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CINERGIA REGENERATIVE POWER SOLUTIONS

November 2018

The Company

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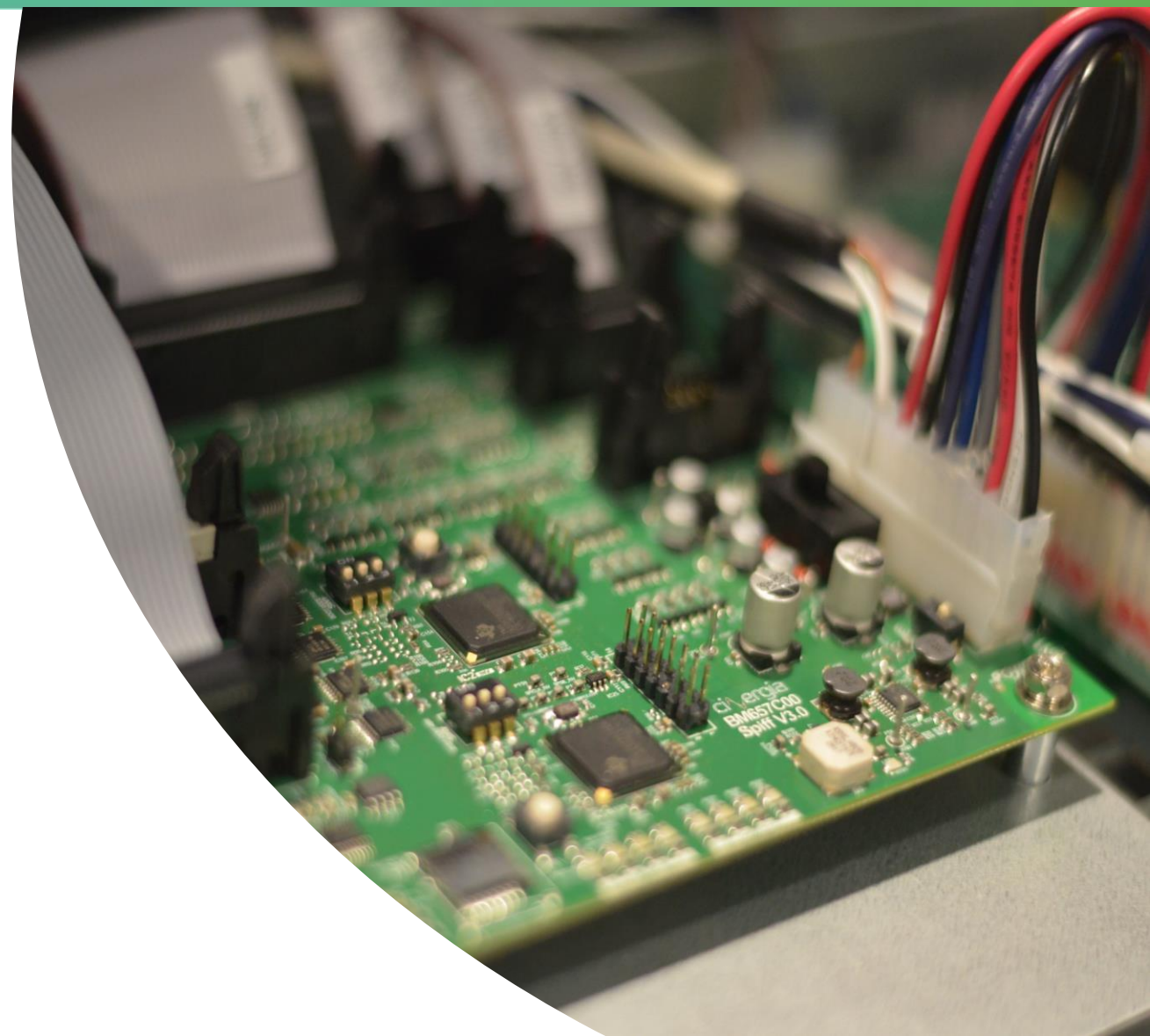
CINERGIA is the result of the know-how, the experience and the passion of our committed team in developing, producing and commercializing power electronics solutions.

Our areas of expertise include **power electronics**, DSP-based **digital control** of converters, **communications** and **HMI**.

We provide solutions for Testing, R&D and Academic applications.



The Company

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- **Power Electronics Specialized**

  CINERGIA accumulates **more than 65 years of accumulated experience** in the conception, design, production and commissioning of power electronics solutions. Before starting up the company, the founding team worked in an R&D center developing tailored power converters for third parties under a technology transfer scheme.

- **Founded on 2008**

  Our original activity was focused on providing **Engineering Services** and **Tailored Power Electronics** solutions. In 2014 the first distributors and sales representatives were appointed to commercialize CINERGIA's **Standard Product** line. The PLUS platform is the updated and improved version of this line, launched in 2018.

- **Industrial Partnership**

  With SALICRU, a company which designs and manufacturies industrial UPS in Santa Maria de Palautordera, Barcelona. Our solutions are based on the combination of SALICRU's power platform and CINERGIA's control and HMI hardware and software, developed in-house.

The Company today

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- **Engineer's Core**

  80% of CINERGIA's team is formed by Electrical, Control and Computing Engineers. Our technical team holds the knowledge and the experience to design, produce and customize high technology solutions.

- **›7500kVA of Power Supplied**

  Since 2014 when the Standard Product catalogue was launched. The PLUS platform is launched in 2018 discontinuing the previous platform launched in 2014.

- **Worldwide Network of Sales Partners**

  Our distributors and sales representatives are in Spain, UK, Germany, France, Italy, Netherlands, Belgium, Luxemburg, Austria, Switzerland, Israel, China, Singapore and India.

The company today

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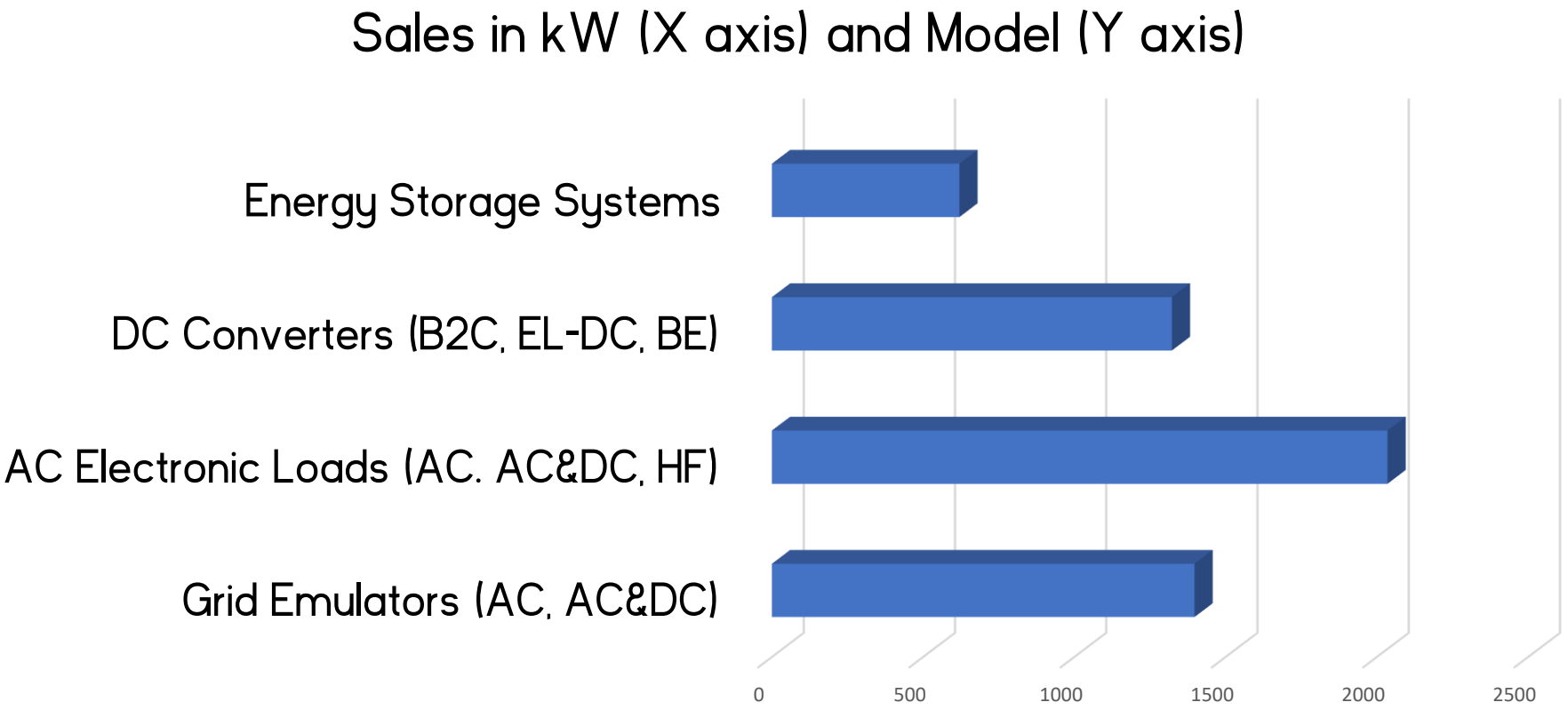

Why CINERGIA?

