epic power

Lifting the world with power electronics

sept 2023

Darío Rubio – Account Manager

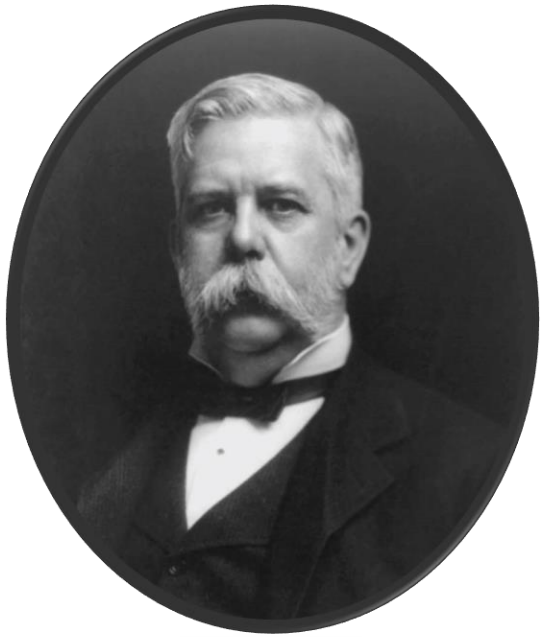
drubio@epicpower.es

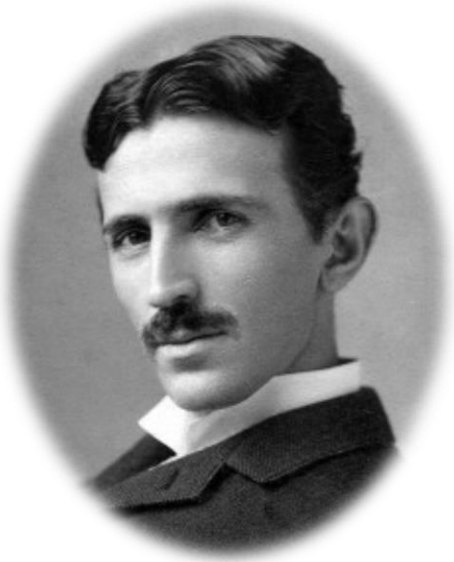
Power electronics and its role in energy intelligence

epic power

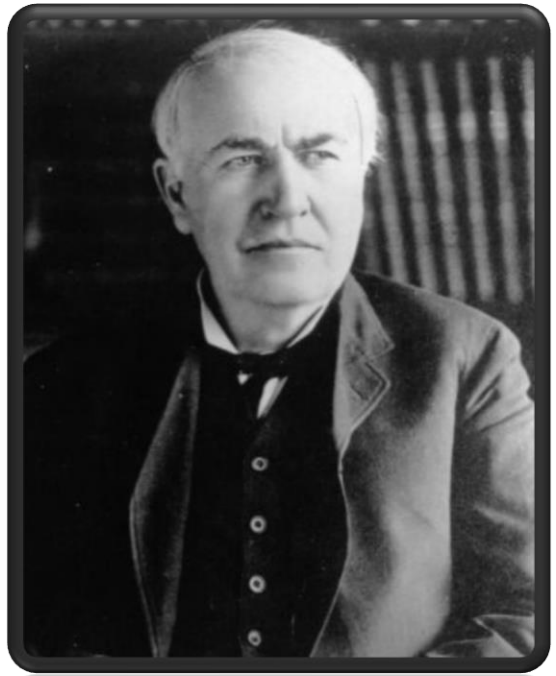
A little bit of history

- Westinghouse (and Tesla)





- Thomas A. Edison



Important factors in the decision

AC

Motors AC (by Tesla)

Simple Transformers AC

Synchronization problems

Suboptimal power transmission

VS

DC

No frequency problems

Maximum power transfer

High-voltage generation

Highly complex DC transformers

But….The world is changing

MIT Technology Review

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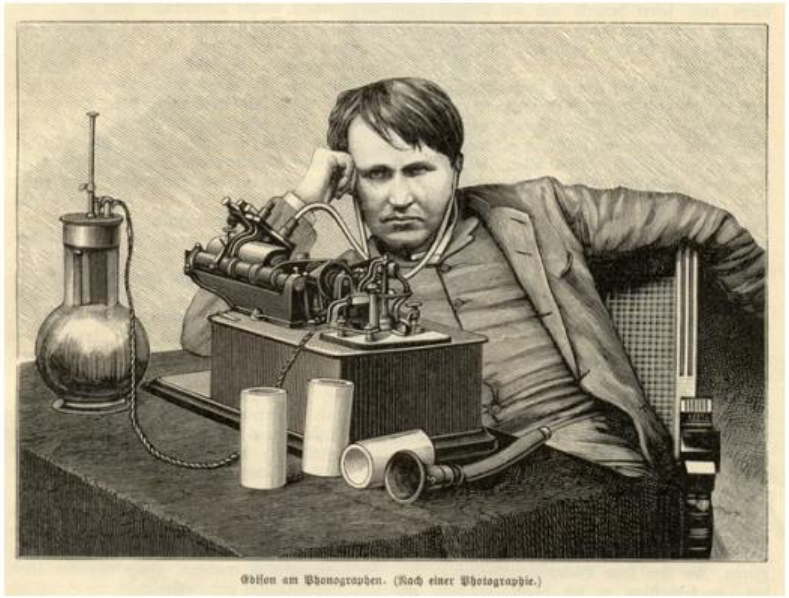
Business Report

Edison's Revenge: The Rise of DC Power

In a world of more electronics and solar energy, there's less and less need for AC power.

by Peter Fairley April 24, 2012



Source: MIT Technology Review. April 24, 2012

Graphic detail

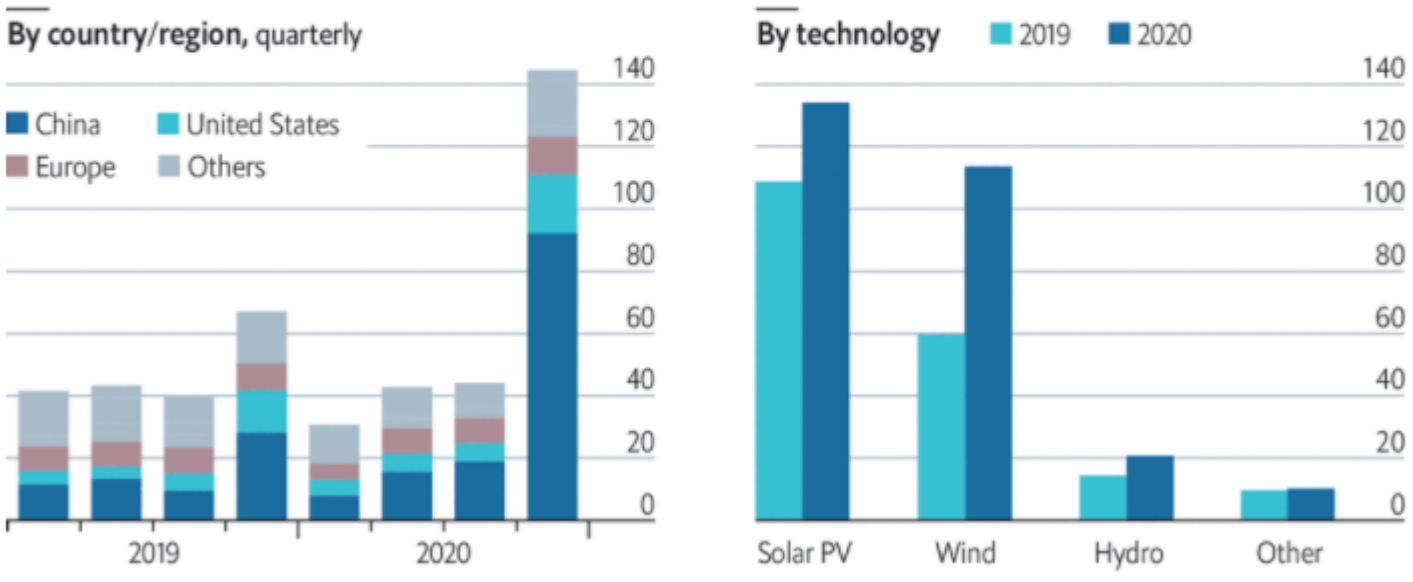
Daily chart

The use of renewable energy is accelerating

But still not quickly enough to offset the use of fossil fuels

Green shoots

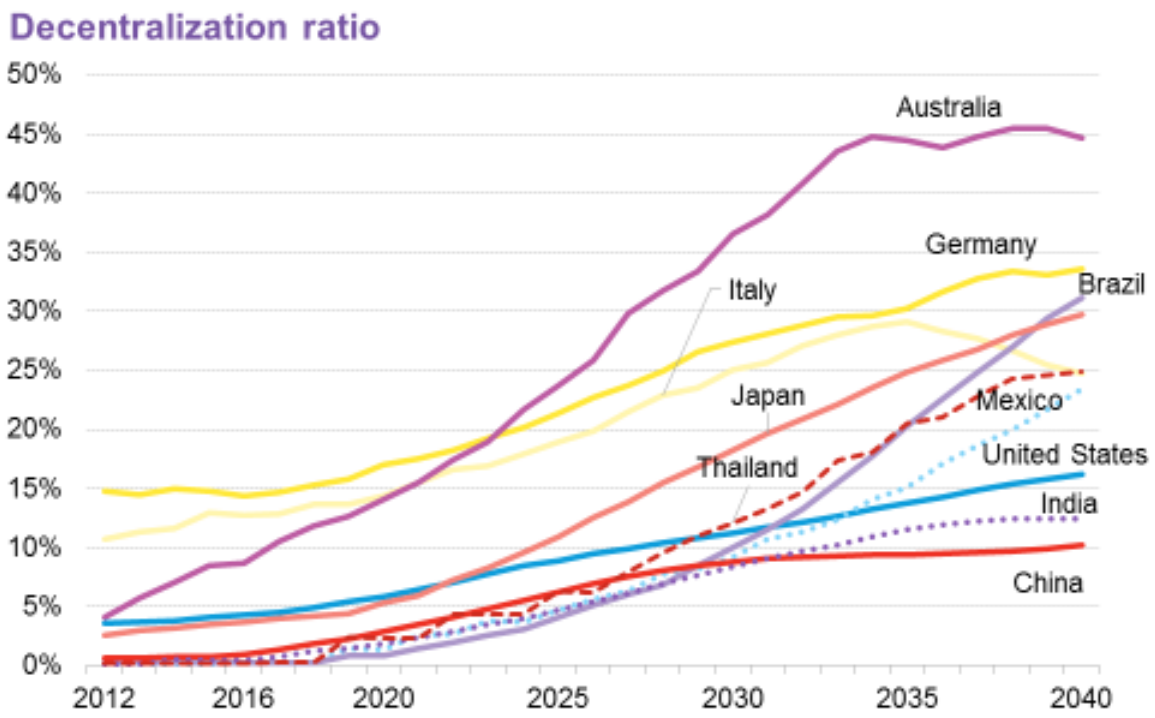
World, renewable energy capacity additions, GW



