

EXPERTS IN  
**DC/DC CONVERTERS**

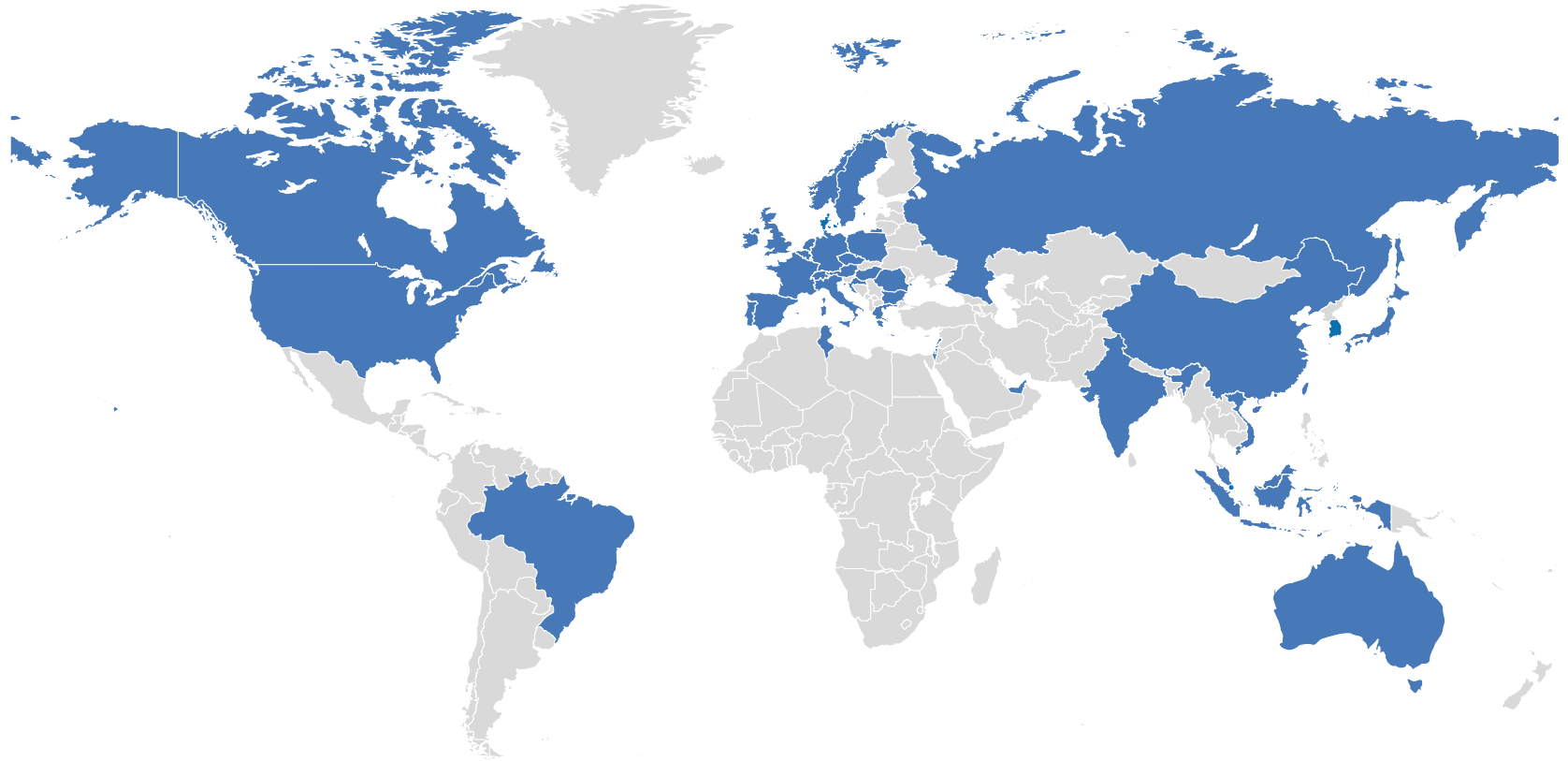
*#DCPOWEREDFUTURE*



epic power

Clients in 41 countries

*Making a  
global impact*



# ***Innovation, Technology & Solutions***

## ► | **Designers and manufacturers**

We have complete control over the power electronics value chain and actively participate in every step of the process. We serve as designers of bidirectional DC/DC converters, oversee industrialization, manage the supply chain, handle certification, and undertake production.

## ► | **Support and design of project architecture**

With our experience, we can assist you in choosing the optimal architecture and control method, and in sizing components and selecting the most suitable ones for your needs.

## ► | **Installation support**

If you need a complete service, harness the expertise of our professional team, ready to support you.

## Who we are

It all began in 2012 when a group of researchers from the Power Electronics Group at the University of Zaragoza embarked on an R&D project for an energy recovery system. The project evolved from a research endeavor into a product and, over the years, continued to improve into an even more advanced solution.

