



Saving energy is one of the main focuses in the data centre industry, due to rising energy bills and environmental constraints. Improving a data centre PUE (Power Usage Effectiveness) is therefore a target for owners and managers, whilst being flexible to cope with such a fast changing market.

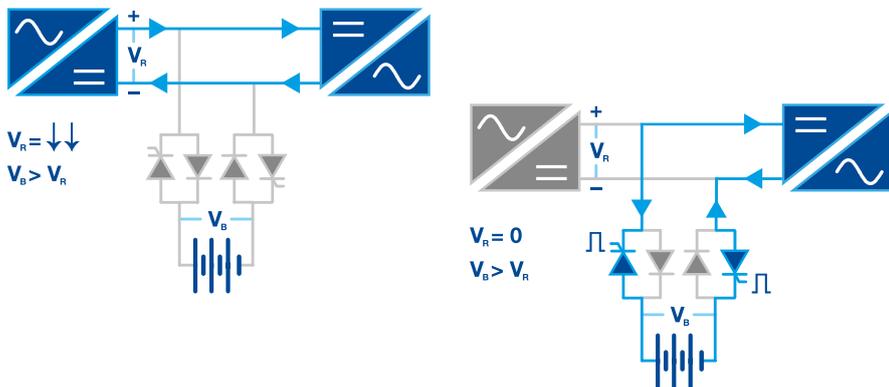
Regarding UPS, all these needs must translate into:

- High efficiency
- Modularity
- Low total cost of ownership

Borri is committed to fulfilling those needs by joining the Eni Programme for the building of its new Green Data Center - discussed in detail here in the case study section - and developing innovative technologies for high efficiency power supply solutions dedicated to ICT.

## Borri patented Green Conversion technology and battery control techniques

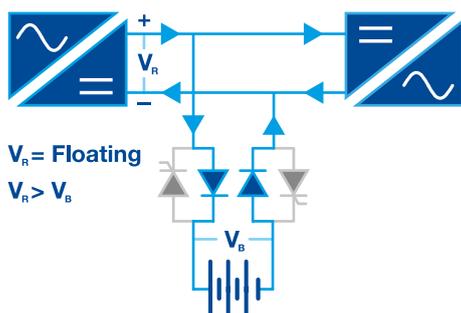
Green Conversion technology is based on a patented control algorithm, managing the battery-inverter subsystem in order to enhance double conversion efficiency and extend battery life.



When a battery is charged and the mains are stable, it is protected from the DC-link ripple by a Green Conversion solid state dynamic battery switch, acting as a digital filter eliminating the chief cause of battery ageing.

Green Conversion inverter control enhances system efficiency by reducing IGBTs commutation losses.

During mains outages Green Conversion controls the dynamic battery switch SCRs and the battery feeds the inverter.

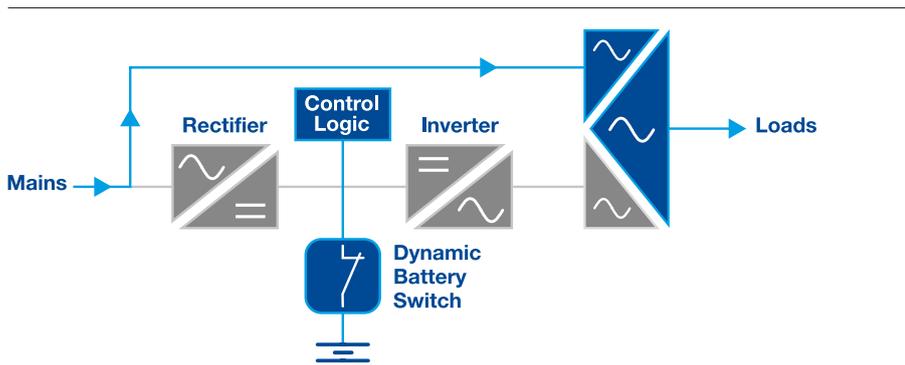


A battery is charged controlling the dynamic battery switch diodes on an intermittent basis, as per battery manufacturers recommendations, or after a discharge has occurred.