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- **Robust equipment**

  All products are based on an on-line UPS power hardware, designed to work 24/ 7, 365 days per year.

- **Energy saving**

  All models are regenerative allowing an average of 80% reduction of the electrical installation rating and the same reduction of consumed energy, both factors resulting in important CAPEX and OPEX savings

- **Flexibility and adaptation to future needs**

  Flexible devices with the possibility of upgrading the power and/or functionalities to attend future necessities

- **High performance at a competitive price**

  Using an industrial power platform allows CINERGIA to provide high quality solutions at a competitive budget.

- **Involvement with our clients**

  To adapt the products to specific needs and to provide support during its commissioning and use

Some of our clients

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HERA

DEACERO

STRI

ARTECHE

ARTS ET MÉTIERS ParisTech

EnBW

RWTH AACHEN UNIVERSITY

IREC

Institut de Recerca en Energia de Catalunya
Catalonia Institute for Energy Research

ALBA
Synchrotron Light Facility

cnrs
FRENCH National Centre for Scientific Research

CETaqua

CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

Miele

University of Novi Sad

Some of our clients

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Valeo

Enel

THE UNIVERSITY OF WARWICK

acciona

Jofemar

UNIVERSITEIT GENT

ÉCOLE POLYTECHNIQUE MONTRÉAL

SIGILLUM UNIVERSITATIS BARENSIS MCMXXV

COMSA EMTE

SIGILLUM PANORMITANÆ STVDIORVM VNIVERSITATIS

MetaSystems

VTT Technical Research Centre of Finland
Corporation

VTT

European Commission
JOINT RESEARCH CENTRE
The European Commission's in-house science service

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Image from Google Earth

The PLUS product family

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Is the product line launched in 2018 improving the functionalities, performance and flexibility of the 2014 platform

- **HIGHER RESOLUTION:** by using an oversampling technique @300kHz on the analogue measurements for I/V probes
- **FASTER DYNAMICS:** transient < 1ms, based on the higher resolution and low noise measurements
- **MORE FUNCTIONALITIES** in AC and DC
- **POWER AMPLIFIER** model for Power Hardware in the Loop
- **USER CONFIGURABLE** analog inputs & outputs (6+6)

The PLUS product family

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- INPUT & OUTPUT Emergency Signal: to integrate the unit in the Emergency Interlock Circuit
- USER CONFIGURABLE LIMITS AND ALARMS: for current, voltage, overcurrent, overvoltage & overload
- SAVING OF LIMITS AND ALARMS: in EEPROM by advanced user (password protected)
- NEW SOFTWARE: more intuitive and flexible
- 4.3" LOCAL TOUCHSCREEN
- DATALOGGING: of test variables, accessible from FTP (200ms minimum step time)

Regenerative Power Hardware

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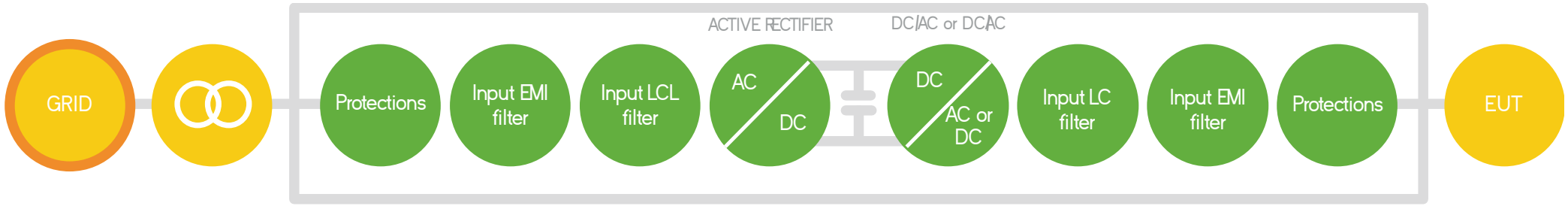

- **Back-to-back topology**
- **Grid-side (input) converter**: An Active Rectifier regulates the voltage at the DC-link while sinks/sources sinusoidal current in/to the AC-grid
- **EUT-side (output) converter**: a DC-AC inverter or DC-DC converter controls the output voltage / current / power / frequency

Overview of the product line

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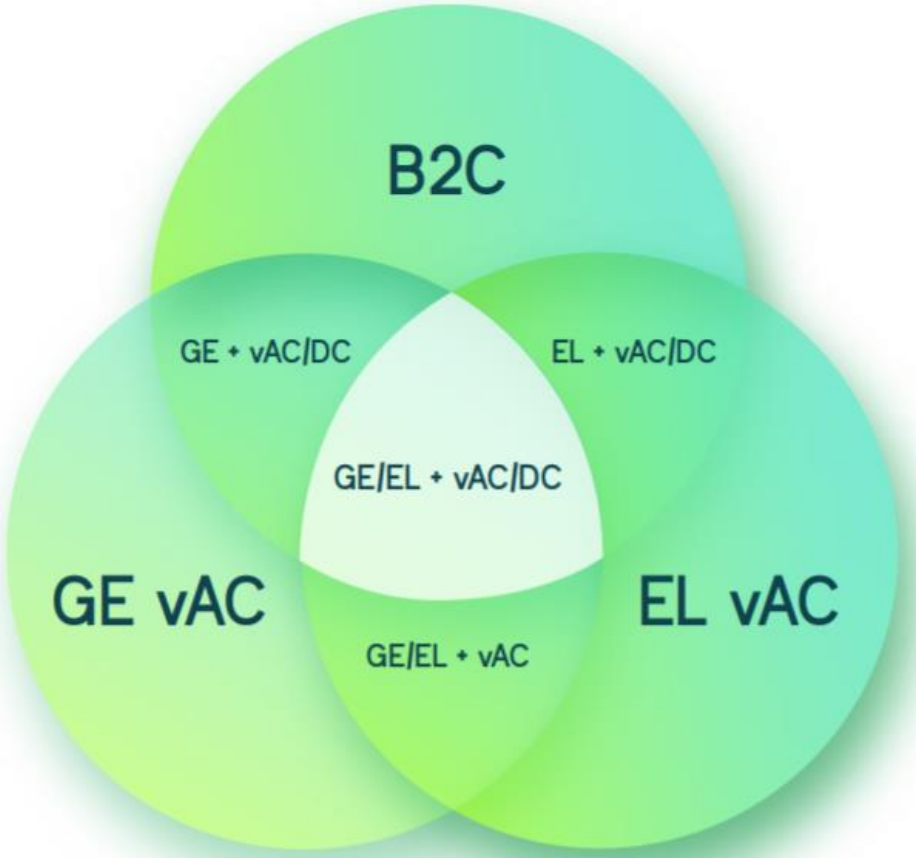