Meanwhile, we have embarked on a journey dedicated to the field of power electronics through innovative solutions. We have evolved into a thriving and well-established company, accumulating over a decade of valuable learning experiences along the way.

- Experts in design and manufacture of power electronics
- Focused on bidirectional DC/DC conversion. Our mission is to design and produce converters that are beyond the state-of-the-art.
- Providing solutions for energy storage, energy savings, peak power reduction and renewable energy integration. Our vision is to contribute to a future where no unnecessary AC/DC transformations occur. #dcpoweredfuture
- Best-in-class technical support in the decision making and in the commissioning process of our converters for reliable and fast integration.

### Transparency

#### *Straight forward*

We aspire to accompany you throughout your entire project, and for you to experience the robustness and reliability of all our solutions.

We are practical and realistic with deadlines, and we share all this information with clients, suppliers, and our team.

We firmly believe in the energy transition we work for everyday.

### Knowledge

#### *We are researchers*

Our solutions incorporate the latest technological innovations, as we stay up to date with the latest research and scientific events.

Through knowledge, we solve conversion problems to ensure your system operates optimally.

Universities and research centers are regular partners. R+D is in our DNA.

### Support

#### *We listen to you*

We are by your side from start to finish, becoming part of your team. We want your solution to perform optimally, so we assist you with complete integration.

Our support is always available to ensure there are no issues during the bidirectional power conversion.

We have the necessary knowledge to tailor the installation to meet your specifications.



# EPC

ISOLATED

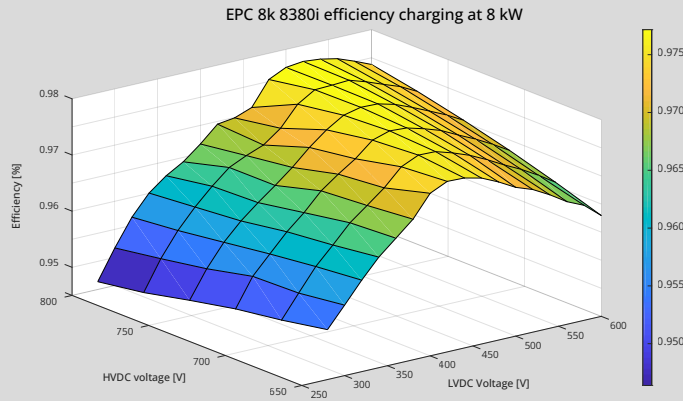


ISOLATED Bidirectional DC/DC converters

## Top rated advantages

- Bidirectionality
- Easily scalable
- Robust CAN communication
- Black start
- Ultra-high efficiency
- Galvanic isolation
- Automatic change of power flow

## ➤ Highest efficiency



## Certifications

- UL compliance
- ISO 9001 & 14001
- ISO 166002 R&D
- CE compliance
- Innovative SME
- Factories of the Future Award winners



Model	EPC 3k5 648i	EPC 5k5 648i	EPC 2k2 624i
Peak power	4.2 kW	6.5 kW	2.6 kW
Nominal power	3.5 kW	5.5 kW	2.2 kW
High side voltage (Vdc)	510 to 848 V		
High side current (max)	6 A (7.5 A)	10 A (12 A)	4 A (5 A)
Low side voltage (Vdc)	38 to 59 V (optional from 0 V)		19 to 30 V (optional from 0 V)
Low side current (max)	75 A (115 A)	115 A (180 A)	92 A (130 A)
Isolation	High to Low side: 2.5 kV High side to earth: 4 kV Low side to earth: 1.5 kV (2.5 kV for EPC-4k8-6125) Low side to user signals: 3 kV (5 kV for EPC-4k8-6125)		
Max. efficiency	98%		
Stand-by	<3 W		
Control	Digital control self-powered from High or Low Side Voltage (Low Side prioritized)		
Digital control self-powered from	Low Side Voltage (optional version from Low and High side: EPC 3k5 648iHL	Low Side Voltage (optional version from Low and High side: EPC 5k5 648iHL	Low Side Voltage (optional version from Low and High side: EPC 2k2 624iHL
Size	Size 1	Size 2	Size 1
Weight	6.05 kg	8.95 kg	6.15 kg



EPC systems have shaped the new generation of bidirectional DC/DC Converters. EPCs (Epic Power Converters) are suitable for a large number of applications ranging from industrial ones to those in the field of renewable energies.

### Why an isolated bidirectional DC/DC Converter?

Bidirectional converters can be isolated and non-isolated.

Isolation implies a galvanic separation between the ports, which means there is no direct current path between them.

This results in improved safety, sometimes required by regulations. It also results in an improved robustness of the converter because if something goes electrically wrong on one side, the other side remains unaffected.

In order to achieve galvanic isolation the use of internal transformers is mandatory. If the voltage transformation ratio in nominal conditions is high (>20), then isolated converters tend to be the preferred option due to cost and efficiency, even if no isolation is formally required.