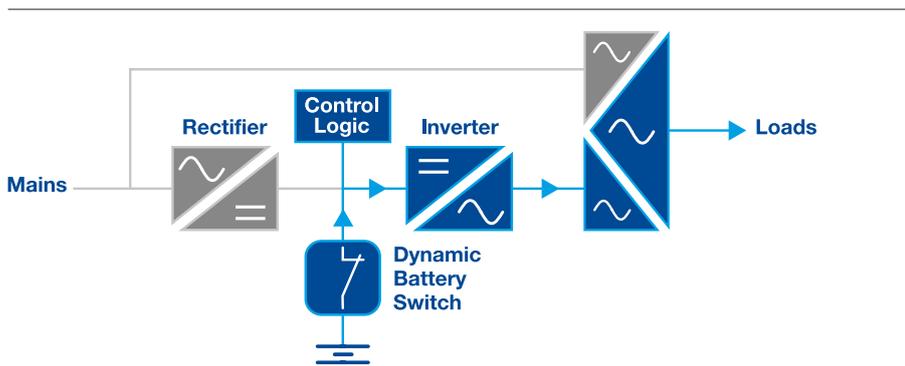
# Maximize your data centre efficiency

## UHE technology for maximum efficiency

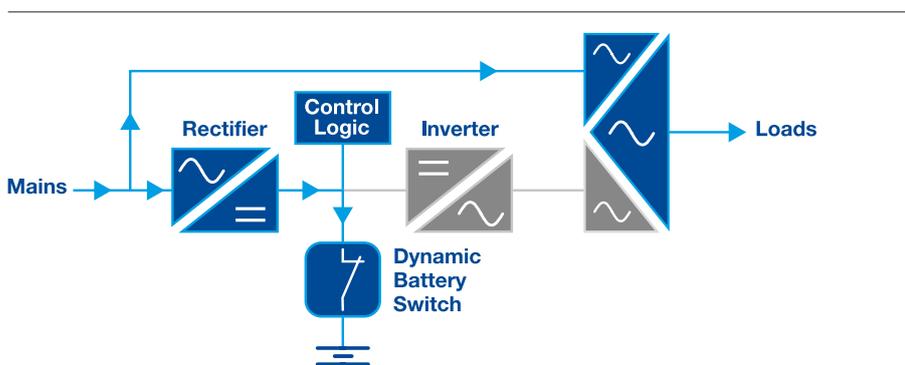
Ultra High Efficiency (UHE) technology is the Borri off-line mode. Based on a sophisticated control technique, in UHE mode 99.46% efficiency is achieved, whilst protecting ICT loads from power quality loss.



Ultra High Efficiency normal mode of operation:  
UHE control logic protects critical loads by monitoring power mains quality, while feeding them via the static bypass line. Rectifier and inverter are in “deep stand-by”. Efficiency is 99.46% .



Ultra High Efficiency on-line mode:  
the inverter feeds power to critical loads whenever mains quality is outside tolerance limits.



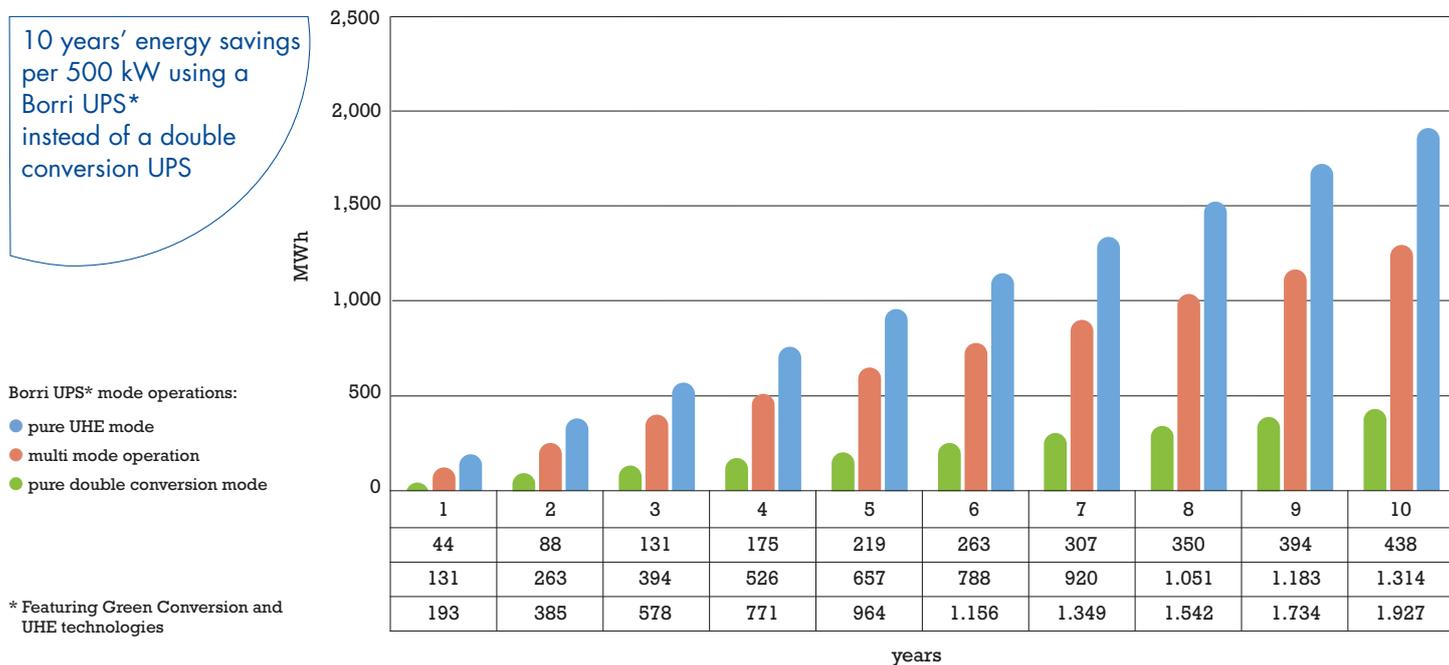
Ultra High Efficiency interactive mode (VHE):  
If input mains stability and reliability is outside preset limits, this mode of operation is activated. Loads are fed by the mains and the inverter is turned on and off by the control logic to stabilize UPS output and the rectifier keeps full battery capacity. That’s what we call Very High Efficiency (VHE) mode. Efficiency is 97%, due to the transient inverter and rectifier contribution to overall losses.