Source: The Economist. May 11, 2021

Bloomberg New Energy Finance

Australia, Germany, Japan, Brazil – most decentralized

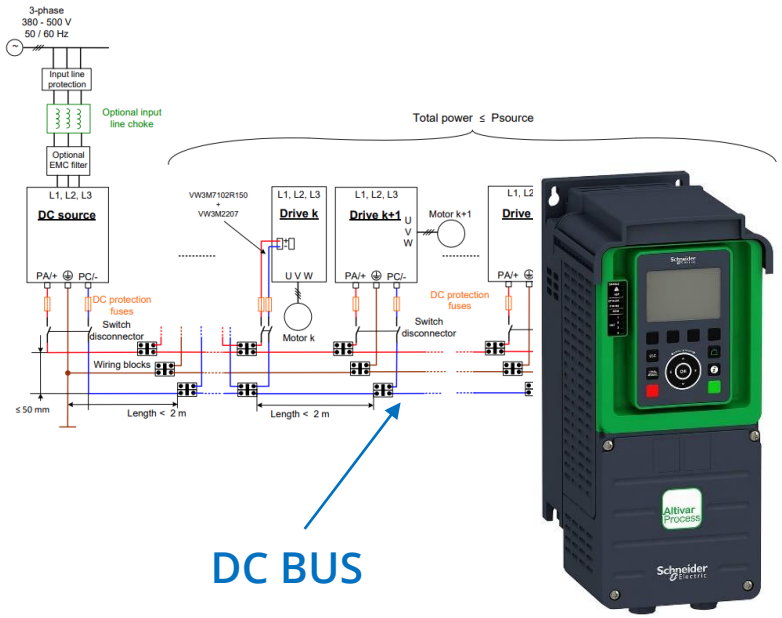


$$\text{Decentralization} = \frac{Non-grid\ capacity}{Total\ capacity}$$

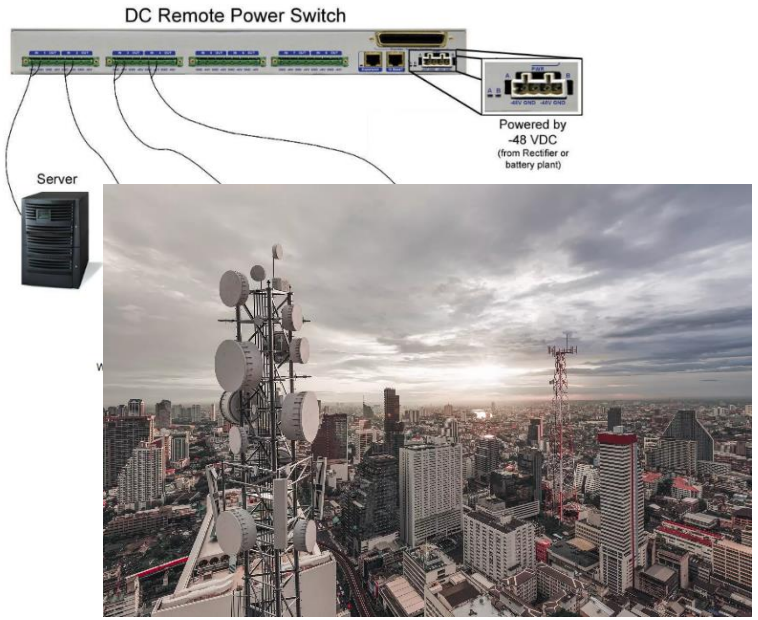
Source:
Bloomberg New Energy Finance, New Energy Outlook 2017

Where is all this energy created from renewable sources used?

Frequency drives



Telecom

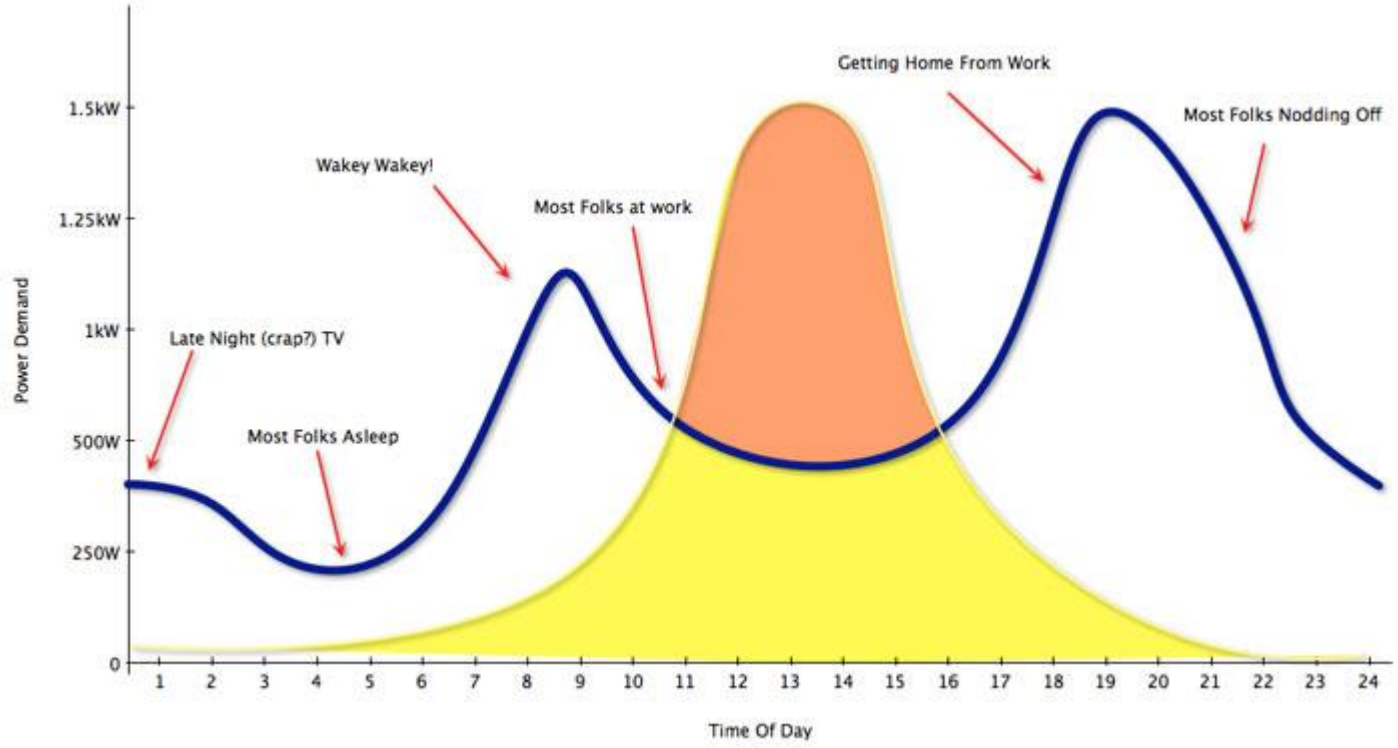


EV charging

Energy transition requires renewables, what about storage?

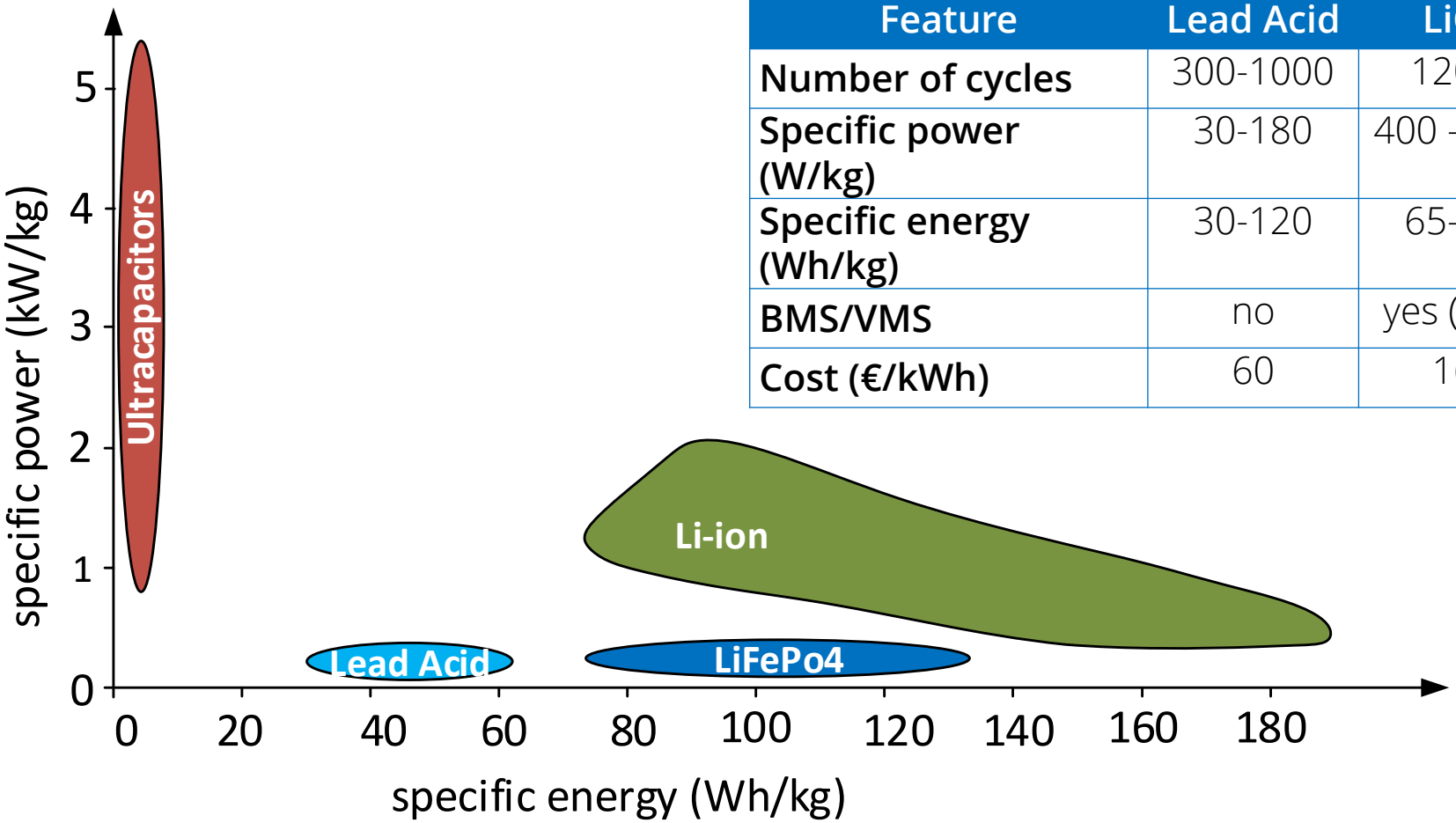
Challenges:

- Maximize production
- Include storage and control
- Ensure grid reliability with fluctuations