EPC 2k2 348i	EPC 2k2 324i	EPC 4k8 6125i	EPC 7k 670i	EPC 8k 8380i
2.6 kW	2.6 kW	4.8 kW	7.5 kW	10 kW
2.2 kW	2.2 kW	4.8 kW	7.0 kW	8.0 kW
280 to 450 V		430 to 830 V	510 to 848 V	500 to 848 V
7 A (9.3 A)	7 A (9.3 A)	9 A	11.6 A (12.5 A)	11 A (15 A)
38 to 59 V (optional from 0 V)	19 to 30 V (optional from 0 V)	110 to 165 V (optional from 0 V)	40 to 100 V (optional from 0 V)	280 to 600 V (optional from 0 V)
50 A (70 A)	92 A (130 A)	45 A	100 A (108 A)	21 A (33 A)
High to Low side: 2.5 kV High side to earth: 4 kV Low side to earth: 1.5 kV (2.5 kV for EPC-4k8-6125) Low side to user signals: 3 kV (5 kV for EPC-4k8-6125)				
98%				
<3 W				

Digital control self-powered from High or Low Side Voltage (Low Side prioritized)

Low Side Voltage (optional version from Low and High side: EPC 2k2 348iHL	Low Side Voltage (optional version from Low and High side: EPC 2k2 324iHL	Low Side Voltage (optional version from Low and High side: EPC 4k8 6125iHL	Low Side Voltage (optional version from Low and High side: EPC 7k 670iHL	Low Side Voltage (optional version from Low and High side: EPC 8k 8380iHL
Size 1	Size 1	Size 1	Size 2	Size 3
6.00 kg	6.05 kg	6.70 kg	7.95 kg	8.90 kg

## Control modes

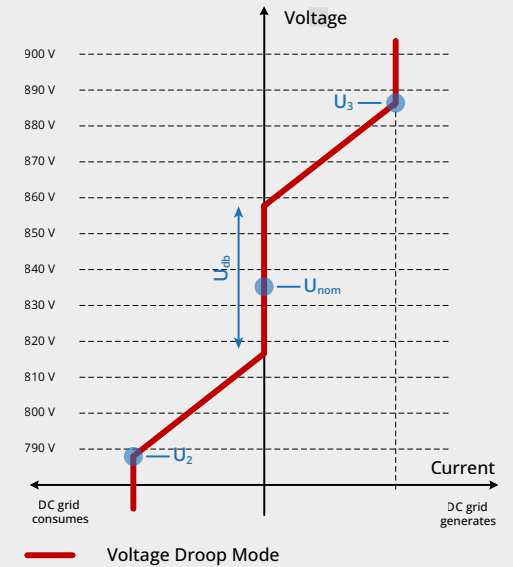
- Current Control Mode (xSCC)
- Power Control Mode (xSPC)
- Voltage Control Mode (xSVC)
- Photovoltaic Mode (xSPV)
- Adaptative Autonomous Mode (AxSA)
- Energy Recovery Mode (xSER)
- Voltage Droop Control Mode (xSVDC)

Voltage Droop Control Mode is an innovative method used in DC systems, particularly in distributed generation and microgrids, to allow multiple power sources to share the load efficiently without the need for communication between them. It is based on the relationship between voltage and current.

A "droop" curve is established, which relates the output voltage of a power source to the current it supplies. As the current increases, the output voltage decreases according to a predefined slope. This way, power is adjusted automatically according to this curve. This method ensures that the load is shared evenly among the sources.

Voltage Droop Control Mode has three key advantages: simplicity (no communication is required between power sources), stability

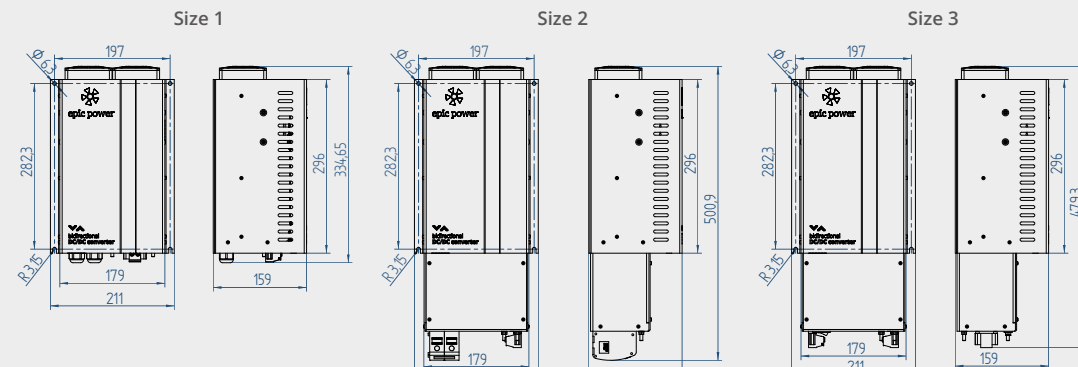
(allowing automatic load sharing), and flexibility (can adapt to changes in load and the number of power sources connected to the system).



