CIRTEM

POWER OPTIMISED

Company presentation

December 2020

CIRTEM POWER OPTIMISED

Mobility

- Speed drives
- DC/DC & Chargers
- ICE & Hybrid Control
- Supervision

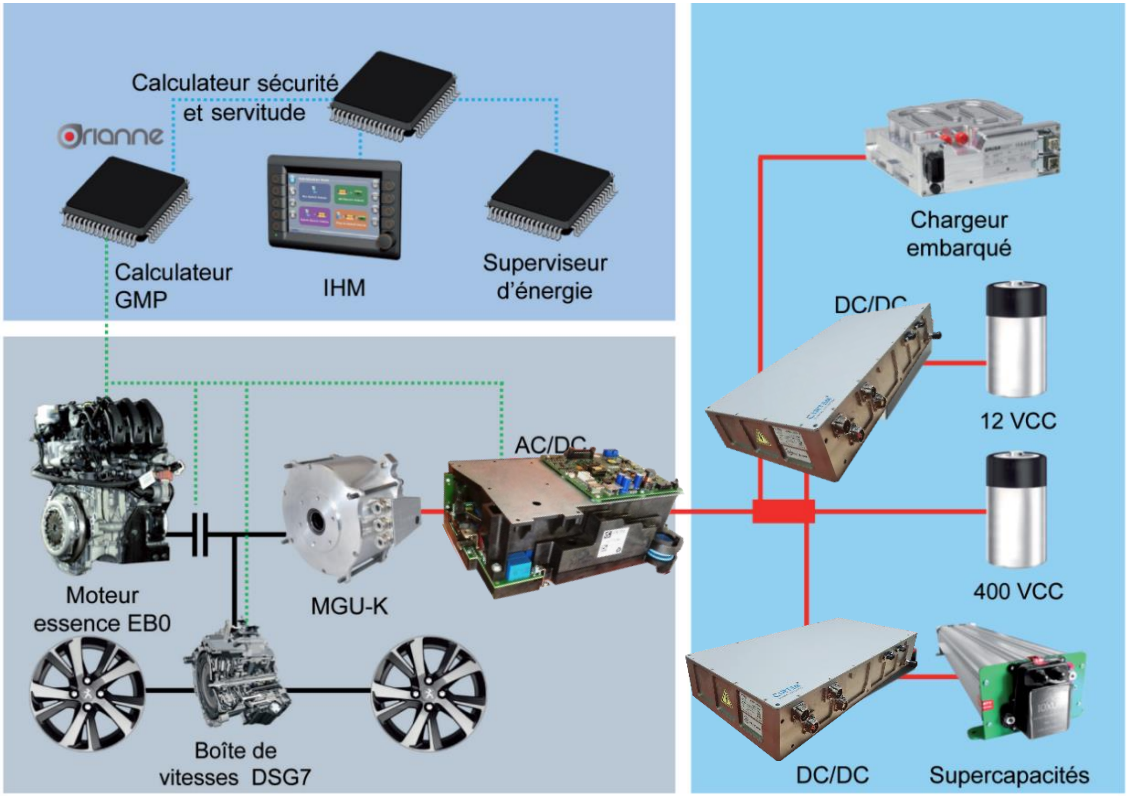
Power Converters and Electronic Equipments

5 kW to 5 MW

50 V to 50 kV

Prototypes up to 10 kU/year

Hybrid Labcar Realization



Powertrain:

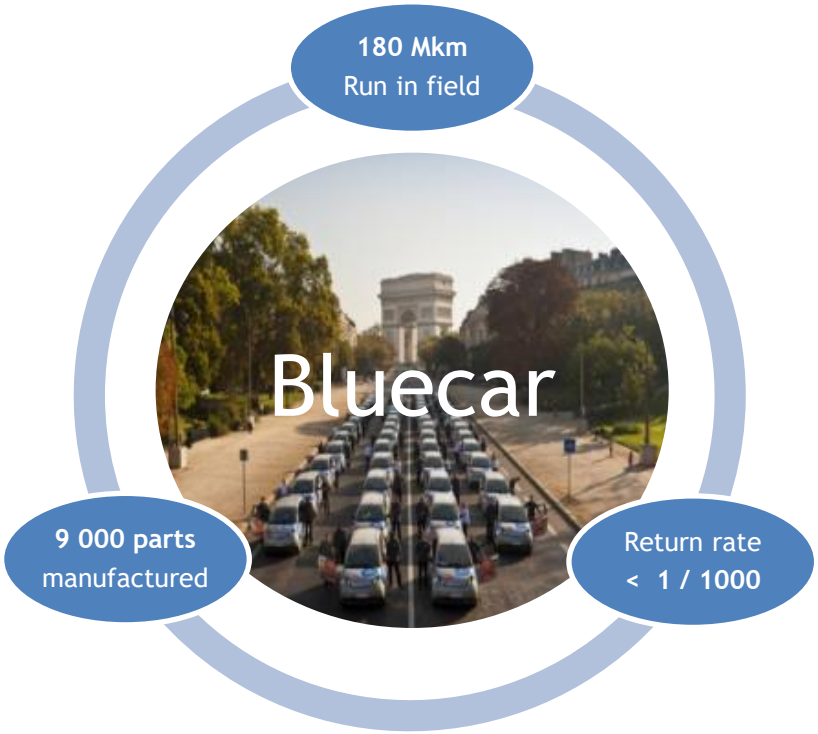
- P2 parallel hybrid architecture
- ICE PSA EBO 1.0l 50 kW
- Electric motor 28 kW
- Gear box VW DSG7

Electric architecture:

- 2 Li-ion batteries 400 V, 2.2 kW.h, 4 kW
- Ultra caps 100 V, 100 W.h
- Embedded charger
- 400 V high voltage bus

CIRTEM Technology
EV Powertrain Inverter

- **3-phase IGBT motor drive** for permanent magnet synchronous motor
- **Freescale MPC 5534** control
- Specs :
  - 450 V DC battery / 170 A by phase
  - Liquid cooling
  - 2 CAN buses



Electron II (GRUAU)

Inverter 70 kW_{nom}

- For synchronous motor (MSAP)
- 3-Phase IGBT inverter
- µC control
- Water cooled
- Max Power 90 kW
- U_{dc} max 450 V

Blue Bus

Battery booster 90 kW

- Reversible DC/DC
- IGBT interlaced leg chopper
- µC control
- Liquid cooling
- Power 90 kW
- U_{dc} max 750 V

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Railway Application Projects

► Reversible Rectifier (RRV Project)

- ✓ Goal : on existing 750 V subway / tramway lines, recover train braking energy to reinject it in the power grid and reduce mechanical braking dust
- ✓ 1 MW peak stationary equipment - 3 installations
- ✓ CIRTEM design and manufacturing of a conversion core, on-site development

► INSERE HT Project

- ✓ 4 cell chopper, flying cap, 3 kV, 800 A, with IGBT, 20 kHz apparent switching frequency
- ✓ CIRTEM design and realization of conversion core
- ✓ Technology demonstrator
- ✓ Collaborative project : SNCF – RFF – LAPLACE Lab. – SCLE SFE (ENGIE Group) – CIRTEM

► Stationary Converter

- ✓ 25 kV AC to 1 500 V DC - 1,5 MW peak
- ✓ Cirtem control design
- ✓ For SNCF test tracks

► HVBS Project

- ✓ 3 MW power compensator for a 20 kV AC line, where the TGV hi-speed train is proceeding
- ✓ Stationary equipment to be installed on problematic areas
- ✓ Collaborative project : SNCF – RFF – LAPLACE Lab. – SCLE SFE (ENGIE Group) – CIRTEM

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Hydrogen Application Projects

