
Overload capability	110% continuative (48,1A) 120% for 1 min / 10 min	110% continuative (80,2A) 120% for 1 min / 10 min	110% continuative (160.5A) 120% for 1 min / 10 min	110% continuative (401,2A) 120% for 1 min / 10 min
Control	Digital			
THDI (@ rated power)	< 3%			
Power factor range	± 0,8 ÷ 1			
Over current electronic protection	yes			
Thermal protection	yes			
BATTERY SIDE				
Maximum battery voltage	756 V dc			
Minimum battery voltage	540 V dc			
Max charge/discharge current	55A	92A	185A	462A
Rated power	30kW	50kW	100kW	250kW
Power overload capability	120% for 1 min / 10 min 110% continuative			
Control	yes			
Ripple on battery side	< 5%			

In “Grid Forming” mode the indicated performances are valid with resistive load, the Max Unbalanced Load is 15%



CLEANISLAND 250 KW

The switch between two working mode described above happens without a voltage drop:



MONITORING

By means of the Elpower monitoring software, it's possible, by the connection of a PC to the RS 232 interface of the CLEANISLAND PCS, to display all the operating parameters including the supplied power and energy, to display the alarms and to activate the data logging. This function allows to acquire the main operating parameters with 0,5 sec frequency; an Excel file is created each hour and all the daily files are stored into a dedicated folder.

It's available, as option, a remote control kit composed of an embedded PC and a 4G router mounted into the PCS cabinet. The monitoring software running inside the PC allows to have the a.m. functions also from remote.

Moreover the remote control kit allows to Elpower to give a support for the commissioning and for the after sales service from remote, because with the monitoring software is also possible to modify the set-up and the firmware and to manage the on board oscilloscope. These functions are only available for Elpower technicians.

A RS 485 interface is available to communicate with MODBUS RTU protocol.

As option is available a communication electronic card that increase the connection capability as follows: 2 x RS 485, 2 x CAN BUS and 1 x TCP/IP.

EMS – ENERGY MANAGEMENT SYSTEM

HARDWARE

Elpower EMS consists of 2 main parts:

1. Dedicated hardware with embedded watt-meters, digital and analog I/O, RS-485 communication interface, RTC
2. Plant monitoring software running on a Windows based embedded PC

The plant management logics (priority of power sources, timings, ..) are implemented in the firmware of the EMS board and can be parameterized via software.

The dedicated hardware allows to control external sources (e.g. genset) via I/O and/or communication interface like Modbus and to have 2 three-phase measurement points (for example loads and power supply) or 6 single-phase points.

LOGICAL FUNCTIONS

When the system operates in automatic mode (controlled by EMS), 3 main operating modes can be identified

1. Grid following with battery charging via renewable sources

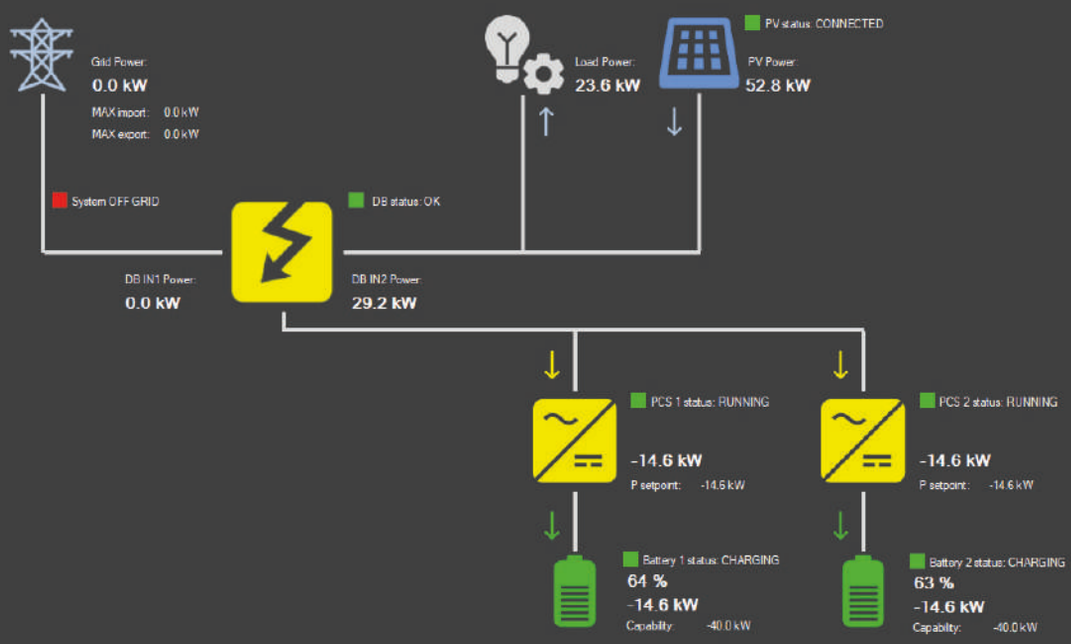
The PCS follows the grid or the grid formed by external sources (e.g. Gensets) on the AC side and uses all the energy provided by the renewable sources to charge the batteries.

2. Grid following with battery charging via external sources

When a scheduled grid forming timeslot is required and batteries are not charged enough, the EMS informs the PCS to use the grid or the external power sources (genset) to charge the batteries

3. Grid forming

When the battery is charged, the EMS informs the PCS to use storage and renewable sources to form the AC grid and supply the plant loads, the EMS turns off the gensets.



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