\*The voltage values shown are for illustrative purposes only.  
\*All modes can be set up in both side, High Side and Low Side voltage.



Documentation	
Installation Manual	
Datasheet	
Applications	
DC/DC converter configurator tool	



# EPC

NON-ISOLATED

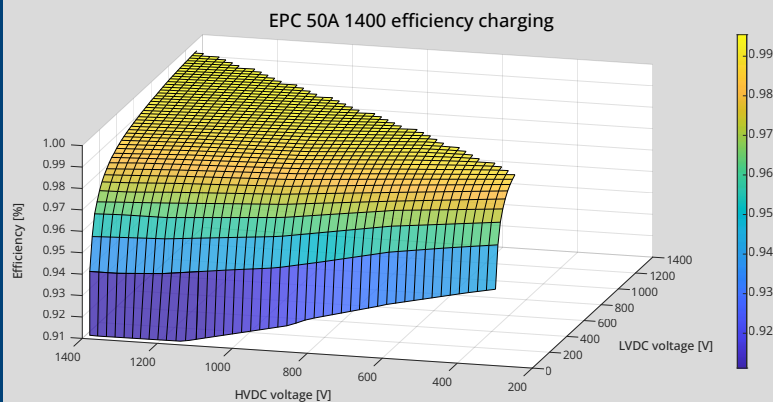


# Bidirectional DC/DC converters

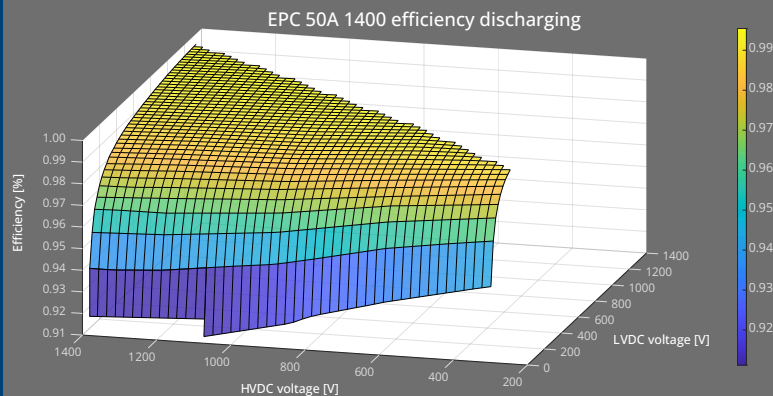
## Top rated advantages

- Wide voltage range
- Voltage and current control
- Soft start from 0V
- MPPT from PV
- Power scalable. Paralleling.
- Rack and wall mounting enclosure

### ➤ Highest efficiency



### ➤ Highest efficiency



Model	EPC 50A 0460	EPC 50A 0848	EPC 50A 1400
Nominal current	50 A	50 A	50 A
Max power (1)	20 kW	40 kW	57 kW
High side voltage range (operation)	50 to 460 V	50 to 848 V	200 to 1400 V
Low side voltage range (operation) (2)	0 to 410 V	0 to 798 V	0 to 1348 V
Max High/Low Side Voltage (withstand)	650 V	1200 V	1400 V
Max. efficiency	98.1%	99.2%	99.54%
Control	Voltage, Current, Power, MPPT, Voltage Droop Control Modes available for both sides (Low and High Side)		
Size	247.5 x 87.9 x 479.3 mm		
Weight	9.34 kg	9.89 kg	10.25 kg
Enclosure	2U Half rack		
IP Rating	IP20		

- (1) Transferred power is the result of the voltage in the Low Side multiplied by the Current. Maximum power is achieved at 1154V in Low Side which means 1154\*50=57.7kW.
- (2) To allow discharging, from Low Side to High Side, the voltage on the Low Side must follow the following equation:  $V_{LOW\ SIDE}[V] \geq (0.02 \times V_{HIGH\ SIDE}) + 10$   
To allow discharging, from High Side to Low Side, the voltage on the Low Side must follow the following equation:  $V_{LOW\ SIDE}[V] \leq (0.98 \times V_{HIGH\ SIDE}) - 10$



The EPC-buck-boost family is a newly designed bidirectional DC/DC power converter that addresses the challenges of the new energy transition.

