SUSTAINABLE PLACES 2022
Sep. 6 - Sep. 9, 2022 | Nice, France

Towards Intelligent DC-based hybrid Grids Optimizing the network performance

Paula Peña Carro. Óscar Izquierdo Monge

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TIGON objectives

- Demonstrate the possibilities offered by microgrids with DC architectures.
- The advantages and disadvantages when compared to AC microgrids.
- Development of power electronics equipment, systems and software tools to carry this out.
- Consolidate all the control systems, topologies and applications so these solutions can go from a promising solution to a commercially available technological option.

The TIGON team

- Showcases Representatives

- Technology and Research Development

- Disemination – Replication – Communication

- Technology manufacturers and Service providers

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CEDER-CIEMAT demo case

The CEDER-CIEMAT is a centre for the development of renewable energies located in Lubia (Soria - Spain). It is a public body under the Ministry of Science and Innovation - Government of Spain.

It has extensive facilities for scientific and technological demonstrations.

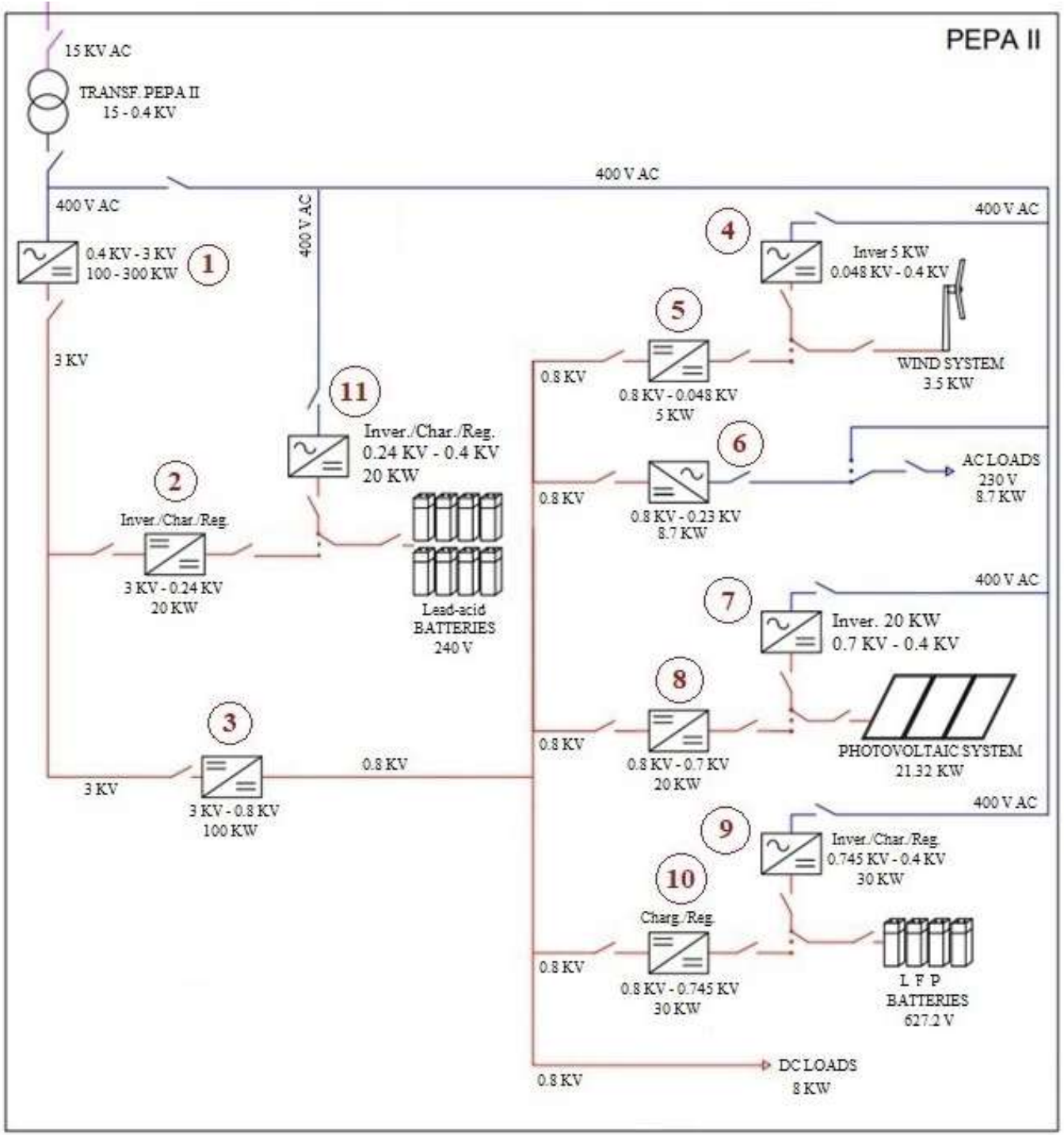
↓

Ideal environment for the installation and study of the microgrid project with a continuous grid.

PEPA II site


Transformation station
15 kVac - 400 Vac
Buildings for equipment
Photovoltaic panels

AC/DC hybrid microgrid architecture scheme



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Generation systems

Wind turbine

Ryse E5: 3.5 kW

WT DC/AC Regulator-Inverter
(5 kW 400 Vdc)

WT DC/DC converter
(5 kW. 630 Vac – 800 Vac)

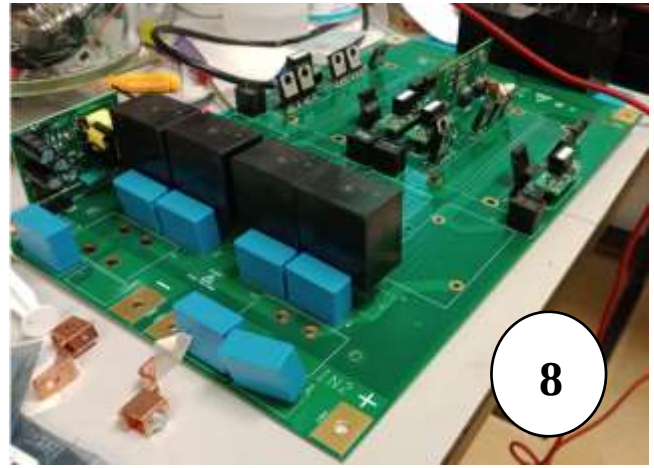
Photovoltaic system

52 Photovoltaic panels (410 W)
21.32 kW

PV DC-AC inverter
(20 kW 400 Vac)

PV DC-DC converter
(20 kW. 700 Vdc – 800 Vdc)

Under development by
Universidad de Valladolid
(UVa)



Storage systems

Lead-acid battery system

Lead-acid battery
120 cells
2 V/cell

Lead-acid battery
DC-AC inverter
(30 kW. 400 Vac)

Lead-acid battery
DC-DC converter
(20 kW. 240 Vdc – 3 KVdc)