ALL in ONE

- GE/EL vAC/DC: AC Grid Emulator / AC Electronic Load / B2C

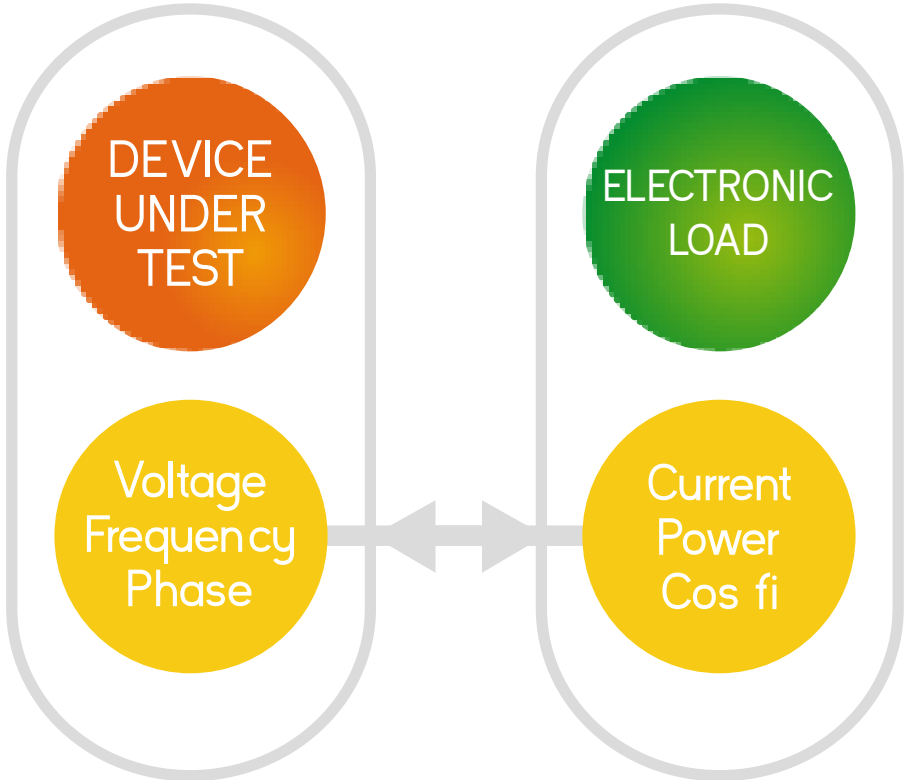
TWO in ONE

- GE vAC/DC: AC Grid Emulator / B2C
- EL vAC/DC: AC Electronic Load / B2C
- GE/EL vAC: AC Grid Emulator / AC Electronic Load

ONE FUNCTIONALITY

- GE vAC: AC only Grid Emulator
- EL vAC: AC only Electronic Load
- B2C: DC Source and Load

The AC Electronic Load



The EL vAC is an AC Regenerative Current Source:

it controls the **AC current magnitude and phase** defined by the user. The voltage and frequency will be imposed by the DUT.

Regenerative Power Hardware: AC version (EL+)

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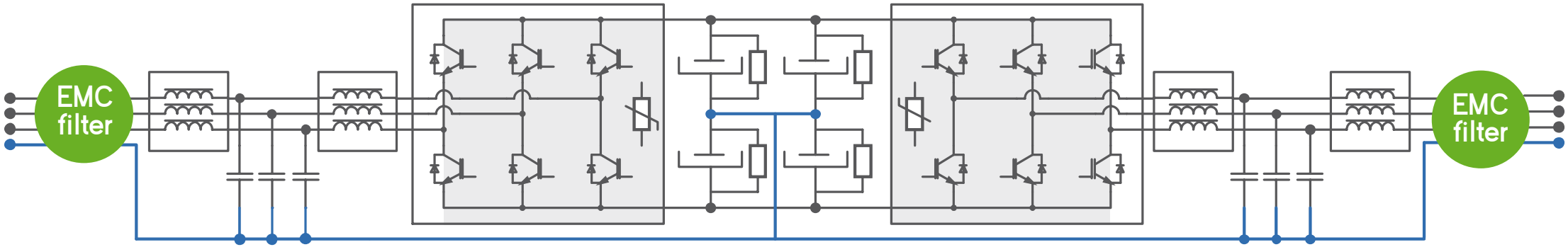

Current Sensor x3

Driver x6

Voltage Sensor x2

Driver x6

Current Sensor x3

Voltage Sensor x3

DSP Controller

DSP Controller

Voltage Sensor x3

HMI

Modbus/ TCP / Ethernet

The AC Grid Emulator

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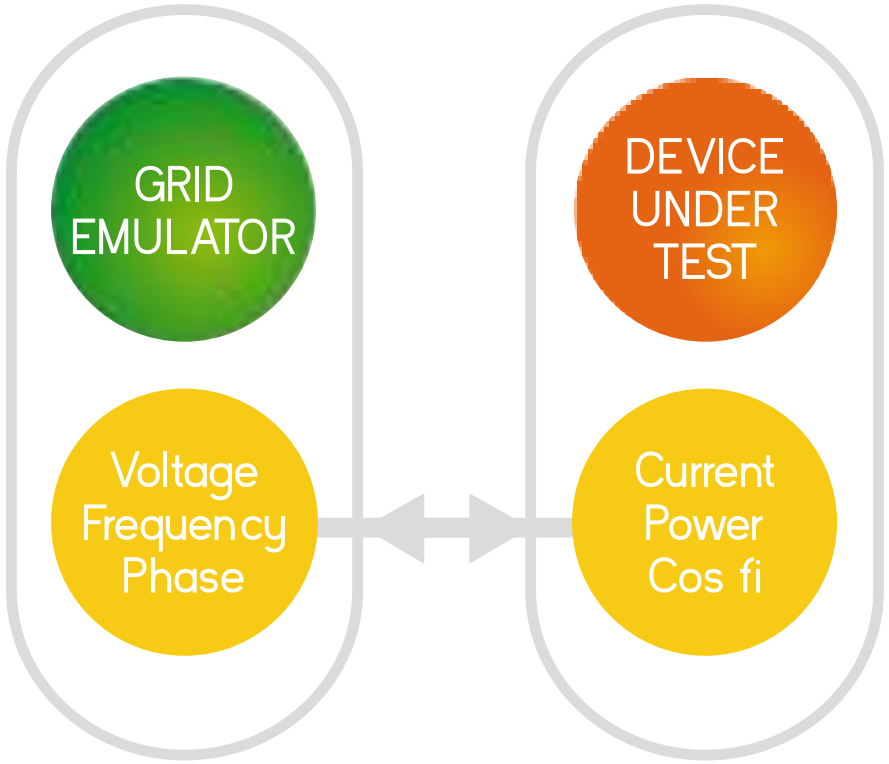

The GE vAC is a 4Q Regenerative AC Voltage Source:

It generates and controls the **AC voltage magnitude, frequency, harmonic content and phase**. The current and power will be imposed by the DUT.

Regenerative Power Hardware: AC version (GE+)

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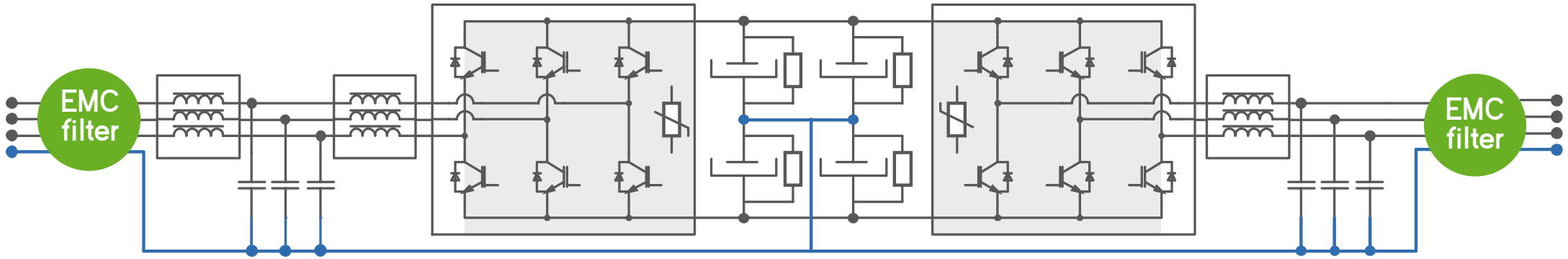