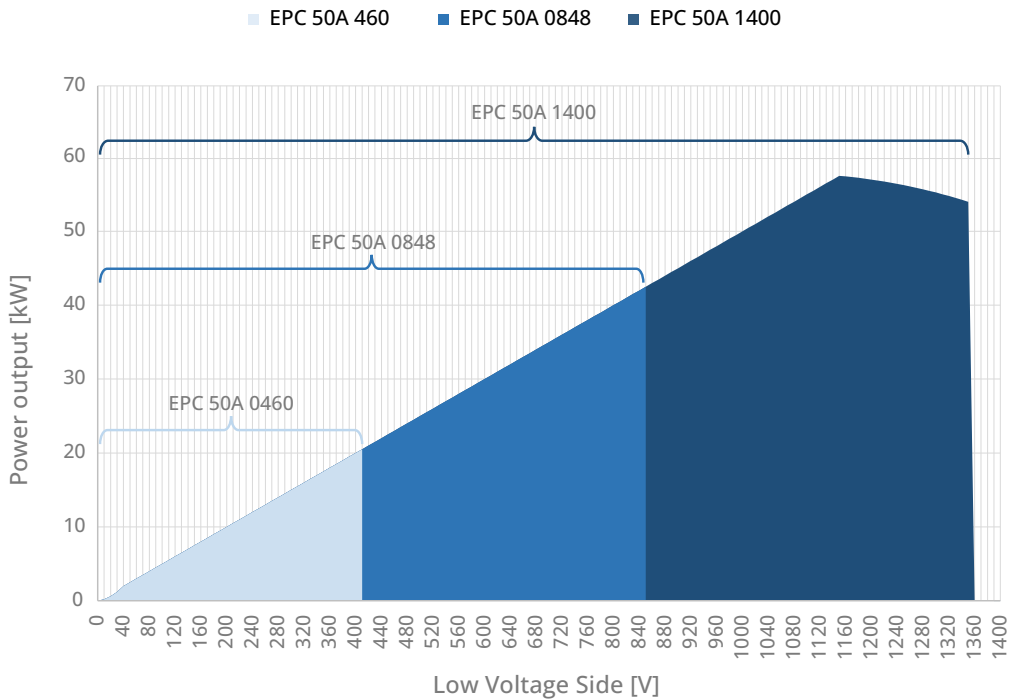
These step-up step-down converters utilize the latest technology and offer a wide voltage range, making them compatible with various input and output voltage levels for multiple industrial applications.

They achieve high efficiency in both directions, ensuring effective energy flow without significant power losses.

The converters support parallel operation for higher power output and can be installed in compact spaces.

They include a standalone configuration with soft-start and wide voltage ranges for an easy initial set-up.

The converters offer scalability and improved system reliability through a modular parallelization approach to power conversion. They integrate CAN communication, enabling precise control over output parameters and measurement.



## Control modes

- Current Control Mode (xSCC)
- Power Control Mode (xSPC)
- Voltage Control Mode (xSVC)
- Photovoltaic Mode (xSPV)
- Voltage Droop Control Mode (xSVDC)

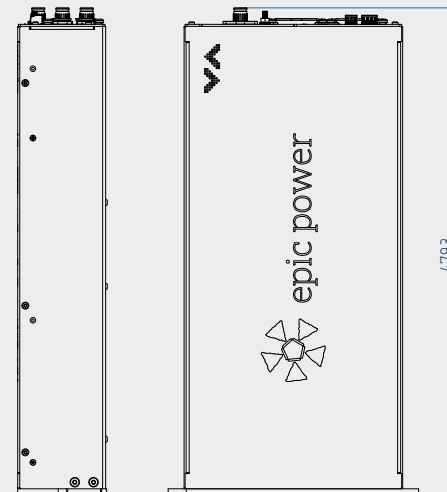
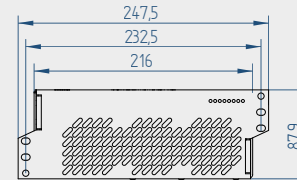
**X Side Photovoltaic Mode (xSPVMODE).** In this mode, the EPC converter executes the Maximum Power Point Tracking (MPPT) algorithm on the designated side (either HVDC or LVDC), depending on where the solar panels are connected. This mode is designed to optimize energy transfer from the photovoltaic (PV) panels to the designated side of the converter.

## Superior MPPT Control

Our MPPT control mode is highly effective and performs perfectly, even under challenging conditions. It is especially suitable for dynamic environments such as,

- Mobile Conditions: For example, solar panels installed on a trailer.
- Marine Conditions: On a boat with solar panels, where the boat, even when anchored, is subjected to constant motion due to water movement.

This robust MPPT algorithm ensures optimal performance and energy efficiency regardless of the environmental conditions, making it ideal for various applications requiring reliable and efficient solar energy harvesting.



### Documentation

Installation Manual



Datasheet



Applications



DC/DC converter configurator tool





EES  
Energy Storage

# ENERGY STORAGE Integration

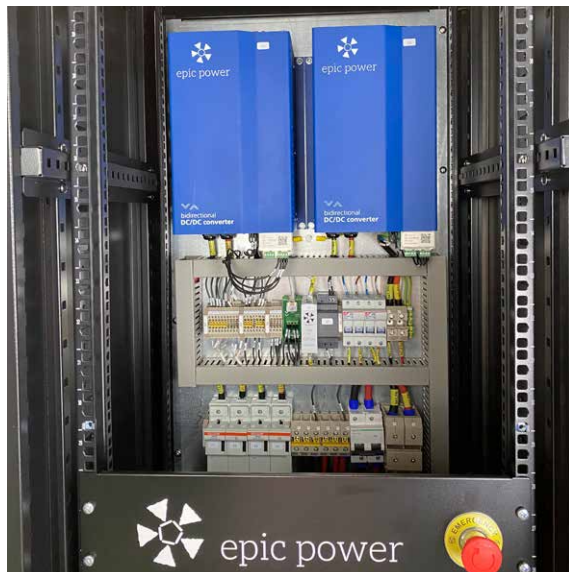
## ■ Bidirectional DC/DC converters to energy storage

Our way of life and industrial demands require energy storage as the key to achieving decarbonization goals and integrating renewable energies.