Under development by
CEA & EFACEC

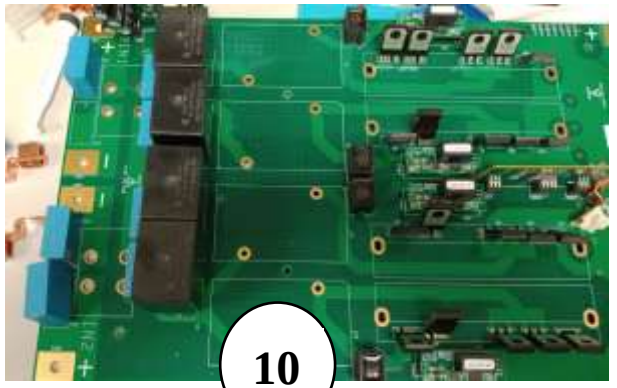
LFP battery system

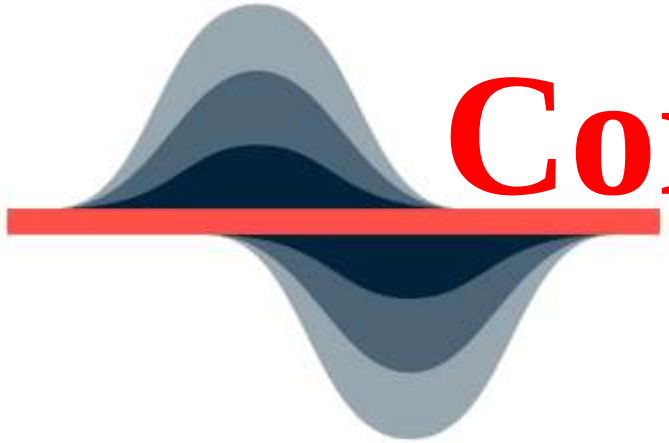
LFP battery
14 modules
196 cells 3.2 V

LFP battery DC-AC inverter
(30 kW 400 Vac)

LFP battery DC-DC Converter / Charger
(30 kW. 627 Vdc - 800 Vdc)

Under development by UVa





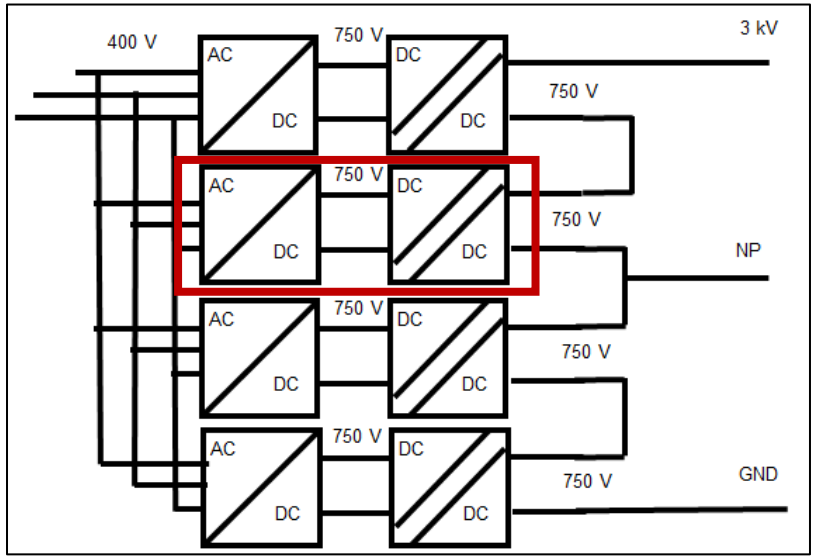
Converters

Solid State Transformer (STT)

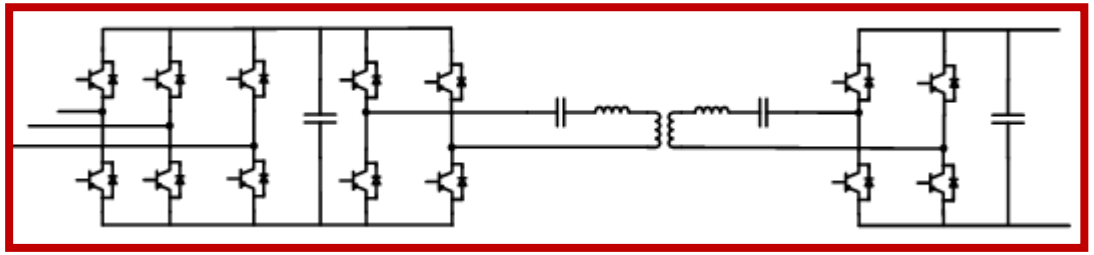
Solid State Transformer (SST)
100 kW 400 Vac – 3kVdc