Current Sensor x3

Driver x6

Voltage Sensor x2

Driver x6

Current Sensor x3

Voltage Sensor x3

DSP Controller

DSP Controller

Voltage Sensor x3

HMI

Modbus/ TCP / Ethernet

The B2C: the Regenerative DC Source / Load

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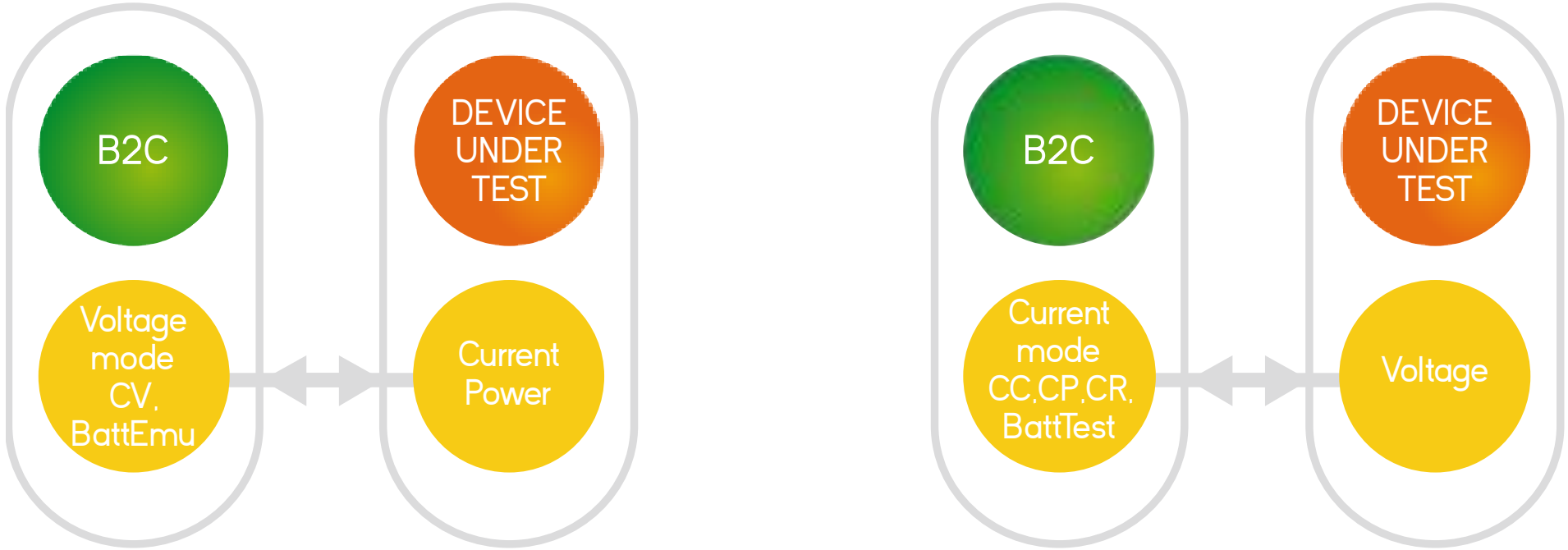
The B2C is a **DC Regenerative Converter** that can work in Source/Sink applications (2Q and 4Q) as a Voltage Source or an Electronic Load or Battery Tester/Cycler or Battery Emulator or PV Panel Emulator.



The B2C+ (Regenerative DC converter)

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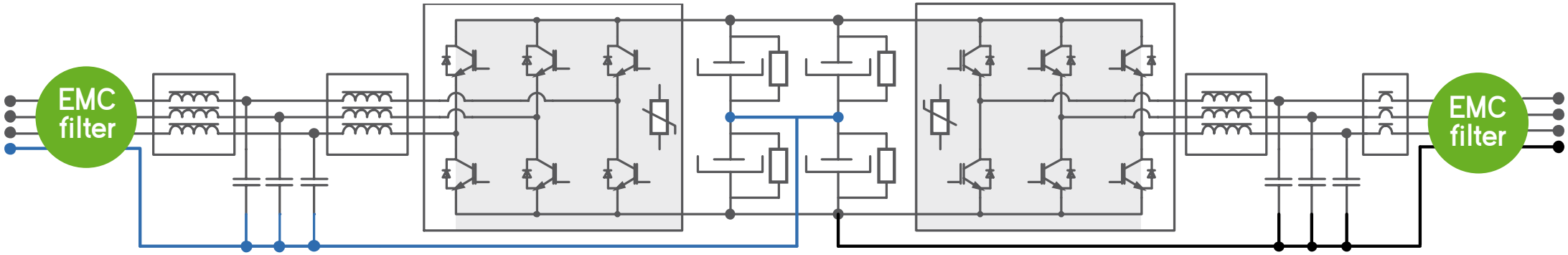

Current Sensor x3

Driver x6

Voltage Sensor x2

Driver x6

Current Sensor x3

Voltage Sensor x3

DSP Controller

DSP Controller

Voltage Sensor x3

HMI

Modbus/ TCP / Ethernet

Two in One: the AC/DC Electronic Load

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EL vAC + B2C = EL vAC/DC

Two in One: the AC/DC Grid Emulator

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GE vAC + B2C = GE vAC/DC

Two in One: the AC Electronic Load and Grid Emulator

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All in One: the GE/EL vAC/DC

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EL vAC + GE vAC + B2C = EL vAC/DC

Summary of Models and HW Versions

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Model	Regenerative AC Source (GE+)	Regenerative AC Load (EL+)	Regenerative AC source/load (GE/EL+)	Regenerative DC source/load (B2C+)
Versions	AC only	AC only	AC only	Battery Testing
	Power Amplifier	Power Amplifier	Power Amplifier	Battery Emulation
	AC/DC	AC/DC	AC/DC	PV Emulation
		HF		

Models & Hardware Versions

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Model	HW Version	AC modes				DC modes			
		CV	CC	CS/CP	CZ	CV	CC	CP	CR
GE+	vAC	✓	-	-	-	-	-	-	-
	vPA-V	✓	-	-	-	✓	●	●	●
	vAC/DC	✓	-	-	-	✓	✓	✓	✓
EL+	vAC	-	✓	✓	✓	-	-	-	-
	vPA-C	-	✓	✓	✓	●	✓	●	●
	vAC/DC	-	✓	✓	✓	✓	✓	✓	✓
GE/EL+	vAC	✓	✓	✓	✓	-	-	-	-
	vAC/DC	✓	✓	✓	✓	✓	✓	✓	✓
B2C+		-	-	-	-	✓	✓	✓	✓

✓ Available in the Standard version

● Available as an option

- Not available

Grid Emulator GE+

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Grid emulators are designed to emulate Electrical Grids in AC and DC (optional). The equipment is 4 quadrant regenerative so the energy can be re-injected to the power grid.

As an AC programmable voltage source, It can create different electrical networks:

- Three phase power grid (3F+N) from 0 to 480Vac
- Single phase and Two phase (Split phase) systems
- (optional) DC Voltage Source from -750 to 750Vdc

It can also create disturbances for testing purposes as:

- Voltage harmonics, up to 15th multiple and 1 free-harmonic up to the 50th independent per phase
- Flicker (programmable amplitude and frequency)
- Overvoltage
- Interruptions and voltage dips (balanced and unbalanced)
- Programmable variations in frequency
- Programmable virtual R of grid