AC/DC Reversible Converter

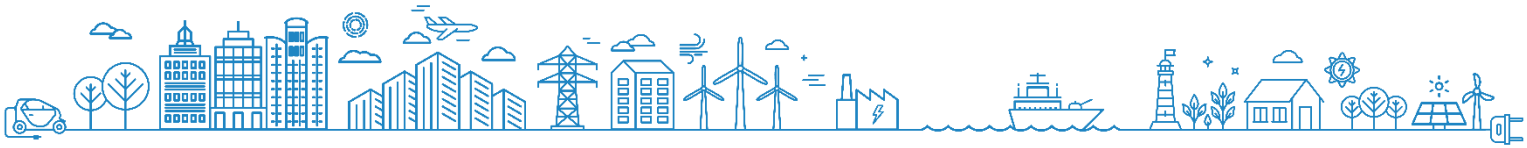
HEL25600A

► Main features:

- ✓ Reversible
- ✓ Configurable On or Off grid
- ✓ Can accept the connection of 3 types of stacks (130, 145 et 160 cells)
- ✓ Isolated galvanically with a three-phase transformer
- ✓ Rated power up to 188 kVA
- ✓ 10% of surcharge capacity

► Electrical characteristics:

- ✓ Input voltage : 280 V_{dc} – 750 V_{dc}
- ✓ Input maximal current : 540 A_{dc}
- ✓ Output voltage : 400 V_{eff} ± 10%
- ✓ Output frequency : 50 Hz
- ✓ Output power (depending on the type of stacks) : 152 kW – 188 kW

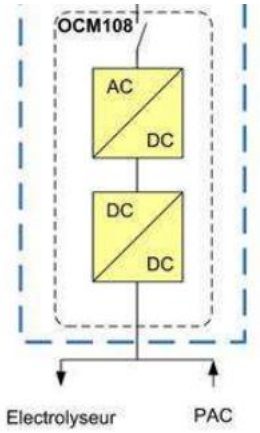


AC/DC Reversible + DC/DC Converter

OCM 108

► Main features:

- ✓ Reversible
- ✓ Configurable On or Off grid
- ✓ Possible to parallelize for more power
- ✓ Single phase uninsulated network
- ✓ CAN connectivity



► Electrical characteristics:

- ✓ Input voltage range : 80 Va – 265 Va
- ✓ Frequency : 47 to 63 Hz
- ✓ Output voltage range : 100 – 450 Vdc
- ✓ Max continuous output power : 6 – 10 kW
- ✓ Max continuous output current : 40 A
- ✓ Efficiency : Up to 96,5 %

DC/DC Reversible Converter

CND100

► Main features:

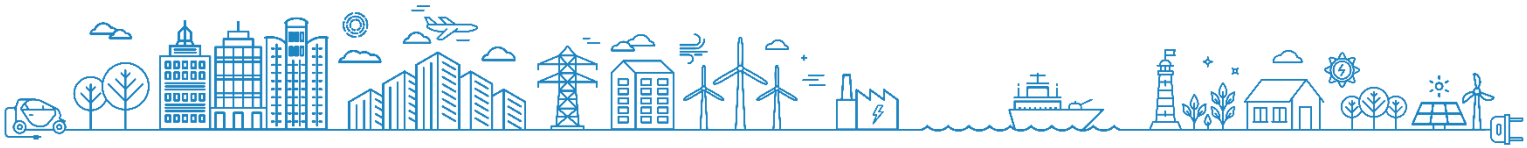
- ✓ Interlaced convertor with IGBTs
- ✓ Advanced control algorithm for optimal power module usage and efficiency
- ✓ Bootloader for field upgradeable firmware
- ✓ Liquid cooled
- ✓ IP Protection : ….
- ✓ Can work in mode buck or boost

► Electrical characteristics:

- ✓ Input voltage range : 150 V_{dc} – 750 V_{dc}
- ✓ Output voltage range : 40 V_{dc} – 550 V_{dc}
- ✓ Max continuous output power : 120 kW
- ✓ Max continuous output current : 300 A
- ✓ Efficiency : Up to 97 %

Others projects
On demand

- **CIRTEM also developed other converters DC/DC with different powers :**
  - ✓ 20kW
  - ✓ 33kW
  - ✓ 100kW
  - ✓ 125kW
- **Large acceptable voltage range depending on fuel cell types.**
- **Customized converter development depending on targeted application.**



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