Developed by
EFACEC&CIRCE

1



SST selected topology



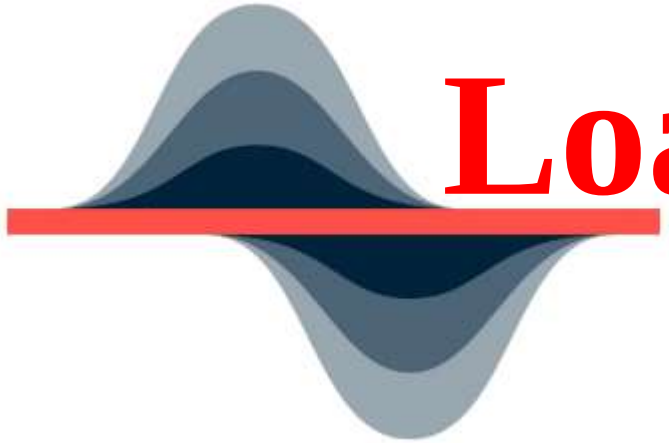
DC Converter

DC Converter

100 kW 3kVdc - 800 Vdc

Developed by
CEA&EFACEC

3



Loads

AC programmable loads

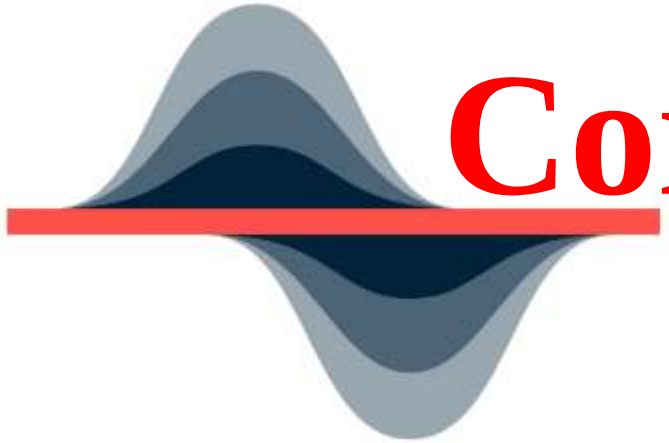
AC loads DC-AC converter
(8.7 kW. 800 Vdc - 230 Vac)

3 AC programmable loads (1 master / 2 slave)
2.9 kW/each one

Developed by
TechnoCEA

DC programmable loads

3 DC programmable loads
4 kW/load



Control systems

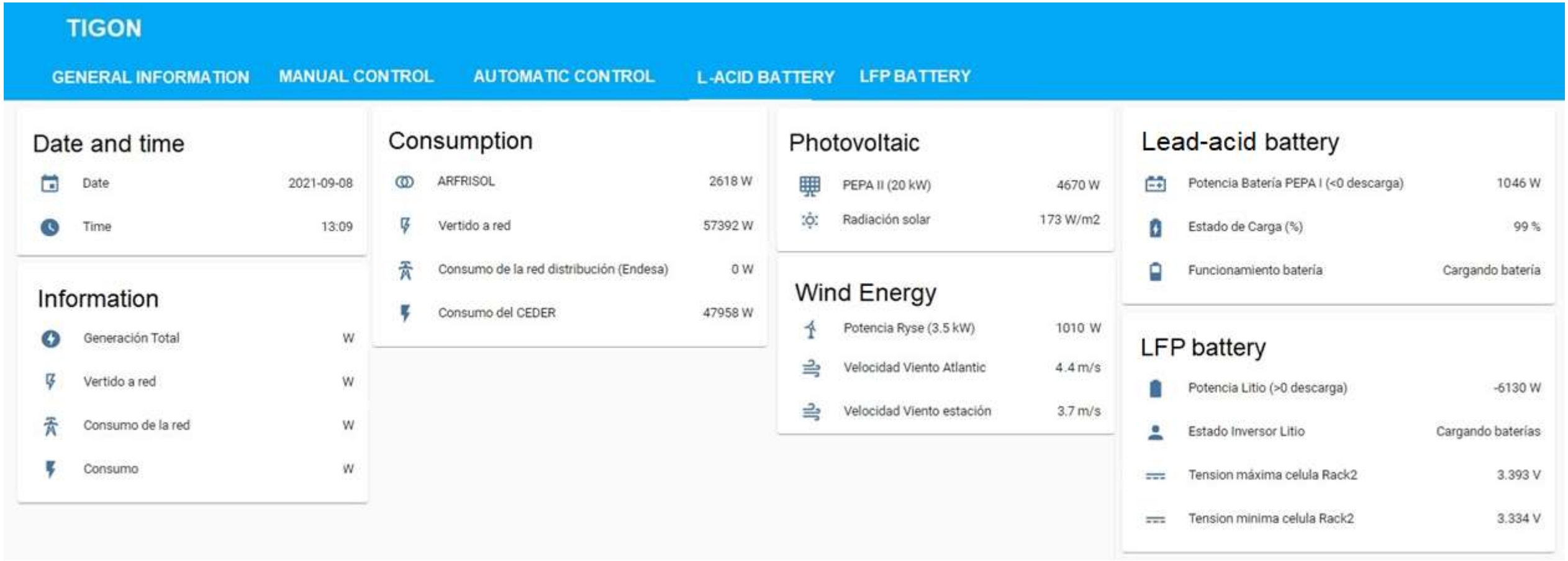
It is essential to have a control and management system for the equipment that makes up the microgrid in order to:

Correct operation of the whole
Detect, prevent and mitigate possible problems that may arise.
Study and analysis of the global operation of the microgrid.

Required

Installation of network analysers in each of the units for real-time readings.
Communication between all units
Possibility of manual and automatic operation via management software (Home Assistant)
Data logging
Cybersecurity system

EMS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GENERAL INFORMATION
MANUAL CONTROL
AUTOMATIC CONTROL
L-ACID BATTERY
LFP BATTERY
Date and time
Date 2021-09-08
Time 13:09
Information
Generación Total W
Vertido a red W
Consumo de la red W
Consumo W
Consumption
ARFRISOL 2618 W
Vertido a red 57392 W
Consumo de la red distribución (Endesa) 0 W
Consumo del CEDER 47958 W
Photovoltaic
PEPA II (20 kW) 4670 W
Radiación solar 173 W/m2
Wind Energy
Potencia Ryse (3.5 kW) 1010 W
Velocidad Viento Atlantic 4.4 m/s
Velocidad Viento estación 3.7 m/s
Lead-acid battery
Potencia Batería PEPA I (<0 descarga) 1046 W
Estado de Carga (%) 99 %
Funcionamiento batería Cargando batería
LFP battery
Potencia Litio (>0 descarga) -6130 W
Estado Inversor Litio Cargando baterías
Tension máxima celula Rack2 3.393 V
Tension minima celula Rack2 3.334 V

TIGON

GENERAL INFORMATION | MANUAL CONTROL | AUTOMATIC CONTROL | L-ACID BATTERY | LFP BATTERY

ESTADO

Estado	Reposo
Activar Inversor	
Funcionamiento batería	Parada
T° baterías	33 °C
Estado de Carga (%)	99 %
Carga completa	No
Descarga completa	No