Electronic Load EL+

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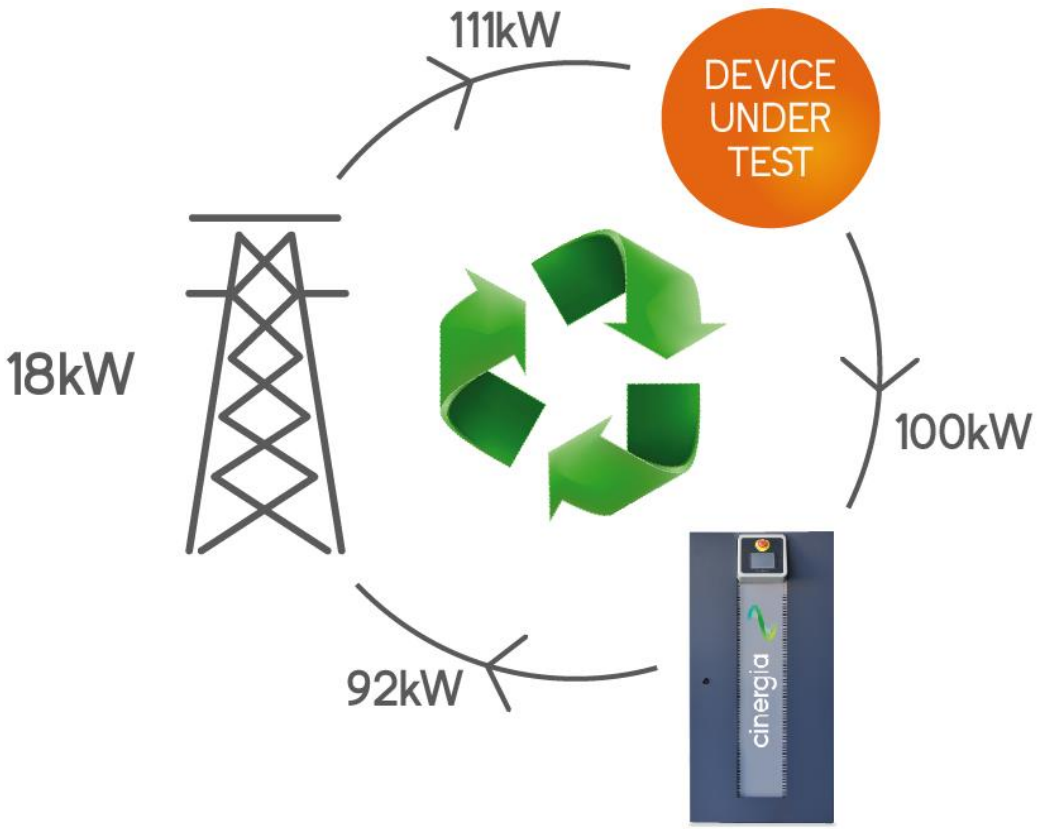
CINERGIA electronic loads are **Regenerative** and full **4Q** allowing:

- Saving 80%(*) of the test energy
- Reducing the grid power to 20%(*)
- Additional operative savings by automating the test



(*) Actual energy savings and power reduction figures will depend on each test platform. Values shown here are an example for a DUT with efficiency of 90%.

Electronic Load EL+

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Electronic loads are designed to emulate linear and non-linear AC and DC currents to test electric and electronic devices. All CINERGIA Electronic Loads are regenerative and full 4Q.

AC Electronic Loads can emulate single phase and three phase (balanced and unbalanced, linear and non-linear) loads. Operating modes available:

- Constant Current (CC) with harmonic generation (up to 15th multiple and 1 free-harmonic up to the 50th)
- Constant Power (CP)
- Constant Impedance (CI)

DC Electronic Loads provide 3 channels that can work independently or parallelized to increase the current. The following operating modes are available:

- Constant Resistance (CR)
- Constant Power (CP)
- Constant Current (CC)
- Constant Voltage (CV)

Note: The functionality of AC and DC equipment in the same unit is an option and will be quoted separately

Bidirectional DC Converters B2C+

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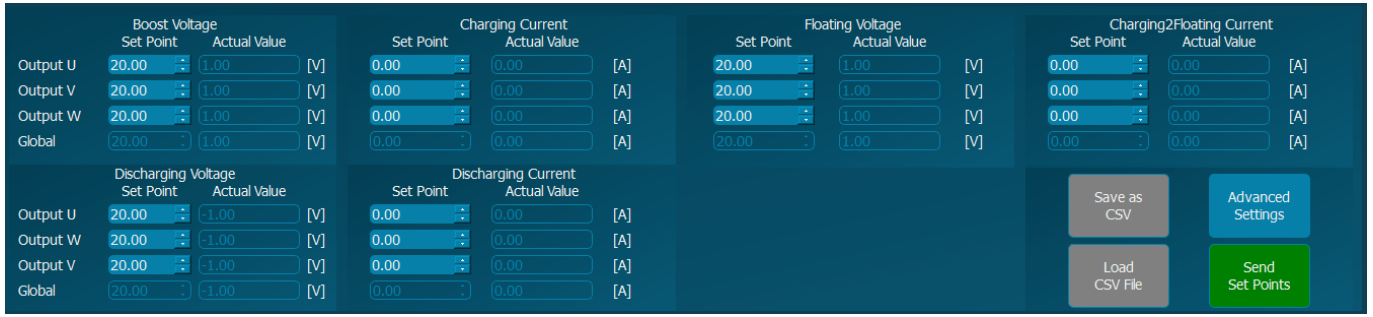
CINERGIA's DC Regenerative Converters are designed to generate a controlled DC voltage or current in sink/source applications. This equipment has energy recovery capability which allows energy and power savings

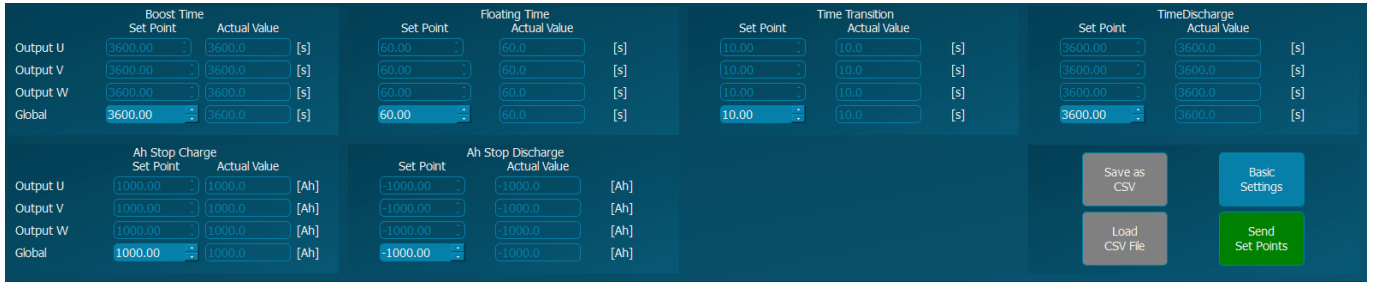
The equipment has 3 independent DC output channels. Each channel can be regulated independently or they can be parallelized for high current applications. Operation modes:

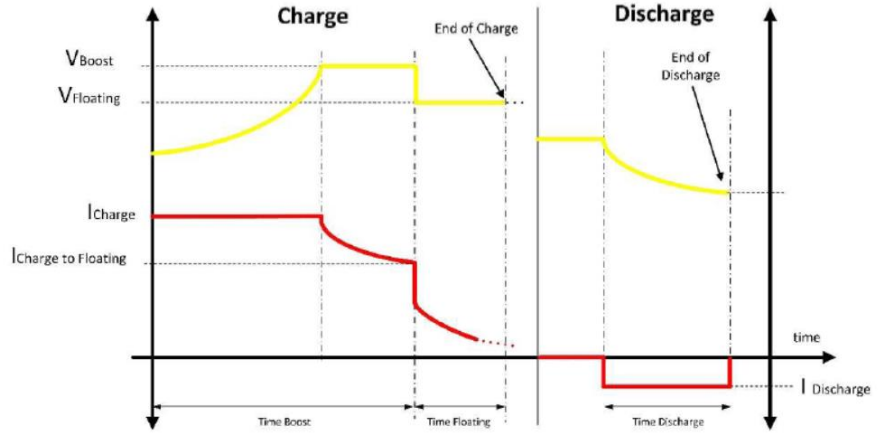
- Constant Voltage (CV)
- Constant Current (CC)
- Constant Power (CP)
- Constant Resistance (CR)
- Software options: Battery Testing, Battery Emulation, PV Panel Emulation
- Hardware options: Separated Channels Control, Serial/Parallel connection

B2C+: Battery Testing / Cycling

The Battery Testing software option (included in the B2C+, available as option in vAC/DC versions) allows advanced testing of batteries: charging, discharging and cycling