Source: https://www.solarquotes.com.au/

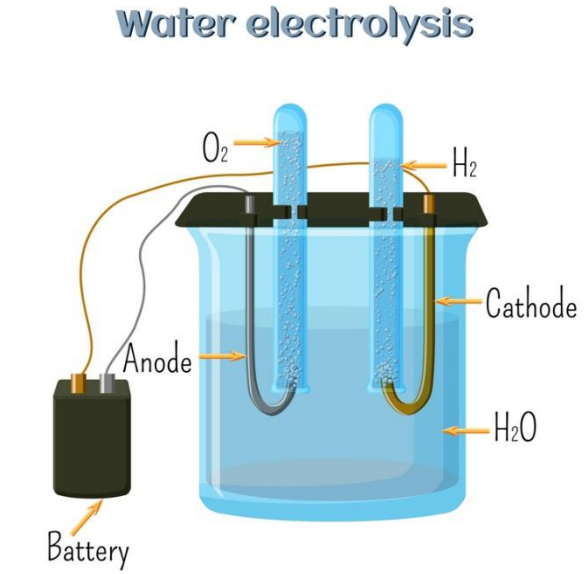
Storage technologies, all in DC



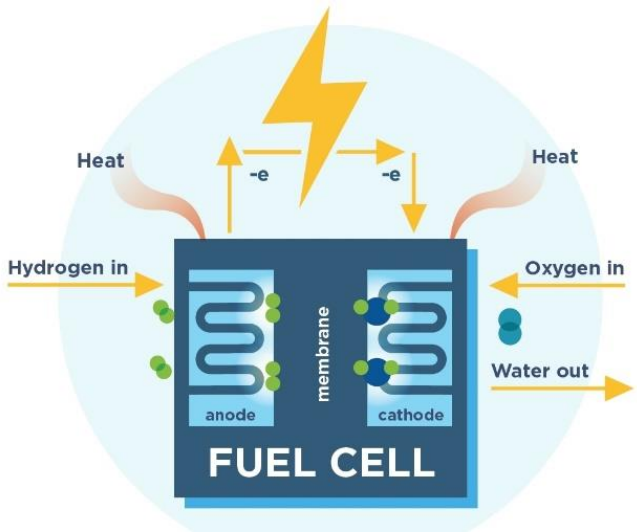
Feature	Lead Acid	LiOn	LiFePO4	Ultracap
Number of cycles	300-1000	12000	1000-2000	>1000000
Specific power (W/kg)	30-180	400 - 2500	15 - 200	5000
Specific energy (Wh/kg)	30-120	65-190	90 - 125	5
BMS/VMS	no	yes (BMS)	Yes (BMS)	yes (VMS)
Cost (€/kWh)	60	160	350	17000

Source: epic power, Nov. 2021

Green hydrogen as an energy vector, electrolyzer and fuel cell, all in DC.



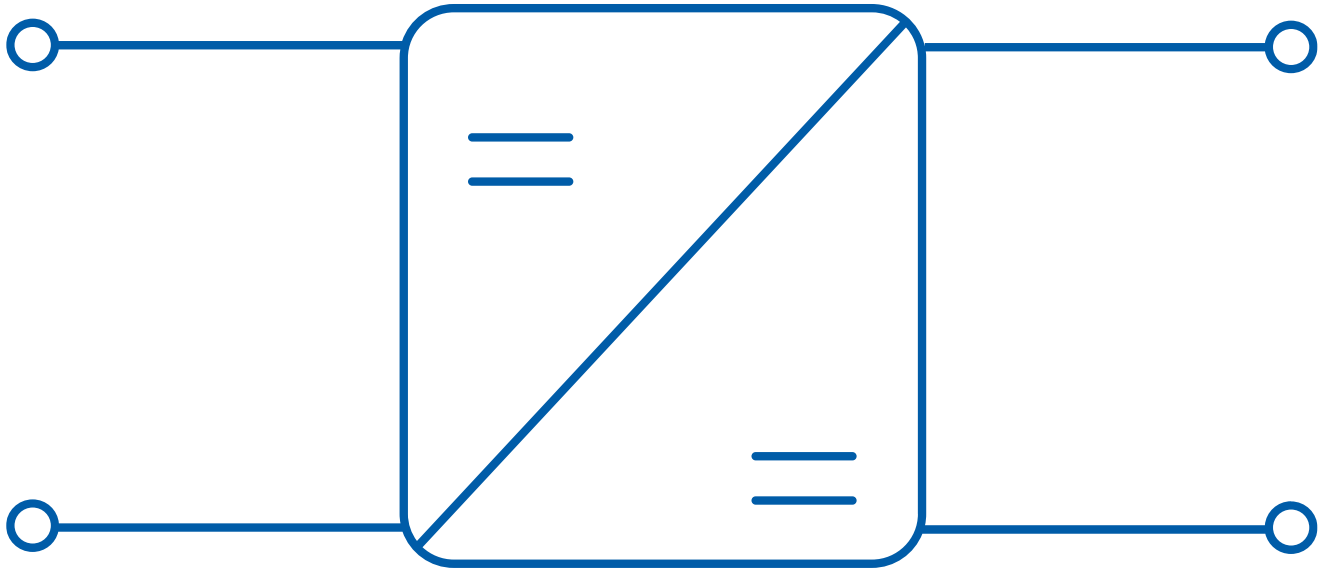
$$2H_2O \rightarrow 2H_2 + O_2$$



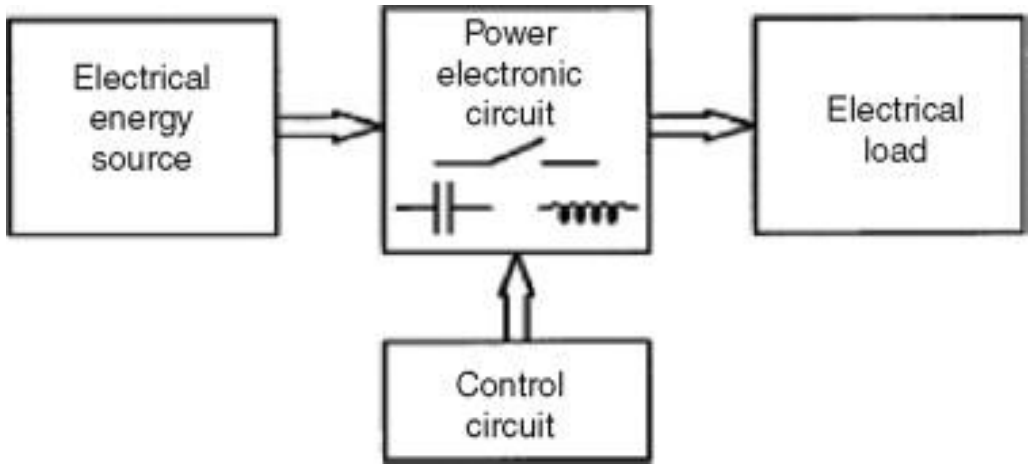
Is so much conversion really necessary?

AC/DC. Gerard Huerta. 1977

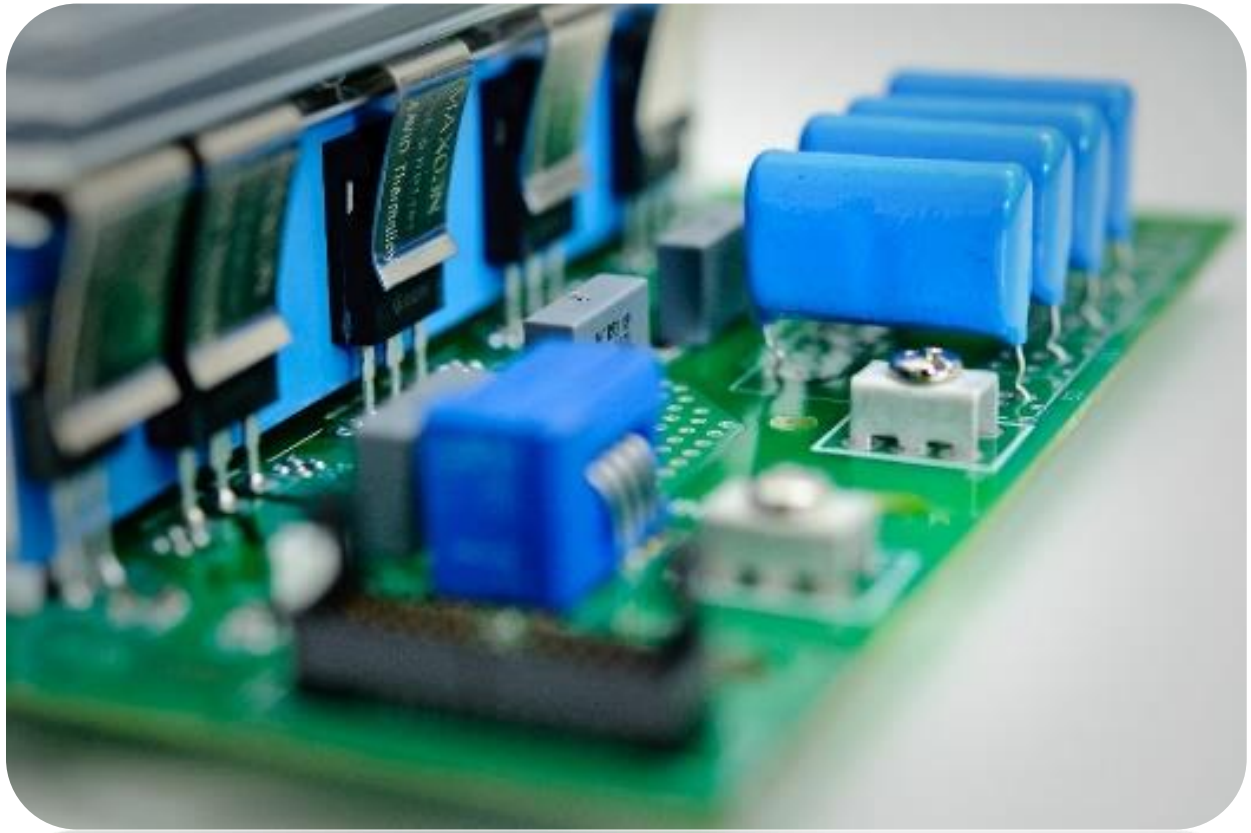
The world needed the development of a configurable DCDC transformer.