MODELO

Bateria_PB_AC_7EAN_100	Conectada
Cargador 50kW	Conectada

VALORES

Flujo de Potencia Baterias	0 W
Tensión	246 V
Consigna de potencia	0 W

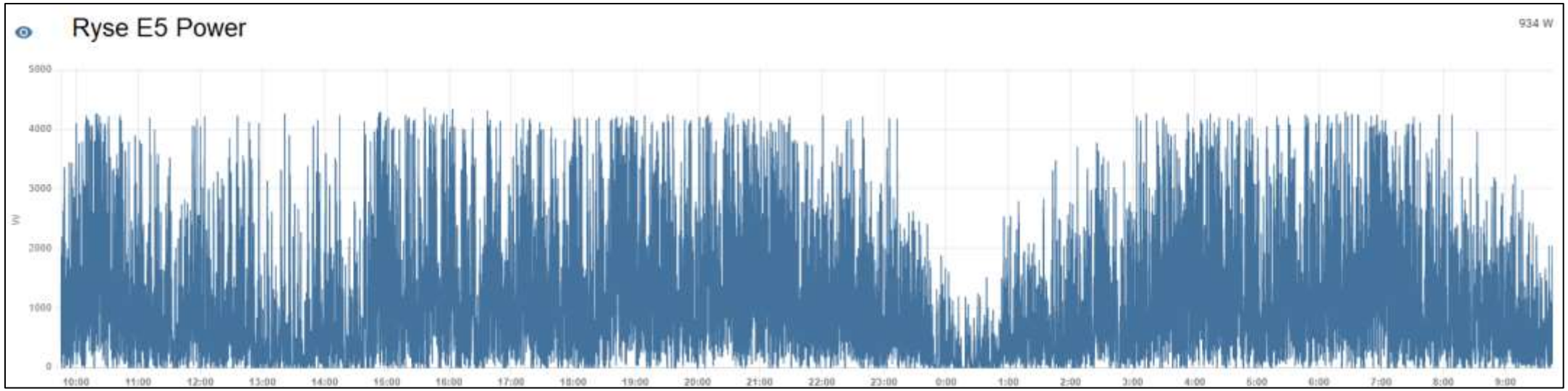
CARGA / DESCARGA

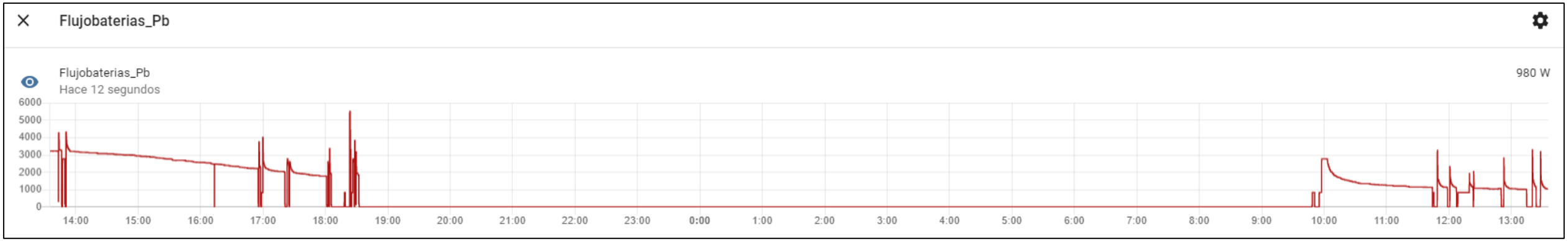
Tipo de carga	Normal
Tipo de carga	Normal
Consigna Potencia (W <0 descarga)	0
Consigna Potencia	EJECUTAR

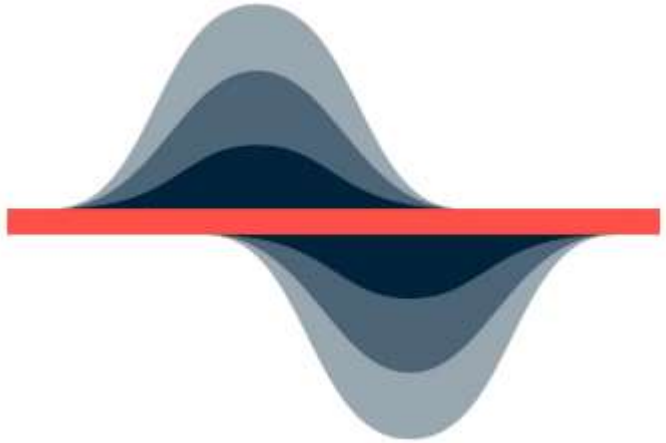
ERRORES BATERÍA

Error Tension de Red	OK
Error Frecuencia de Red	OK
Error Sobrecorriente de Red	OK
Error Sobretensión de Batería	OK
Error Sobrecorriente de Batería	OK
Error Sobretemperatura de Batería	OK
Error Sobretensión de bus	OK
Error Sobretemperatura de IGTB	OK
Error iGTB	OK
Error maniobra	OK

EMS - Graphics







Conclusions and Future work

- The CEDER-CIEMAT centre is a demonstrator centre for the TIGON project.
- It houses within its facilities a microgrid with hybrid AC/DC architecture.
- The generation and storage systems are currently installed and in operation, forming an AC microgrid - instantaneous data collection and action on the equipment.
- The STT, DC/DC converters, management and cybersecurity systems are under development.

* Completion of the installation of the hybrid micro-grid
* Start-up - Data collection
* Carrying out studies and subsequent comparative analysis between the conventional microgrid and the hybrid microgrid of:
    - Equipment efficiency
    - Energy registered before/after the converters
    - Energy generated and consumed at global level
    - Costs / benefits. Etc.

Thank you

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