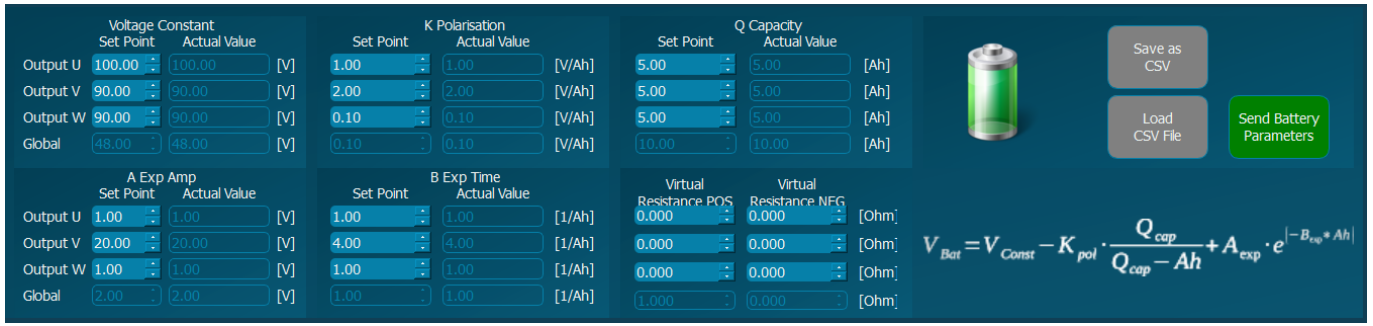


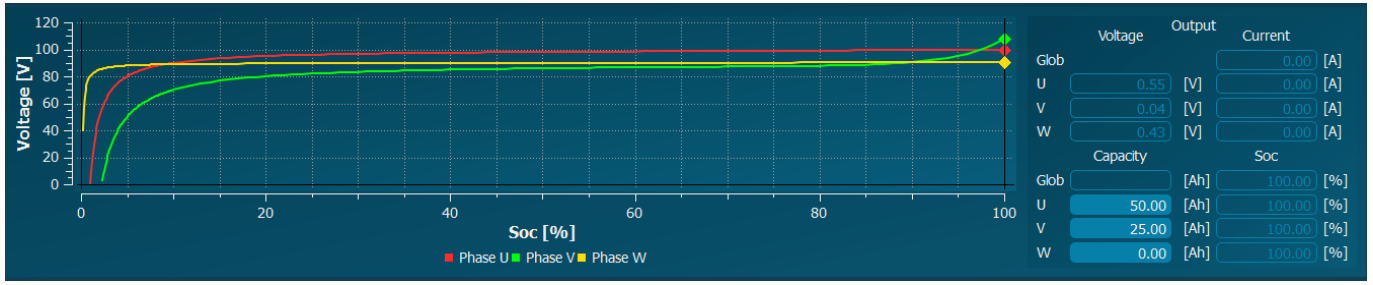


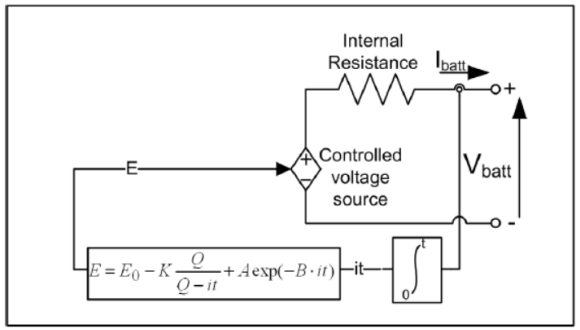


B2C+: Battery Emulator

The Battery Emulator is DC regenerative power converter that behaves as a real battery pack. CINERGIA's BE is based on a mathematical model that allows the emulation of different cell technologies







Type / Parameters	Lead-Acid 12V 1.2Ah	Nickel-Cadmium 1.2V 1.3Ah	Lithium--Ion 3.6V 1Ah	Nickel-Metal-Hydrid 1.2V 6.5Ah
$E_0(V)$	12.6463	1.2505	3.7348	1.2848
R (Ω)	0.25	0.023	0.09	0.0046
K (V)	0.33	0.00852	0.00876	0.01875
A (V)	0.66	0.144	0.468	0.144
B $(Ah)^{-1}$	2884.61	5.7692	3.5294	2.3077

Model based on the article:A Generic Battery Model for the Dynamic Simulation of Hybrid Electric Vehicles

Olivier Tremblay, *Member IEEE,* Louis-A. Dessaint, *Senior Member IEEE,* and Abdel-Illah Dekkiche Electrical Engineering Department, Ecole de Technologie Superieure

Smart Grid and Micro Grid Solutions

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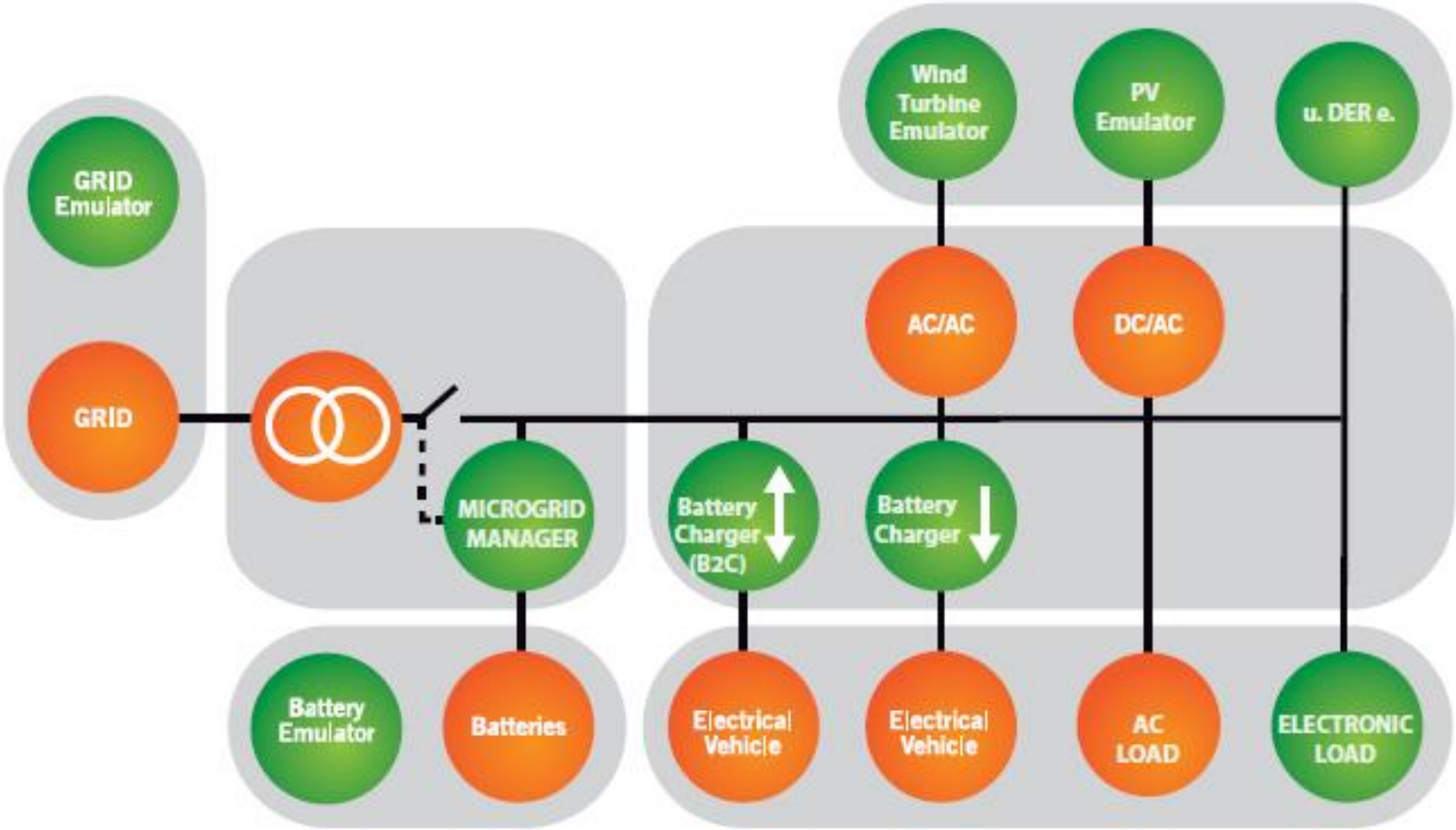