ICT loads have to have a grade of immunity to power disturbances to be compliant with EMC international standards and product development guidelines (i.e. ITIC/CBEMA curve). Borri UHE technology protects ICT loads by monitoring mains quality, enabling on-line operation whenever

disturbances approach load immunity limits. The maximum of system efficiency is thus achieved taking advantage of ICT load’s built-in immunity to power quality issues, whilst ensuring them the protection they actually need.

## Benefits of Borri new technologies

Here below are shown the energy savings that can be achieved by replacing a traditional UPS with a Green Conversion - UHE UPS:



\* Featuring Green Conversion and UHE technologies

This study has been done in collaboration with the Measurement, Reliability and Quality Laboratory of the Information Engineering Department at University of Florence

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With its new technology Borri reaches the highest levels of environmental sustainability and minimizes the TCO (Total Cost of Ownership) of its solutions for data centers, thanks to the highest

energy efficiency and reduction of maintenance costs, proving ideal partner wherever the reduction in PUE is a primary goal.

# Case study Eni Green Data Center

## Maximum protection at the highest efficiency thanks to new technologies developed by Borri

“Borri designs and manufactures a new generation of UPS based on patented technology Green Conversion to meet the requirements of Eni”

### Key players

#### End-user

Eni is one of the largest integrated energy companies in the world, operating in the sectors of oil and gas exploration & production, international gas transportation and marketing, power generation, refining and marketing, chemicals and oilfield services. Eni is active in 90 countries with 78,000 employees.

#### Consultants

Founded in 1992, Ariatta Ingegneria dei Sistemi specializes in consulting, design, project coordination and management of technical plants in civil, industrial, healthcare and urban fields. Since 2000 the firm has designed electrical plant infrastructures for more than one million euros cooperating with the most

eminent international architects and, in most cases, it has also managed the construction work, following the start-up and functional tests. Marco Negri and Walter Nardelli (Reorder) were entrusted with the scientific supervision.

#### Eni Green Data Center

Building area: **45,000 m<sup>2</sup>**

Data rooms area: **5,200 m<sup>2</sup>**  
in 6 IT rooms (2,600 m<sup>2</sup> phase 1)

IT systems **7,000**

Core CPUs **60,000**

PUE **<1.2**

Reduction of CO<sub>2</sub> emissions  
**335,000 tons per year**

Electric Power by UPS **30 MW**

### The challenge

Eni has decided to build a new data centre in Italy, located in Ferrera Erbognone, Pavia adjacent to Enipower's power plant to host all their data processing systems, including administrative information and high performance computing calculation systems (HPC).

The company Ariatta was entrusted with the direction of the project, design, execution and supervision of works.

The goal of the project is to reach an annual average PUE (Power Usage Effectiveness) value of less than 1.2 .

### Our solution

Borri Spa has developed a double conversion, transformer-free 200 kW UPS which is based on two innovative technologies:

- High double conversion efficiency, up to 95% based on Green Conversion patented technology
- Ultra High Efficiency (UHE) reaching 99.46% efficiency based on Borri off-line technology

#### Benefits are:

Low dissipation losses of the UPS, in addition to saving electrical energy, minimize room cooling by virtue of negligible heat release. Automatic or manual switching from one mode of operation to another always optimizes critical loads power supply efficiency.