Power Electronics applied to energy conversion / control



Source: Muhammad H.Rashid. Power Electronics Handbook. 2001

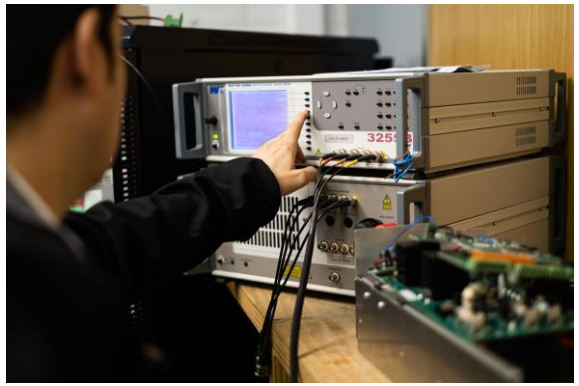


We believe in a

#dcpoweredfuture

Focus: Developing bidirectional DCDC converters beyond the state-of-the-art

R&D engineering, design, manufacturing, certification and support

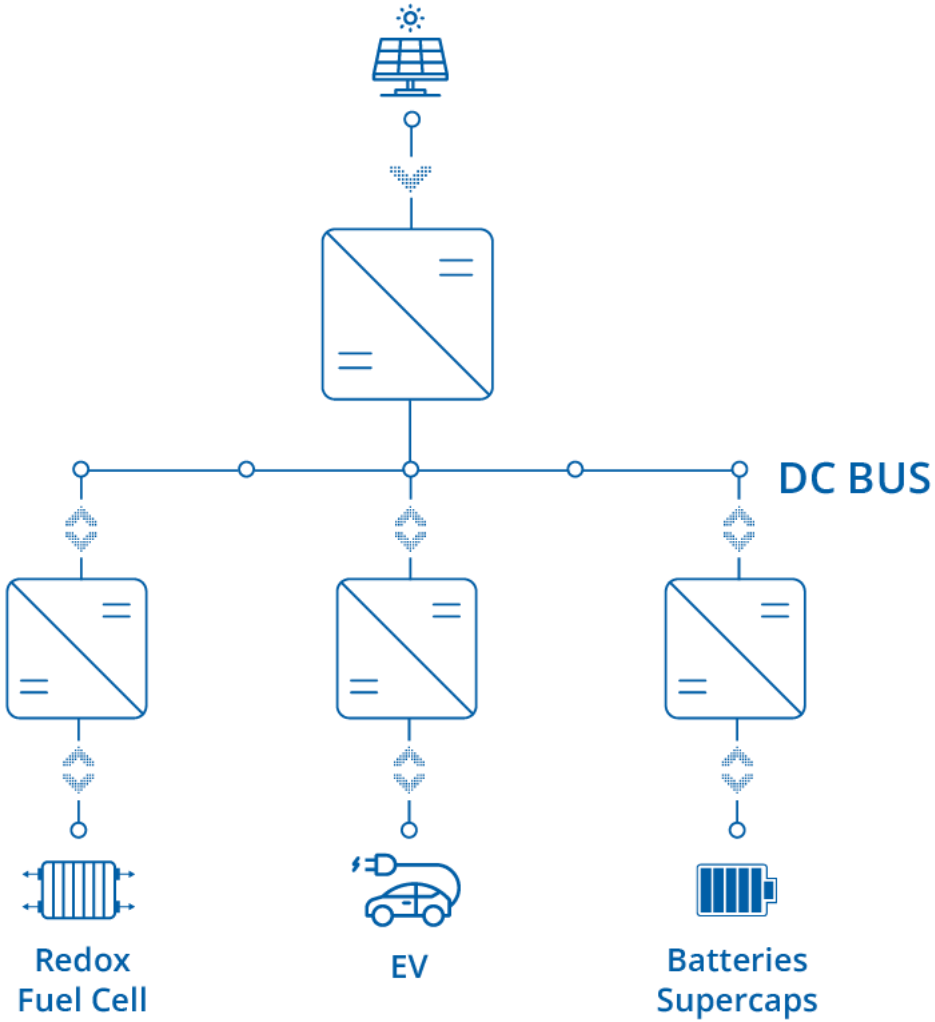


CE

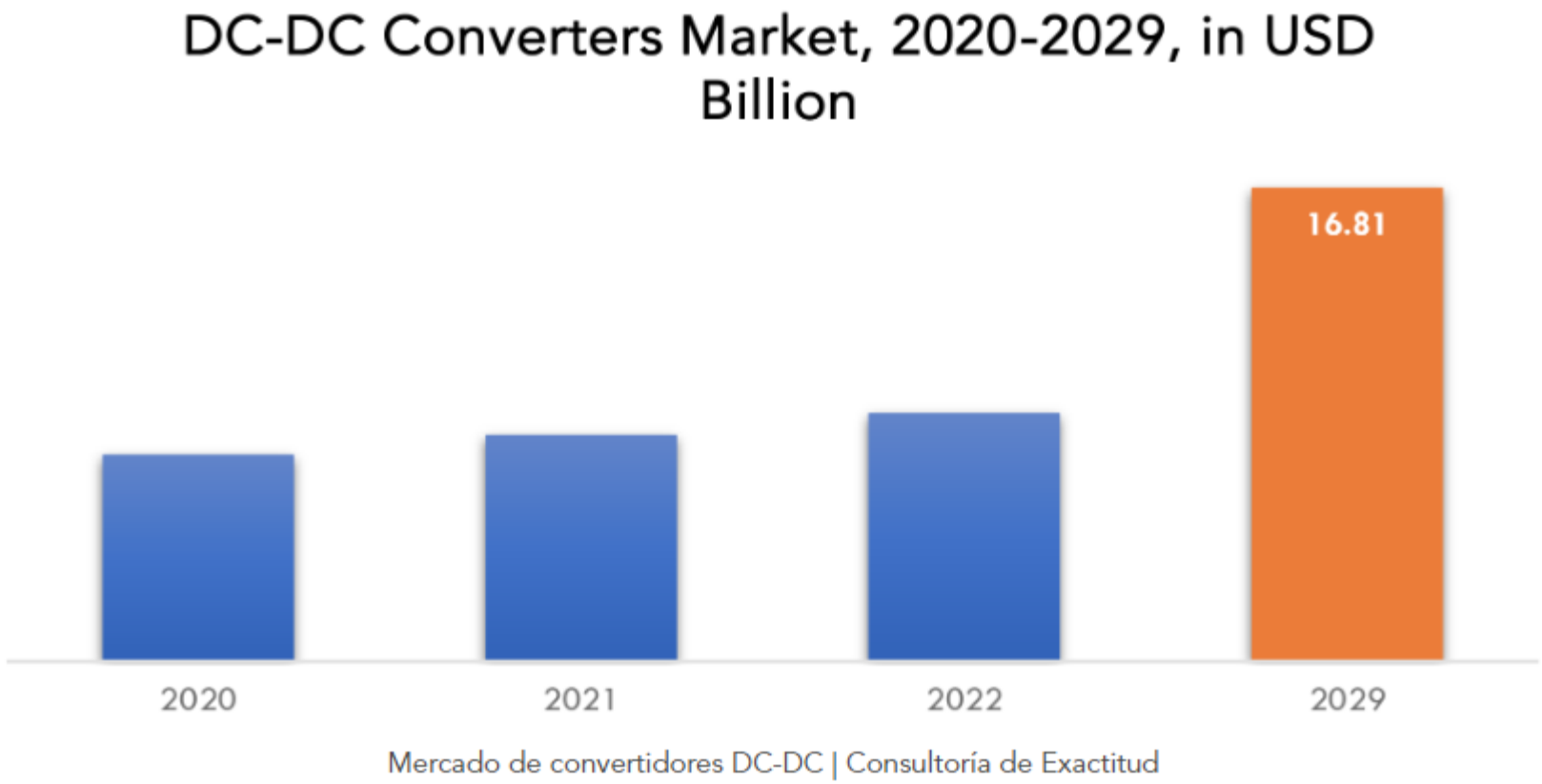
C ETL CM US LISTED
Intertek

The growth potential of DC/DC converters

- DC networks are becoming more and more common



DCDC converters market growth forecast



Company growth

Accumulating knowledge in power electronics DCDC conversion for 12 years

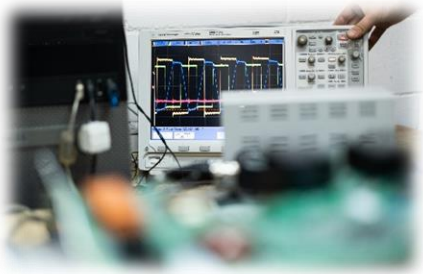
Where are the *epic power* converters?

- Providing solutions in over 40 countries

Competitive advantages

Vertical operation

Complete control of each converter



Research

Certification

Design

Production & Support

Design

Hardware capabilities

- Silicon Carbide technology
- High-frequency magnetics
- Isolation and Non-Isolation topologies
- High efficiency up to 99.3%.

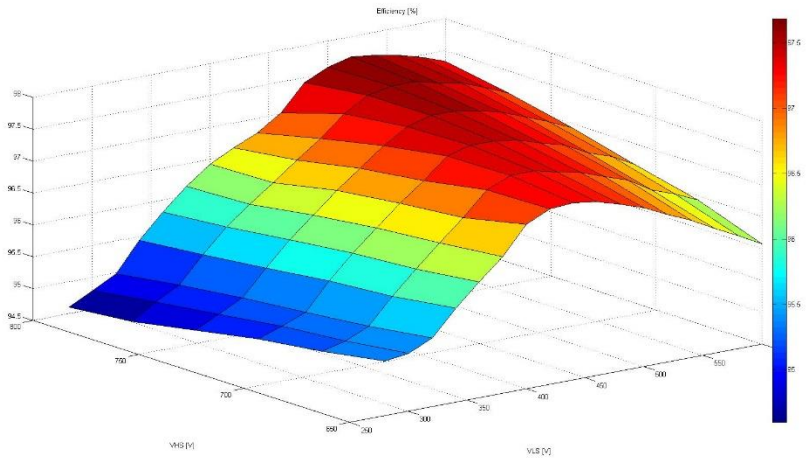
Control capabilities

- Power, Current, Voltage and custom regulations
- Fast response and accurate control
- MPPT function on both sides

Competitive advantages

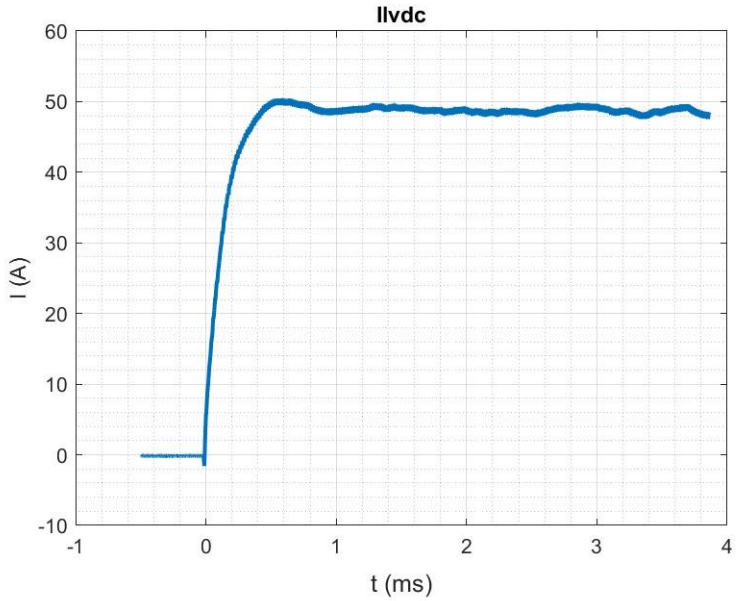
Highest efficiency

- Efficiencies up to 99.3% world top in bi-directional configurations



Control strategy

- Control developed for fast step response, less than 1 ms in current control mode