Smart Grid and Micro Grid solutions

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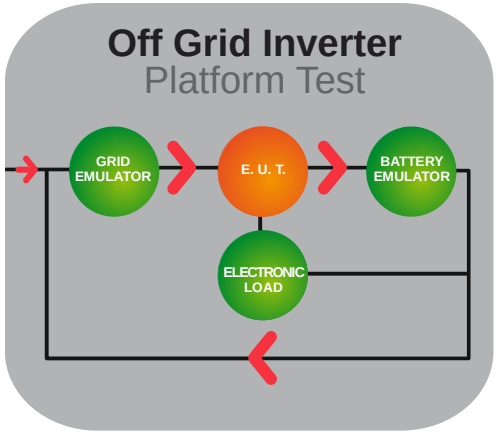
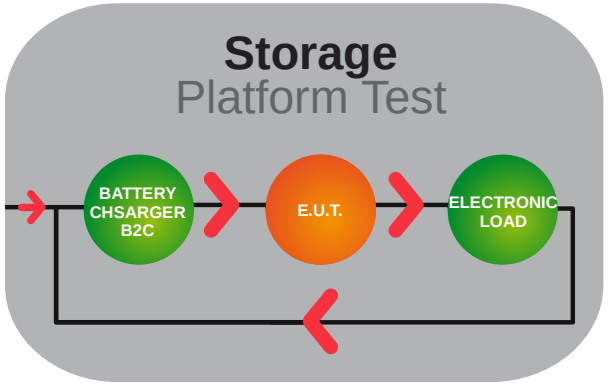
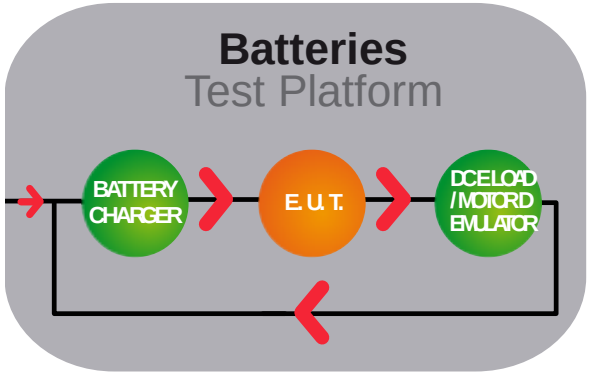
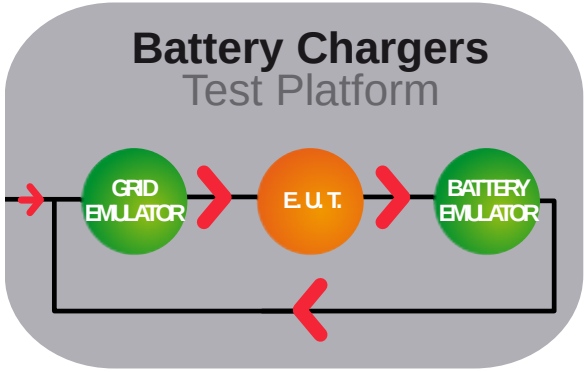
CINERGIA Products:

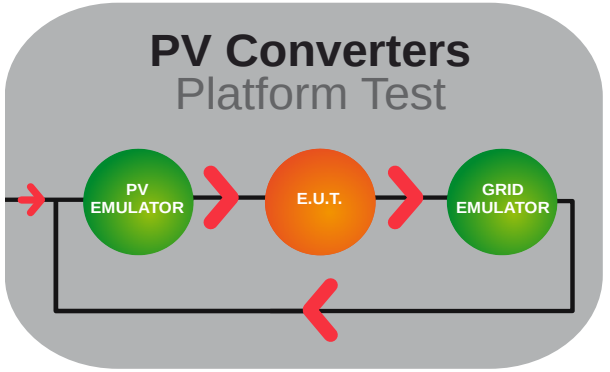
- Grid Emulator (GE)
- DC Electronic Loads (EL-DC)
- Battery Emulator (B2C option)
- Bidirectional Battery Chargers (B2C)
- PV emulator (B2C option)











Electromobility solutions

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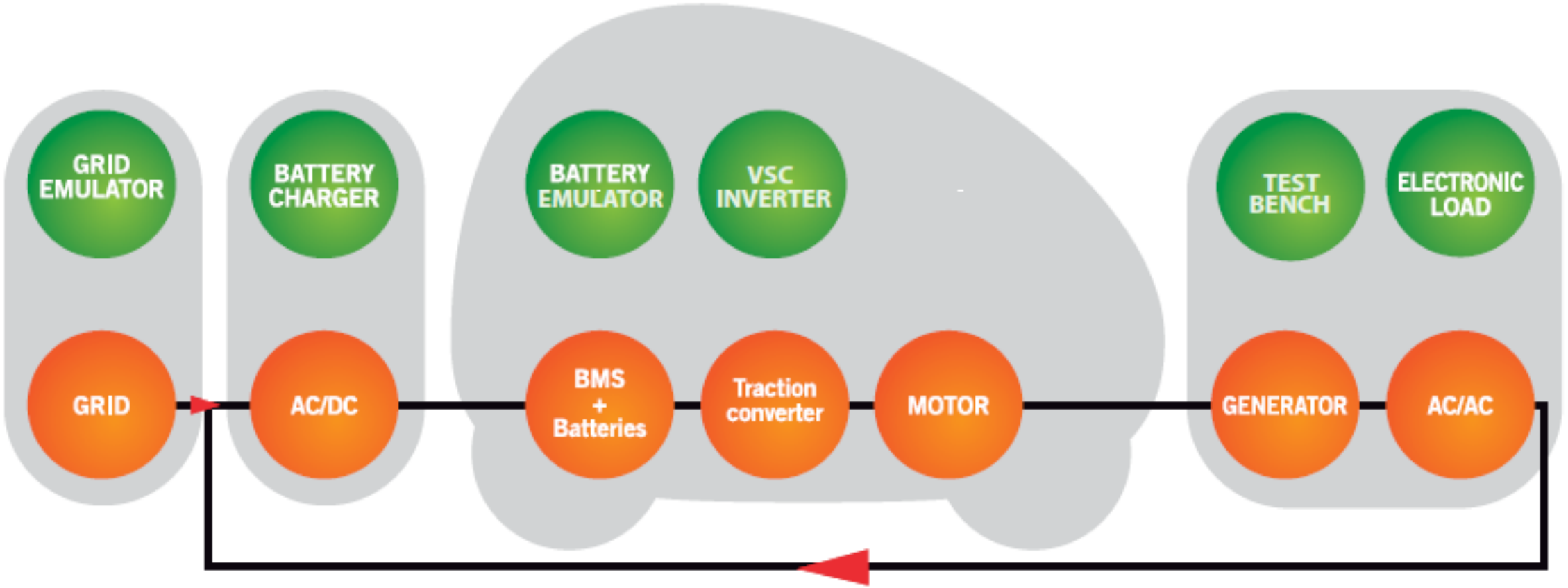

Electromobility solutions

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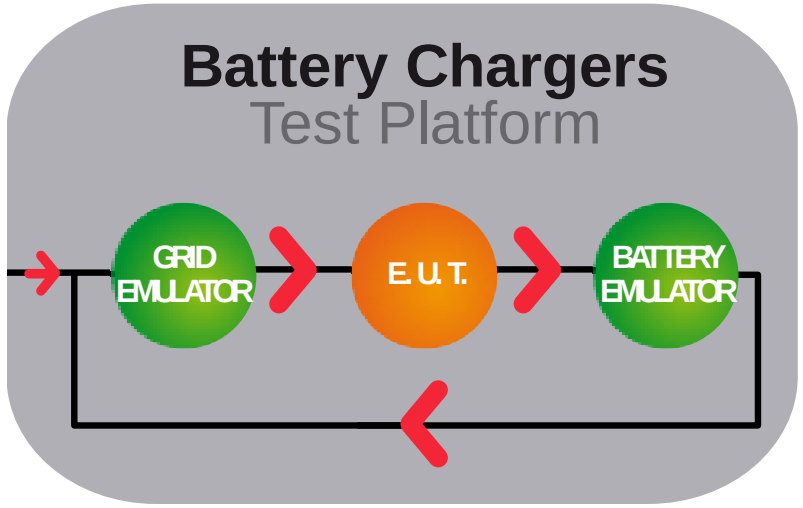
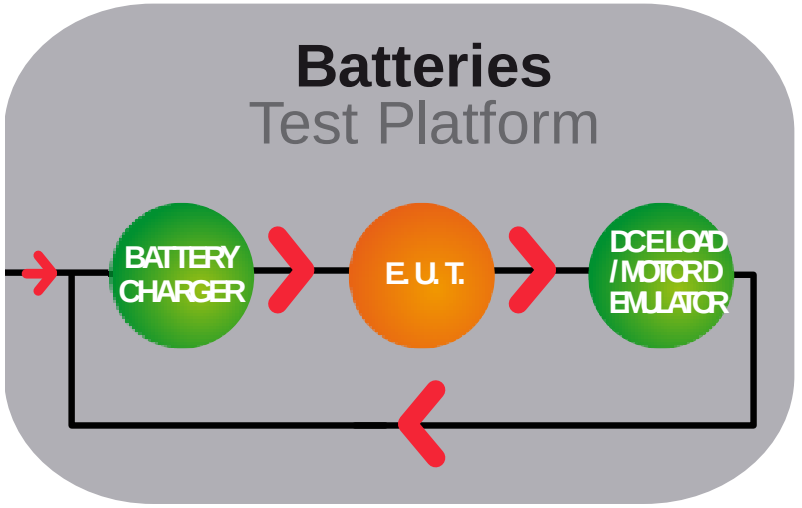
CINERGIA Products for testing Batteries and Chargers (on-board / off-board):