The intermittent nature of these energies makes it essential to store surpluses and utilize them when needed.

Batteries are and will continue to be a critical element adaptable to all applications. To achieve this, bidirectional DC-DC converters play a crucial role.

Each storage technology has unique characteristics not always compatible with standard inverters or appropriate solar panel configurations. Therefore, Epic Power Converters offer the required flexibility needed in the complete solution.



▲ Example of an existing installation

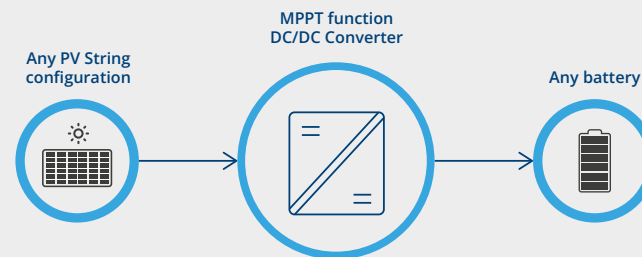
### Key points:

- Bidirectional DC/DC converters link renewable sources and loads in configurable yet simple integration.
- Converters optimize solar panel-battery connections for efficient charging.
- Converters adapt battery voltages to inverters for optimal efficiency.

## Bidirectional DC/DC converters to charge batteries from solar panels.

The wide range of voltages that Epic Power's isolated and non-isolated converters can adapt, along with their capability to perform the MPPT function on either side, opens up a new realm of possibilities for connecting any configuration of solar panels to any energy

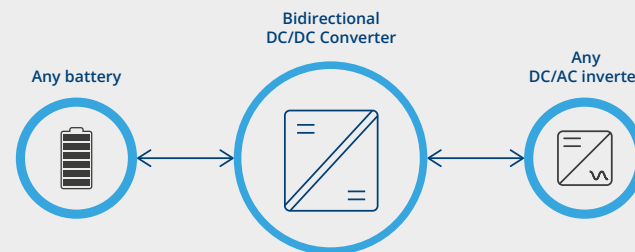
storage technology. Always with the objective of achieving maximum efficiency and ensuring optimal battery health, the configuration of the converters enables the implementation of the most appropriate charging profile. In these diagrams, you can observe several examples.



## Bidirectional DC/DC converters to adapt any batteries to any inverter.

Different battery technologies have limitations in achieving ideal voltages for integration with standard inverters. Low serialization often limits the result in low or medium voltages that are difficult to integrate with high-power inverters. Integrators can serialize batteries up to

1497V, which many inverters can't handle. With Epic Power converters, you can adapt any battery voltage to any inverter from 0V to 1500V. This flexibility allows for optimal efficiency and battery care. The modularity of the converters ensures system reliability, even if some batteries degrade over time.



# FUEL CELL OFF-GRID Case Study



Fuel Cell  
Batteries

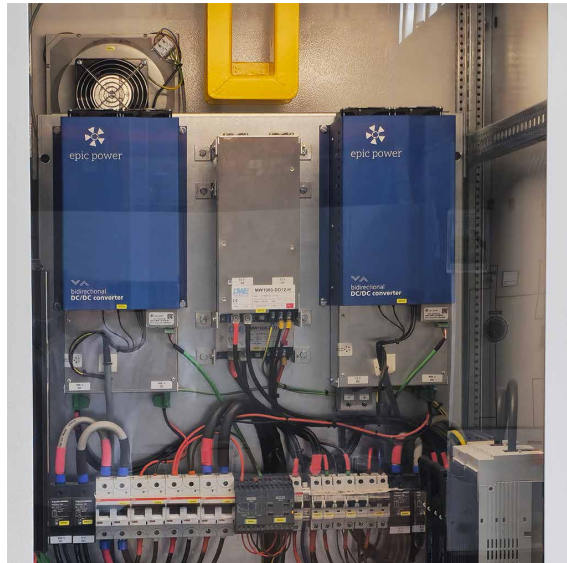
## ■ DC/DC converters for fuel cell applications.

Fuel cells are crucial for achieving an efficient energy transition due to their clean and sustainable nature. Epic power designs and manufactures DC-DC converters for fuel cell applications.

Epic power's bi-directional DC/DC converters offer a comprehensive solution for all DC/DC conversions needed to design efficient fuel cell systems, including balance of plant components.