Competitive advantages

Modular rackable design and excellent power density per kg

MPPT function in the both sides of the converter

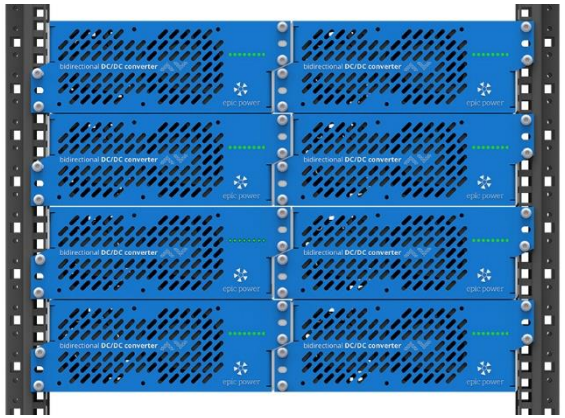
Main markets

Bidirectional DC/DC Converters for

Lift / Crane sector

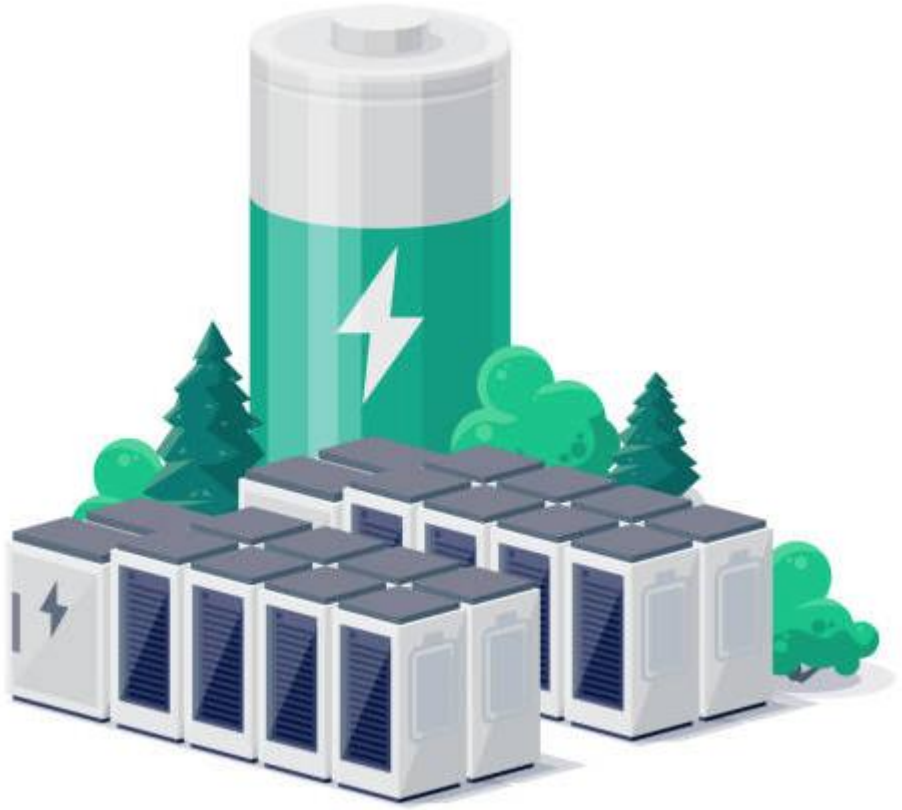
Intralogistics

Energy storage and usage

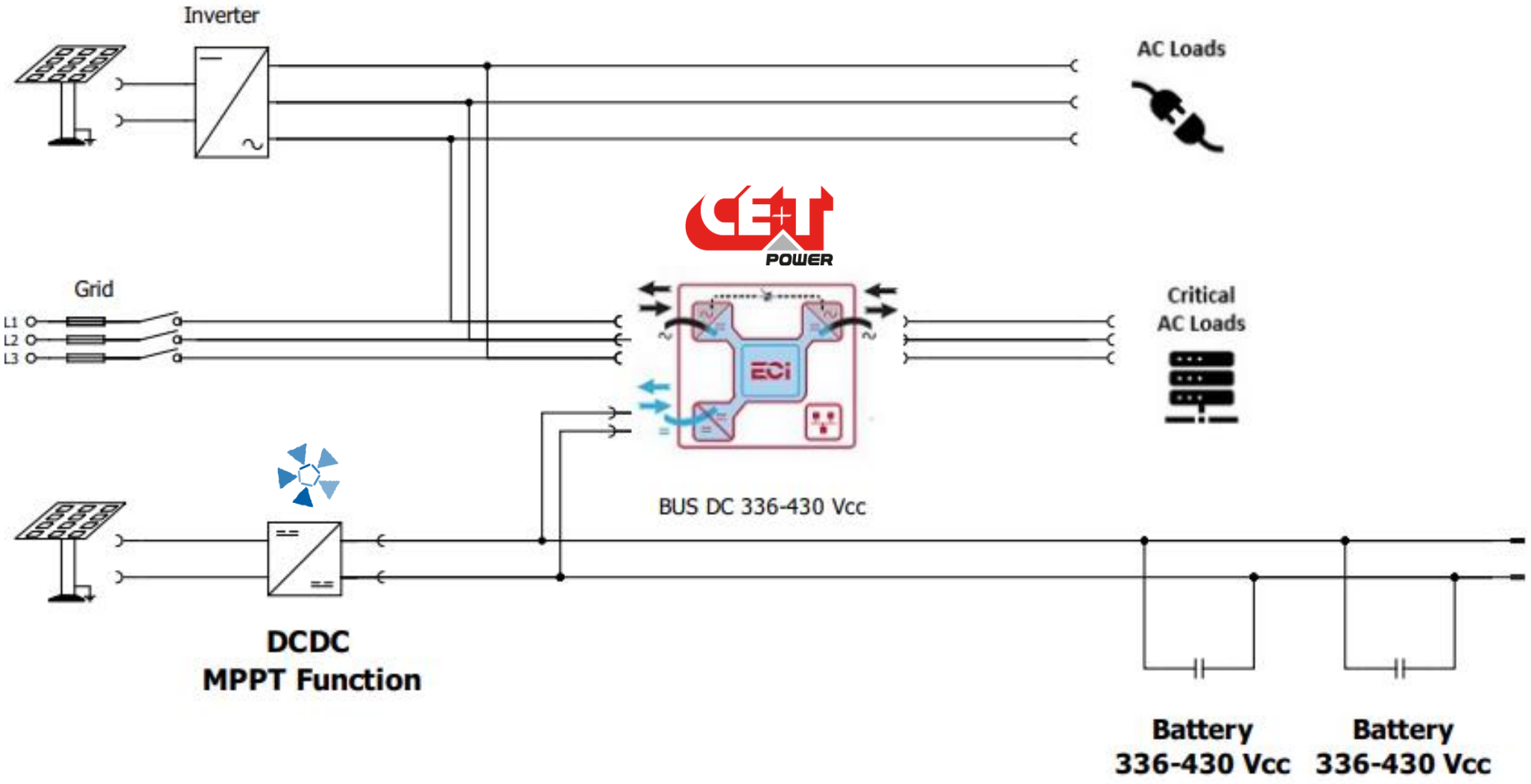


What would happen if we offered a joint solution?

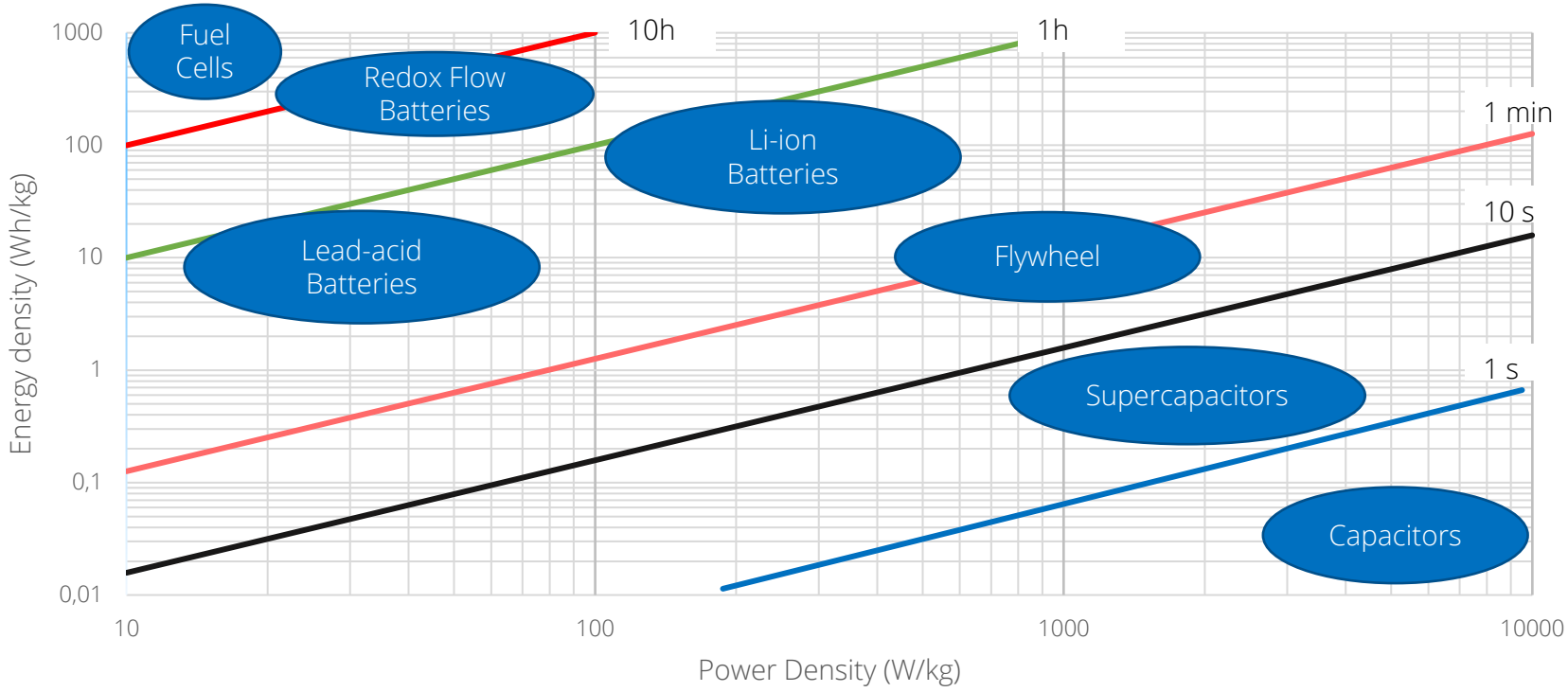
Existing or new solar installations require integrate energy storage



Energy storage in existing installation with the possibility of adding more power.