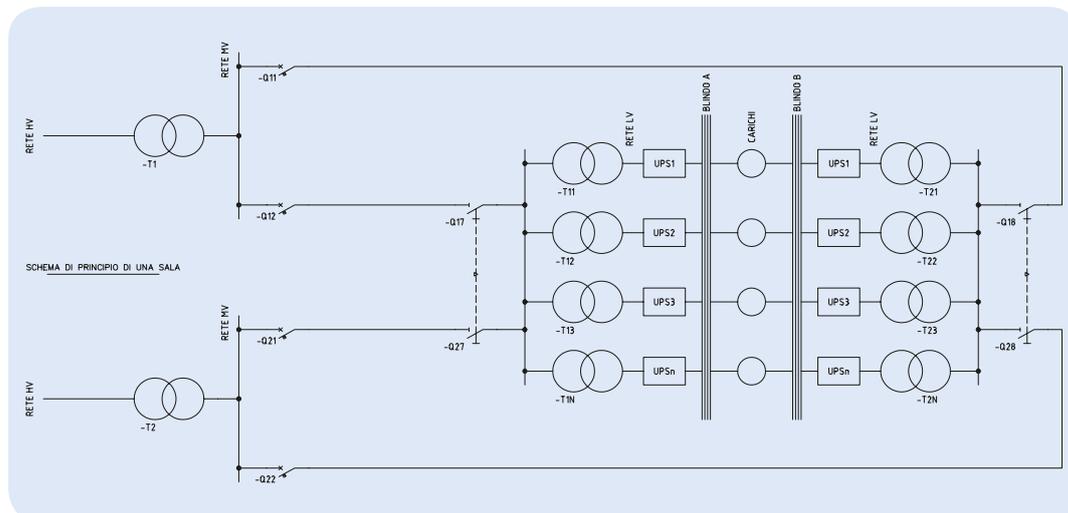
### The system

Borri UPS are powered by two independent lines, coming from two separate medium voltage transformers. Should the main line fail, the system automatically switches on the backup line.

The uninterruptible power supply section consists of no. 50 200 kW UPS for both lines,

A and B, feeding the server rooms via a double busbar.

The UPS is cooled by natural air convection and the design ambient temperature is 50° C. Each UPS is equipped with its own battery cabinet, providing 5 minutes autonomy at full load.

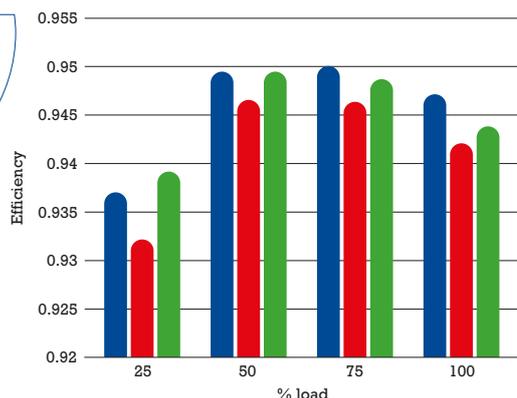


## Validation tests

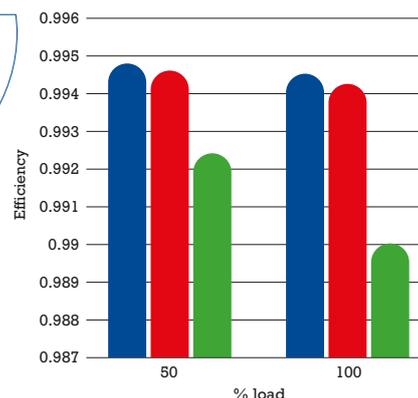
A testing schedule was included in the project. All tests, commissioned by Eni, have been developed by the Electrical, Electronic and Information Engineering Department at the University of Bologna and conducted by TÜV laboratories. The test results show that Borri UPS exceeded the 99.4% target

efficiency, achieving a remarkable 99.46% efficiency at 50% load and 99.43% efficiency at 100% load. All the remaining CE mark type tests, namely electromagnetic compatibility, safety and performance were carried out at Borri in our testing area.

On-line double conversion efficiency versus load



UHE efficiency versus load



## Results and future developments

The development of 200 kW UPS for Eni has allowed Borri to respond to the technological challenge of designing a UPS powering the critical loads of a modern data center to get the highest ever value of PUE. The low losses of the UPS and the high temperature design (50° C rather than the standard 40° C) allow the use of air at ambient temperature to cool

the local UPS, physically demonstrating the advantages of the solution adopted. The UPS section covered by Borri consists of 50 200 kW UPS, but it is expected that an expansion will bring the UPS installed to 150 units for a total computing power of 30 MW with an energy saving of 1.5 MW.



"We completed a challenging and innovative project with ambitious goals that required all the key players to think outside the box.

Borri created a new technology Green Conversion, proving its ability to fulfil this requirement. Excellence has therefore been achieved thanks to those who have expressed willingness to think of something completely new."



"The contribution of Borri was not limited to the supply and installation of high-efficiency UPS but it was fundamental in the preparation of the project.

I really appreciated their proactive attitude, contribution of innovative ideas, collaboration in the analysis of feasibility and availability during all its phases confirming Borri's vocation to providing solutions based on the specific needs of its customers."

Michele Mazzarelli

Vice President Project Manager Programme Eni Green Data Center

Alberto Ariatta

Project Director and Director of works for Eni Green Data Center