These converters can be parallelized to scale up power as required, providing flexibility for various applications.

Collaborations with companies like Premel have resulted in highly adaptable solutions that meet the diverse needs of clients in the fuel cell industry.



▲ Example of an existing installation

### Key points:

- Converters with high current density at low voltages.
- Easy integration using the same DC/DC brand for all necessary conversions.
- Blackstart and peak shaving functions available thanks to the bidirectional capacity of the converters.

## Case study

A 700V DC bus is created to design an off-grid fuel cell system.

This system is capable of starting from scratch using any battery and can also utilize the same battery for peak saving functions when the load requires rapid dynamics beyond what the fuel cell can provide.

The bidirectional functionality eliminates the need for external chargers, as batteries can be slowly charged through the same DC bus when excess energy is available from the fuel cell.

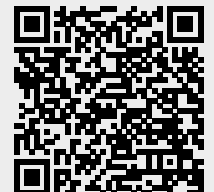
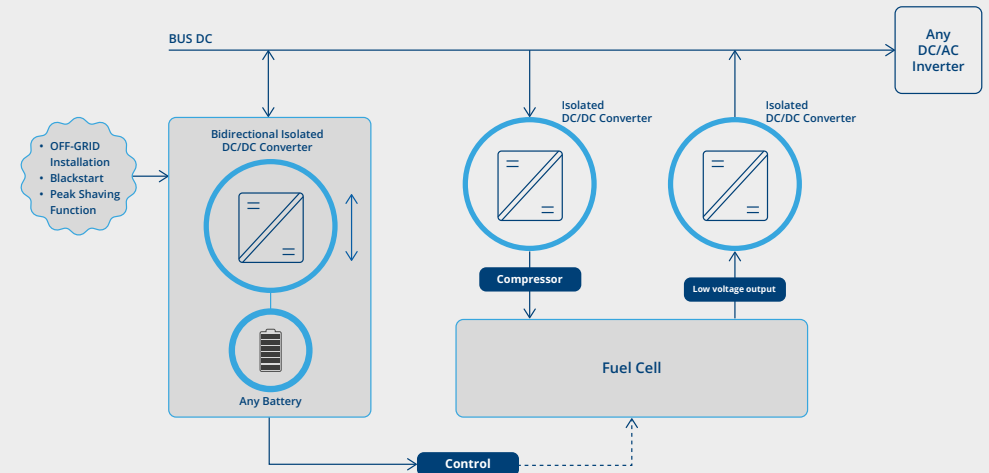
This integrated approach optimizes energy usage and storage, providing a flexible and

efficient solution for off-grid applications.

The ability to utilize a single brand of fully compatible converters to address the entire architecture of a fuel cell system, with the flexibility to configure it according to specific installation needs, offers significant advantages.

Epic Power's project department, drawing on extensive experience integrating DC-DC converters into diverse applications worldwide, ensures seamless operation for both integrators and end customers.

Here is the schematic view of the installation.



# REDOX FLOW BATTERIES with DC/DC converters



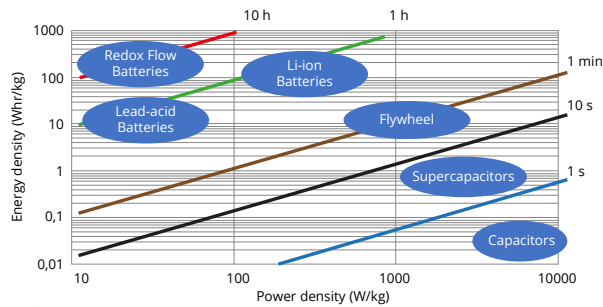
Redox Flow  
Batteries

## Redox Flow Battery overview.

A Flow Battery is a type of rechargeable fuel cell where one or more dissolved electroactive elements flow through a cell to convert chemical energy into electricity.

The electrochemical elements that act as the anolyte and catholyte do not have physical contact between each other and produce electricity through a REDOX (reduction-oxidation) process. Ions are transferred through the membrane in the cell to drive the anolyte and catholyte into other reduction/oxidation states.

The economic effectiveness of the flow battery stems from the clear advantage it holds in terms of cost-efficiency. The separation between energy and power characteristics plays a pivotal role in making the flow battery highly favorable for high-energy, low-power applications. This is primarily due to the simplicity and affordability of expanding the volume of electrolyte, which enables the flow battery to deliver significant energy capacity without incurring substantial costs.



Energy and power density of various technologies

## Key points - epic power DC/DC converters:

- Are key to avoiding common mode currents in containerized solutions with several galvanically isolated stacks working in parallel.
- Overcome limitations in cell stacking, by stepping up the RFB output voltage.
- Play a crucial role in precisely regulating voltage on the DC bus with quick response times, maximizing the benefits for grid operators.
- Offer highly efficient and versatile solutions tailored to the demands of RFBs.