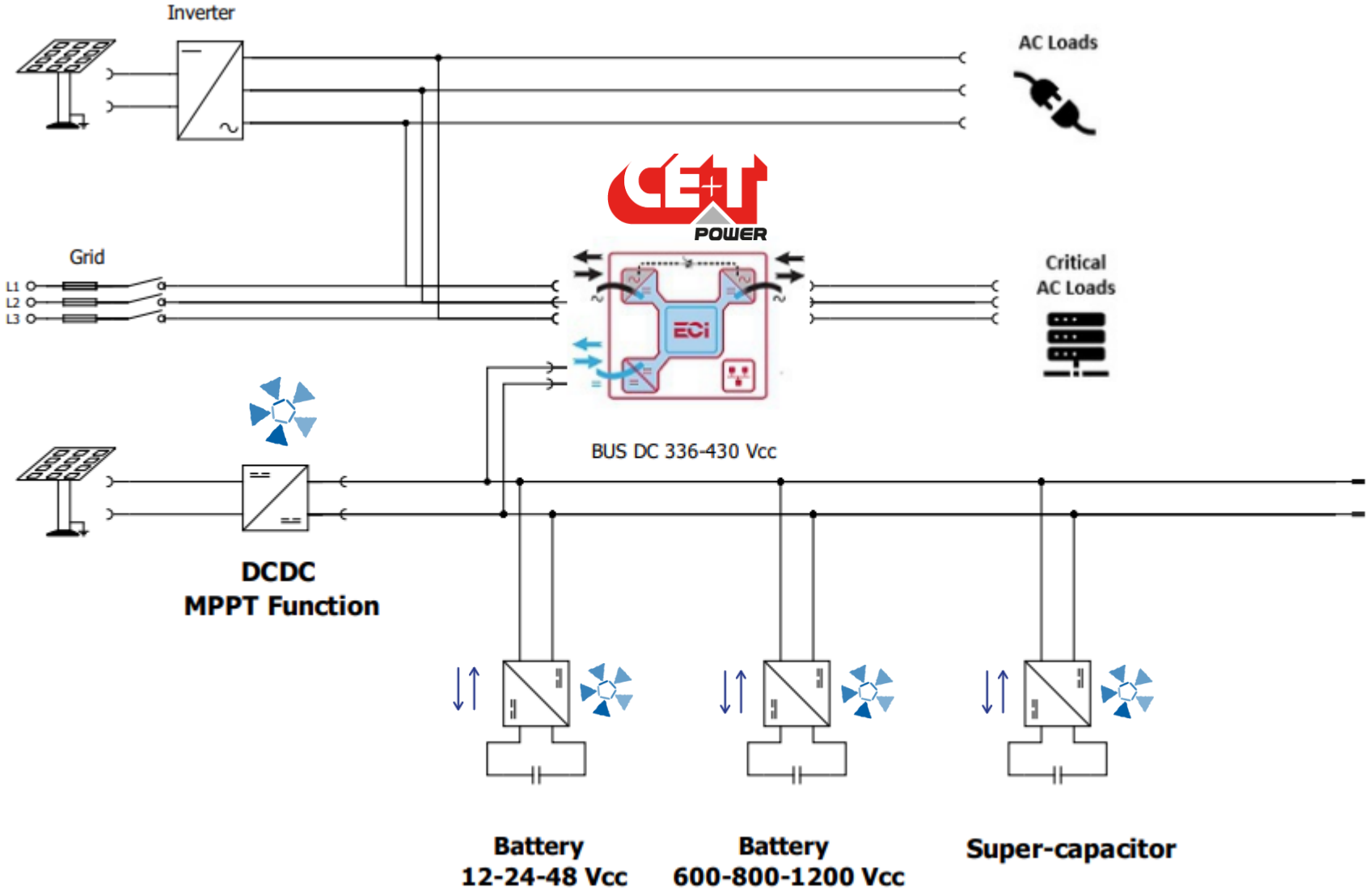
Different storage technologies have very different characteristics