- Grid Emulator (GE)
- DC Electronic Loads (EL-DC) (emulation of traction)
- Battery Emulator (BE)
- Bidirectional Battery Chargers (B2C)





Electromobility solutions

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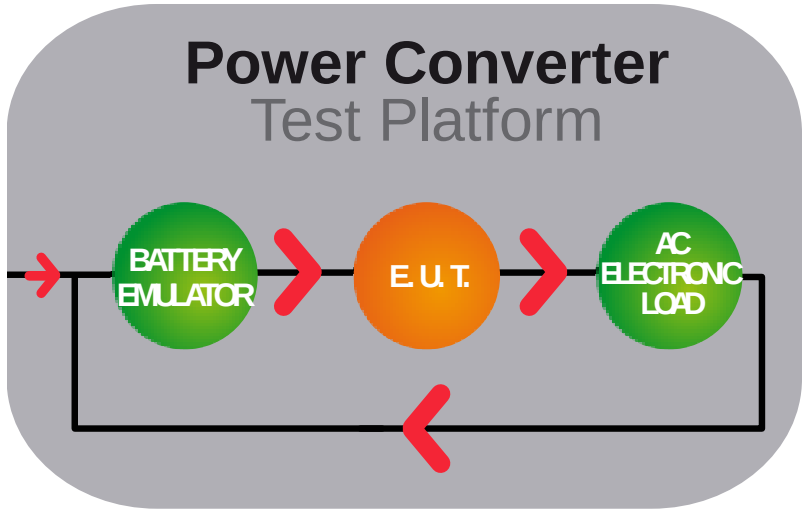
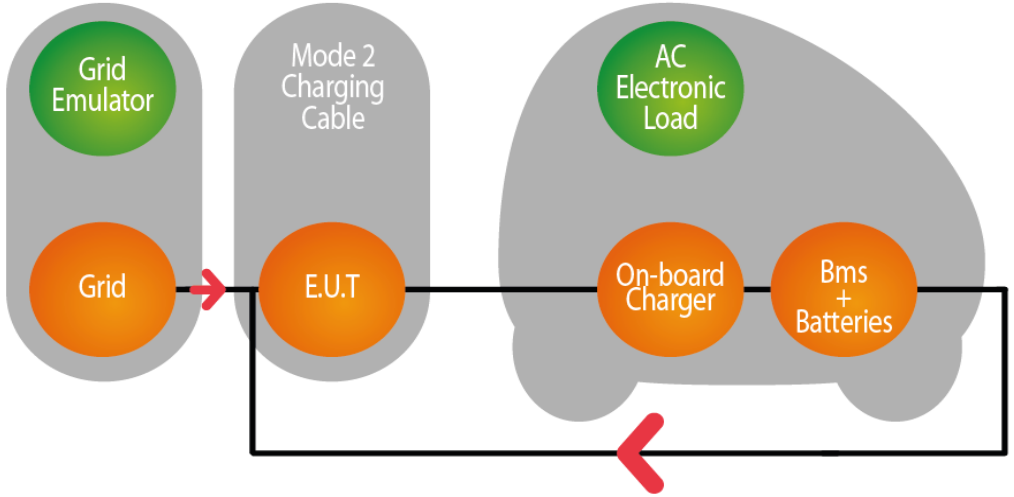
CINERGIA products for Traction Converters tests:

- AC Electronic Loads (EL-AC)
  (please, consult this application. Additional LC filters may be required)
- Battery Emulators (BE)



CINERGIA products for Charging Cable tests

- Grid Emulator (GE)
- AC Electronic Load (EL-AC + IT)



General Test Solutions

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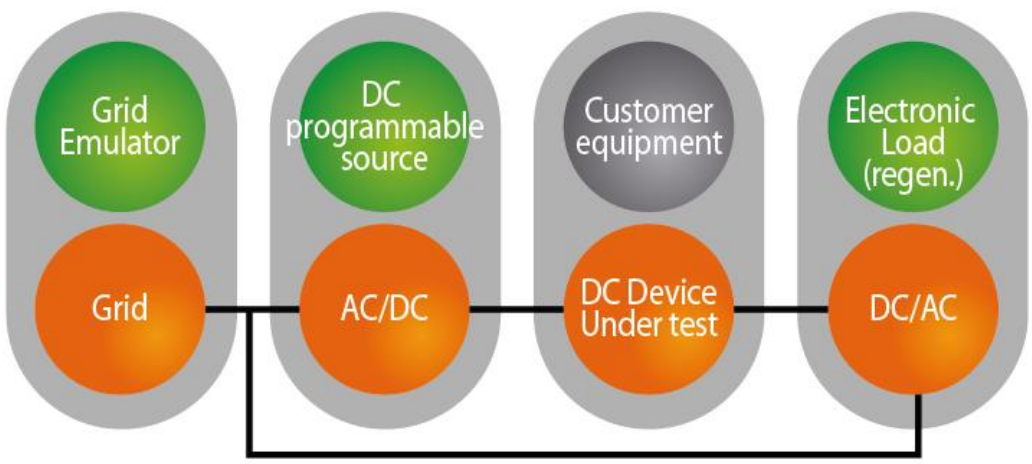
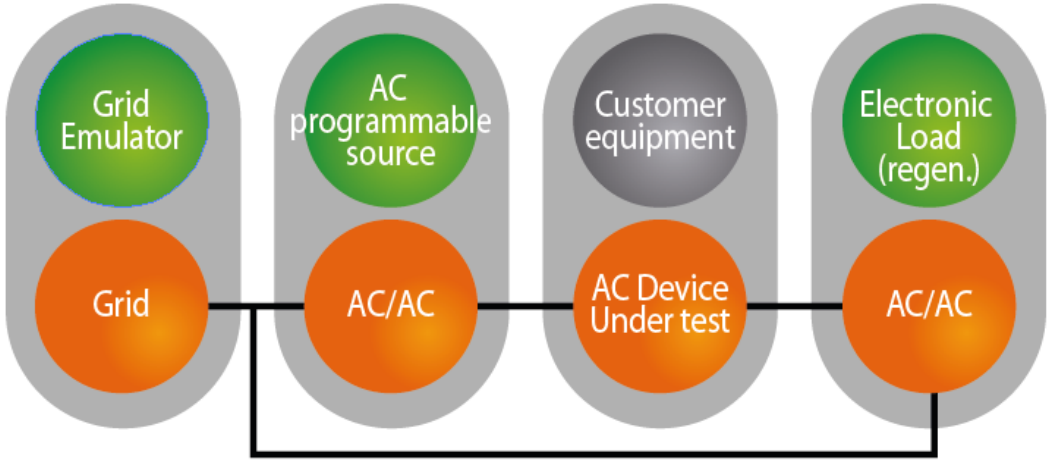
Platforms for academic, R&D and Industrial Labs (R&D, production line, Quality and Certification):





CINERGIA: Regenerative Power Converters

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More information at:

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