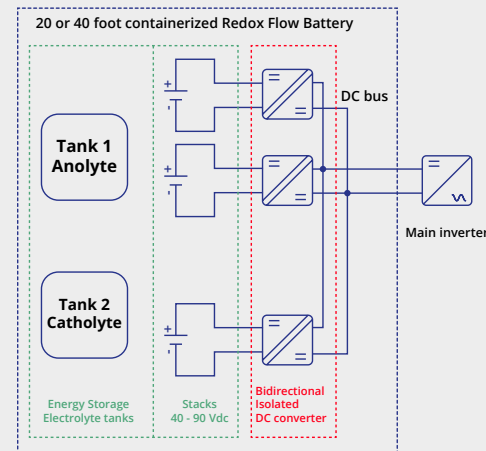
## Why use bidirectional DC/DC converters?

Converters capable of dealing with high currents and voltages are required to connect low-voltage Redox Flow Battery (RFB) stacks with industrial voltages (600-900 Vac).

Our isolated power converters ensure the most efficient and cost-effective solution to overcome the high-voltage gap between the RFB stack and the standard grid voltages. These converters are designed to operate at very high currents on the RFB side and high voltages on the other side with over 95% efficiency.

As Flow Battery stacks can normally deal with power between 5 and 15 kW, several stacks need to be installed together to offer solutions of MW size. To parallelize the stacks and avoid common mode currents between the stacks, galvanically isolated converters connected to each or a few stacks in parallel are required.

Manufacturers of RFB are standardizing the solutions by building 20' or 40' containers including the stacks (power), the tanks of electrolyte (energy) and the power electronics.



General configuration of containerized Redox Flow Batteries

As the operation of the standard RFB are bidirectional, storing energy for certain hours to return it when it's needed most, a bidirectional isolated DC/DC converter is required.

The connection to the grid is accomplished by means of an inverter in each container or, alternatively, through a centralized inverter for the installation.





Marine

# MPPT FUNCTION Hybrid boat Case Study

## ■ MPPT function integration: Hi-tech hybrid boat powered by solar energy.

An MPPT (Maximum Power Point Tracker), sometimes called a power point tracker, is a technique generally used with photovoltaic systems to maximize power extraction under all conditions.

In mobile applications, such as boats, this function is critical because there are many rapid variations in the orientation of the solar panels.

Epic power converters have an MPPT function optimized for these types of applications, with a very fast response time.

Another problem in these applications is the limited space for configuring ideal strings. With our DC/DC converter, you can adapt any configuration of low-voltage strings to charge medium or high-voltage batteries.



▲ The Sobe Sunset sailing powered by the sun

### Key points:

- MPPT function is used in photovoltaic systems to maximize power extraction under all conditions.
- Epic power converters feature an MPPT function that offers a very fast response time to handle rapid changes in solar panel orientation.
- The Epic Power DC-DC converter adapts low-voltage strings to charge medium or high-voltage batteries, solving space limitations in mobile applications.

## Case study

Why to install solar panels in your boat?

Boats ranging from 18 to 34m, reaching high speeds at mid-throttle have a very high fuel consumption. Therefore, the relatively small tanks need to be filled every day.

Added to this are many other additional energy consumptions of the boat, and the idea of the project was to enhance the overall efficiency.

And... How to achieve it? Hybridization

**Bidirectional DC/DC converters as part of the solution.**

The Sobe Sunset is a 30m. recreational

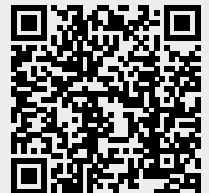
boat, built in 1999. Its owner acquired it in 2019 and noticed the existing market need for this type of vessel.

Quickly, he got to work, implementing a superstructure combined with additional space on the foredeck capable of accommodating 11kW of solar panels, consisting of 28 panels of 120W, nominally at 20VDC, wired in series to obtain 40V for a maximum output of 48A.

This voltage is boosted to the 750VDC bus by a 3kW galvanically isolated Epic Power DC/DC converter, with embedded maximum power point tracking (MPPT) algorithms specially developed for floating solar panels.



▲ Existing installation





*Edison  
would love it*



epic power

Epic Power Converters, S.L.  
+34 976 24 95 80 · Zaragoza (Spain)  
info@epicpower.es



## Recognitions and Awards

### ISO 9001 & 14001

Bureau Veritas serves as our annual auditor for these two standards. Furthermore, we hold ISO 166002 certification, a certification in Spain that pertains to R&D processes.

### UL compliance

Intertek is our quarterly auditor for ETL assesment to ensure compliance with UL standards.

### 2023 Factories of the Future Award winners

First prize in the Murrelektronik award for Best Industrial Equipment or System for the Factory of the Future.

### Innovative SME

The Ministerio de Ciencia e Innovación (Spanish Ministry of Science and Innovation) has awarded us with the Innovative SME recognition until 2025.



■ [epicpowerconverters.com](https://www.epicpowerconverters.com)