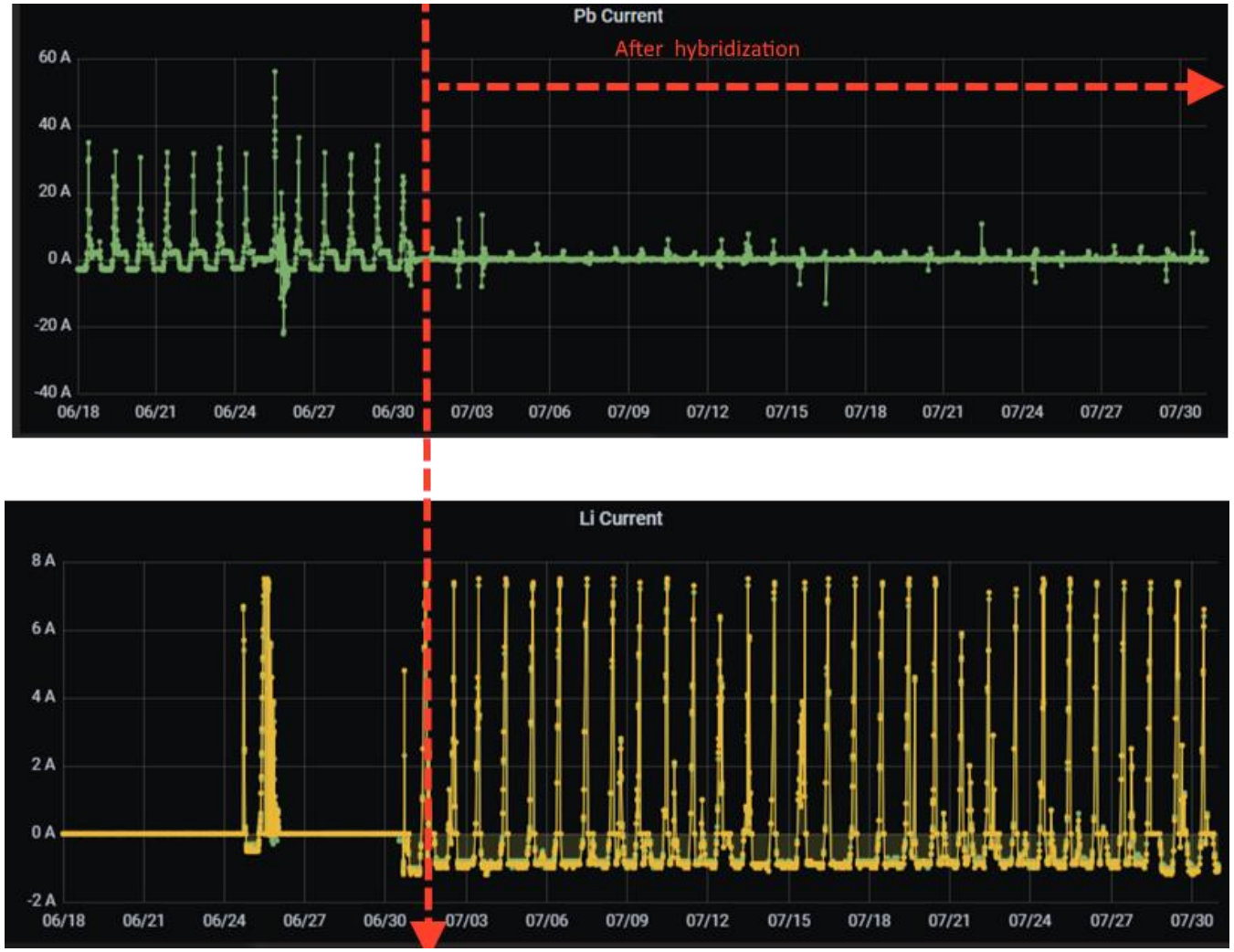
Long Duration

Quick response

Energy storage mixing different voltages and technologies



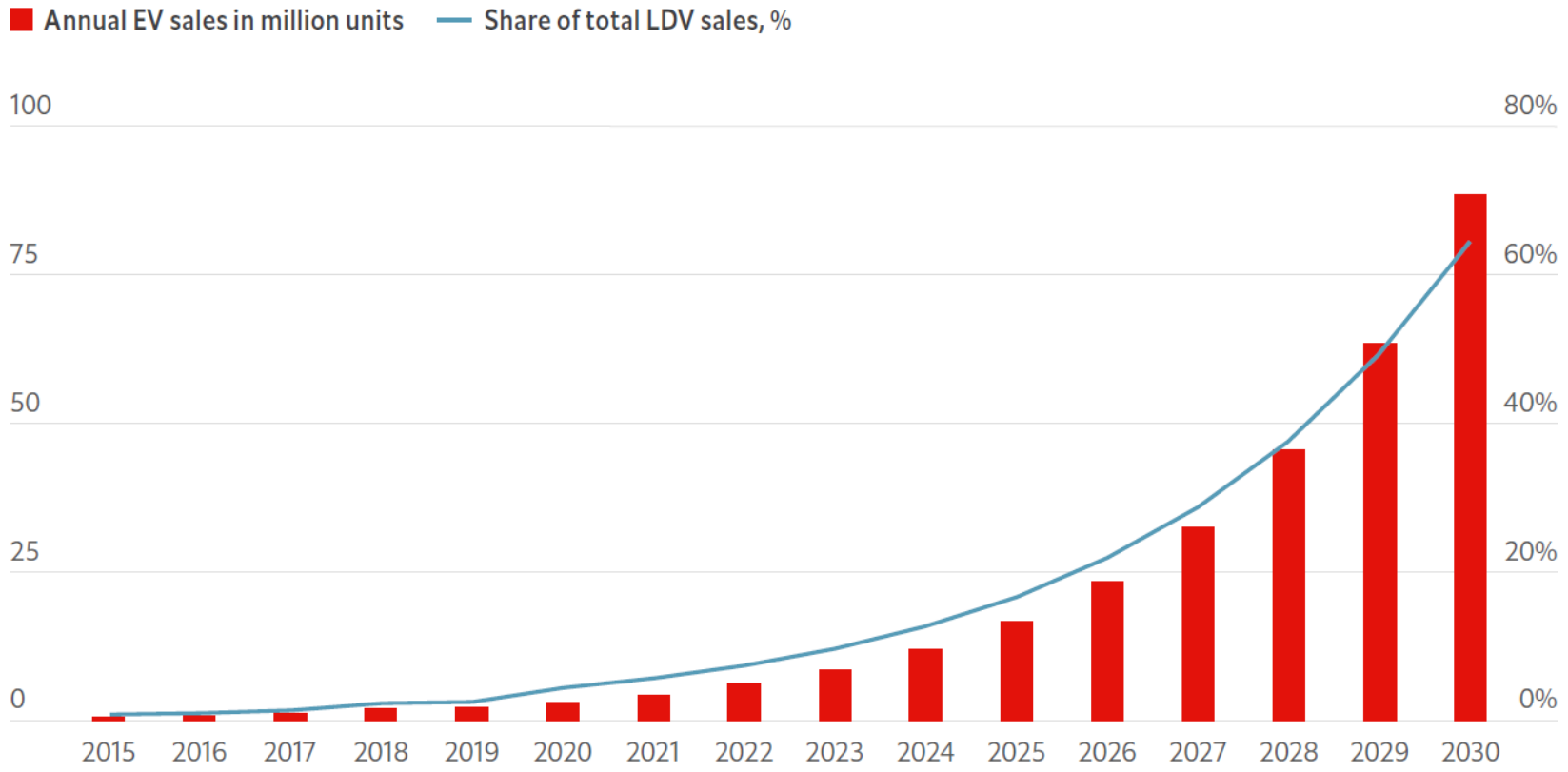
Lithium and Lead-Acid hybridization



EV Chargers

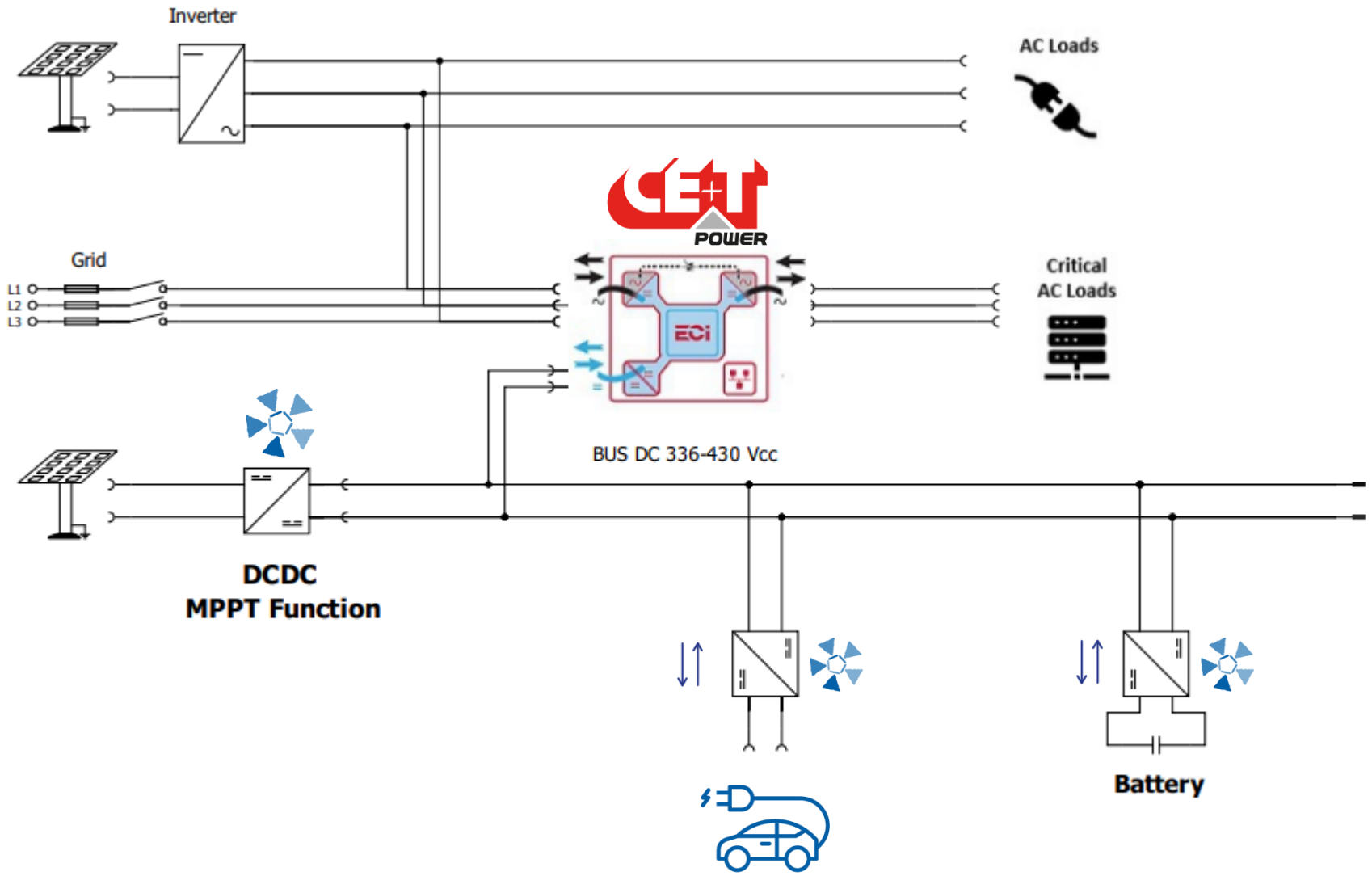
Need to integrate EV chargers in industrial installations

Figure 6. Global LDV Electric Vehicles sales, 2015–2030



Source: The Economist. Sizing the Energy Transition, 2021

Solar + energy storage + Bidirectional EV Charger



Example of Bidirectional EV Charger installation

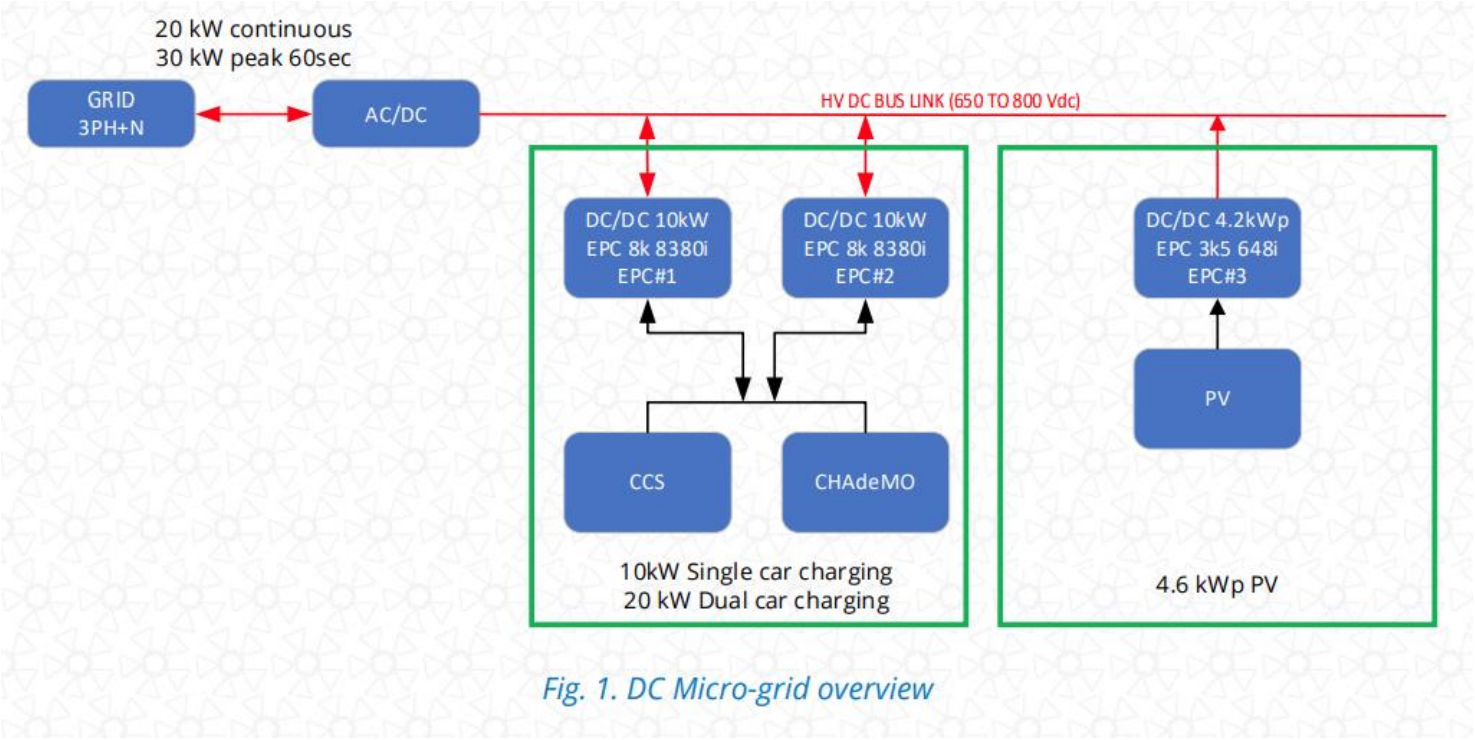
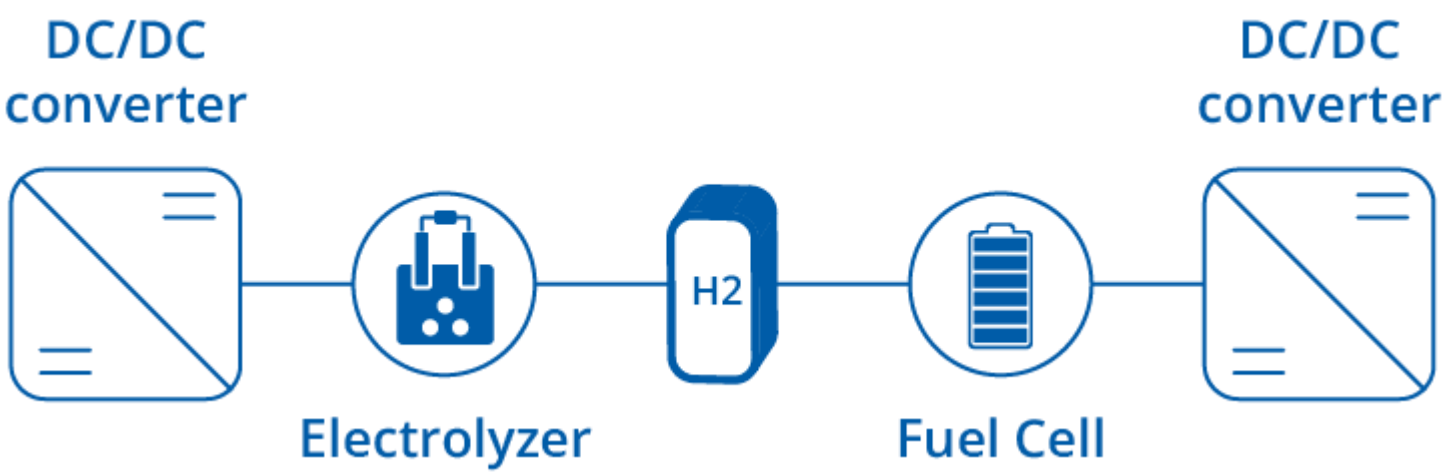


Fig. 1. DC Micro-grid overview

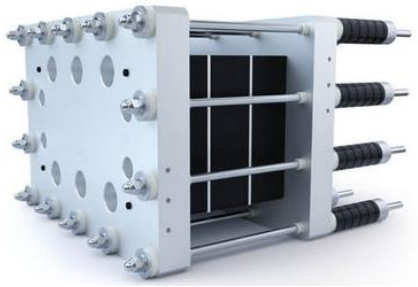
Bidirectional EVSE (Electric Vehicle Supply Equipment) epic power facilities in Zaragoza, Spain

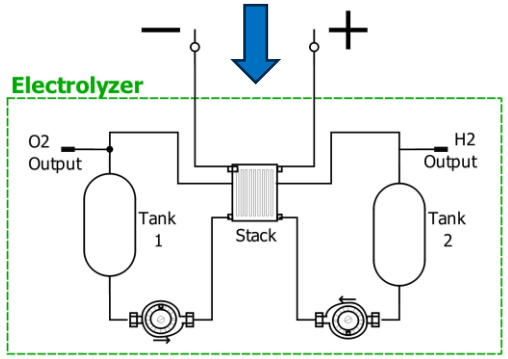
The green H2 works in DC

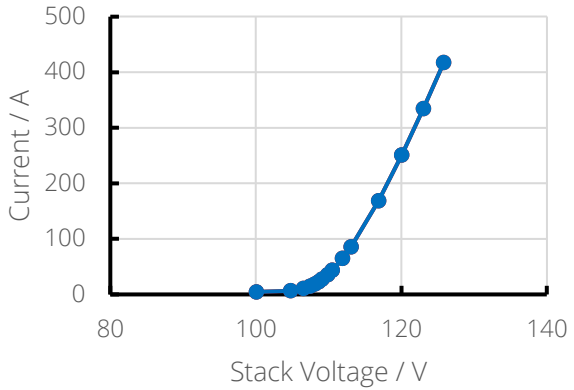


Are electrolyzers and fuel cells that different?

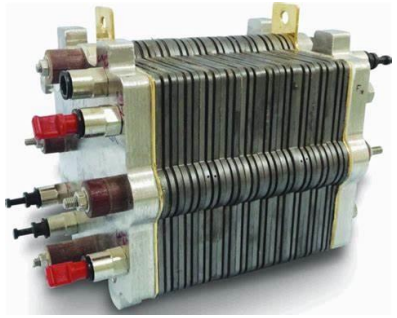
Electrolyzer stack

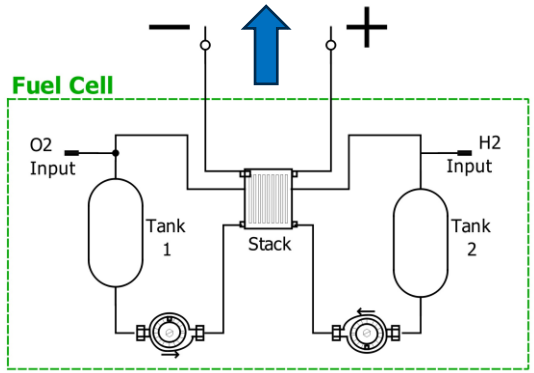


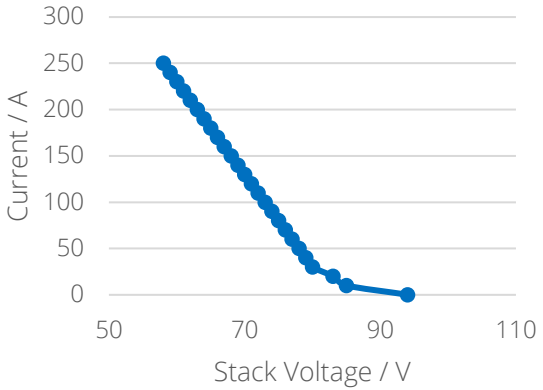




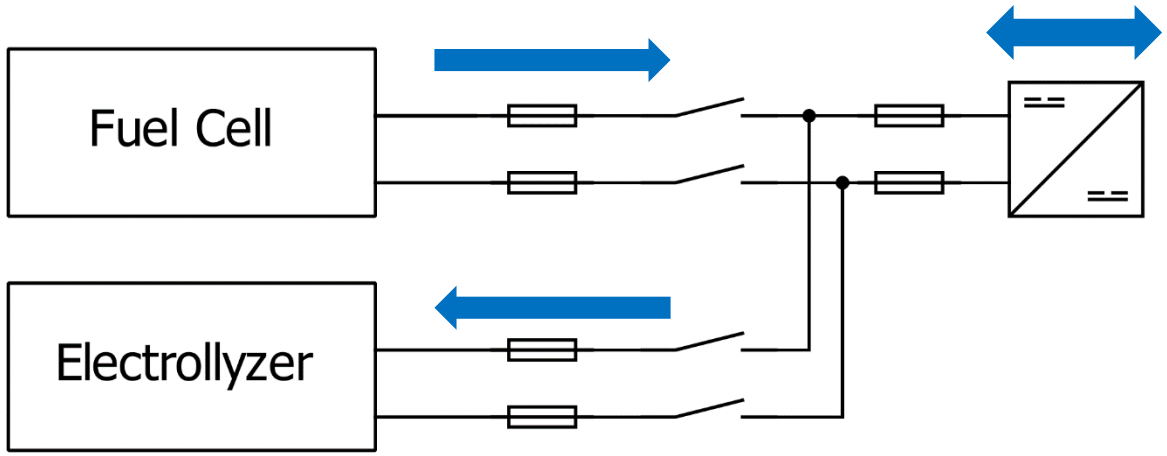
Fuel Cell Stack







Are electrolyzers and fuel cells that different?

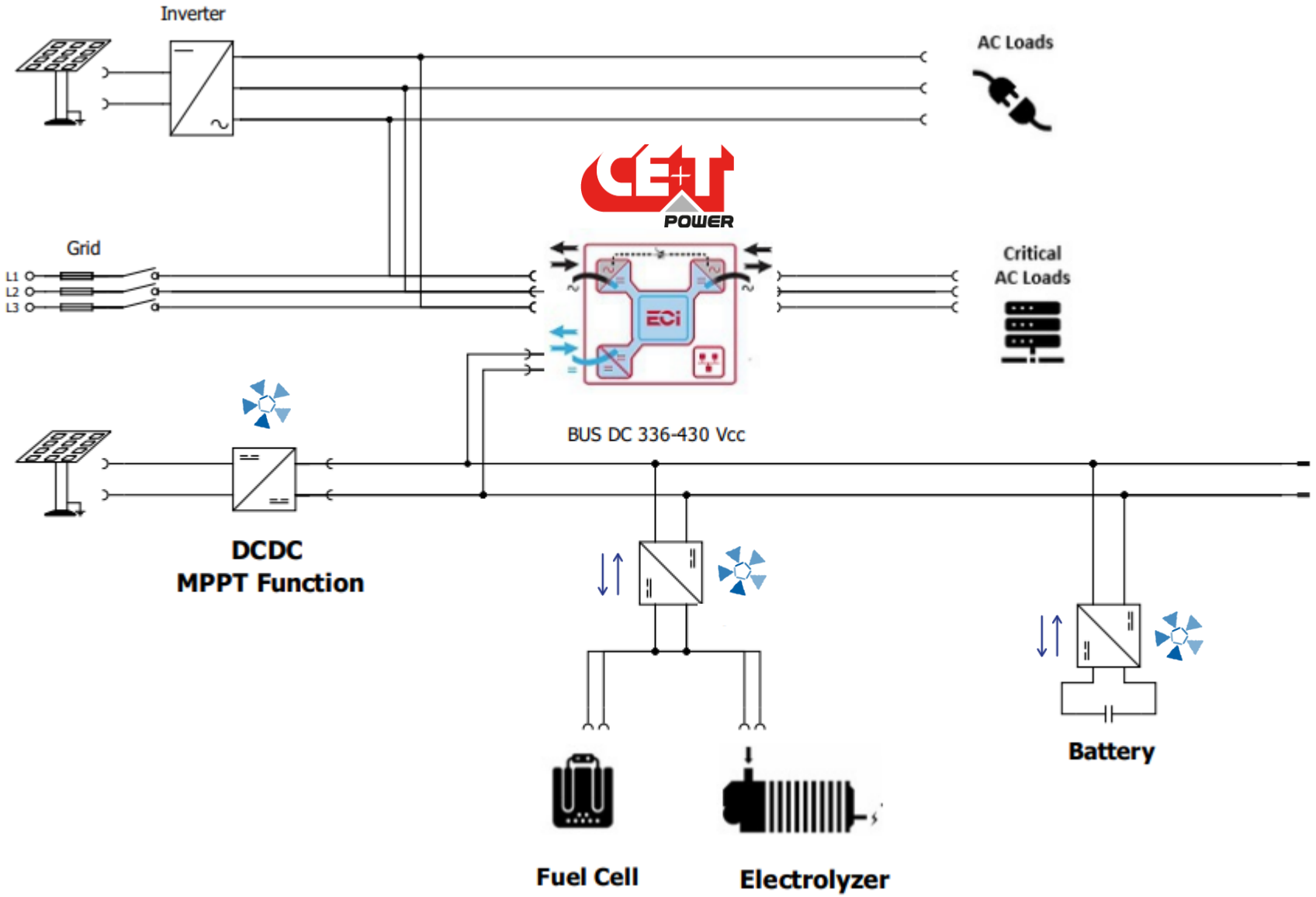


- Electroyzers only work when renewables are available
- Fuel cell is only used when the electrolyzer is off

Bidirectional DC/DC Converters

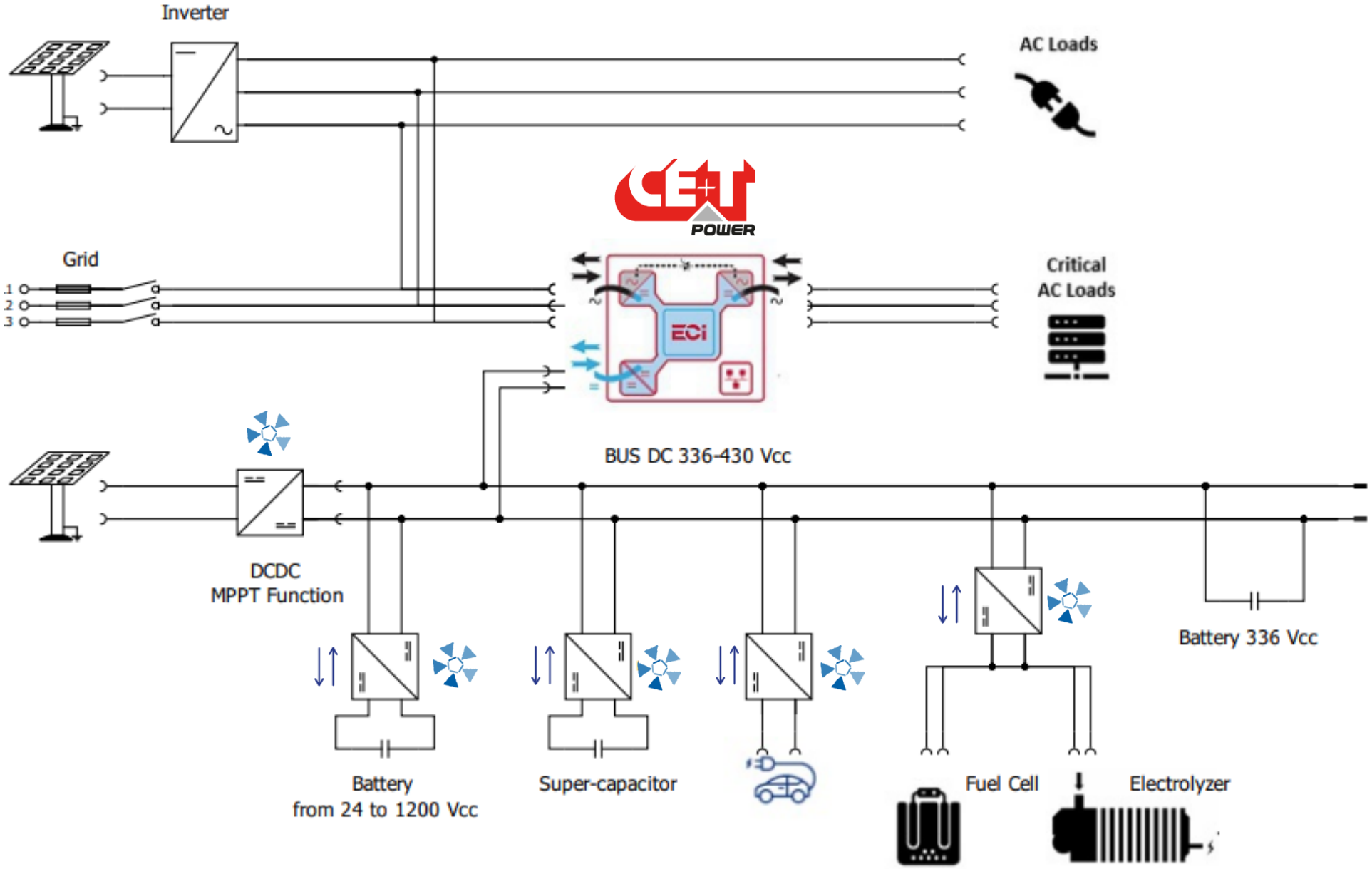
can work with both!

Electrolyzer + Fuel Cell with one bidirectional converter



With our help you will achieve all your goals

The possibilities are endless



Power electronics design and manufacture

Specialized in bidirectional DC/DC converters

Industrialization and production capabilities

Open for new challenges

epic power converters S.L.

drubio@epicpower.es

epic power

www.epicpowerconverters.com

Our solutions

Bidirectional DC/DC converter range

Model	Isolated	High side Voltage [Vdc]	Low side Voltage [Vdc]	Power per unit [kW]
EPC 3k5 648i	✓	510-848	38-59	3.5
EPC 5k5 648i	✓	510-848	38-59	5.5
EPC 2k2 624i	✓	510-848	19-30	2.2
EPC 2k2 348i	✓	280-450	38-59	2.2
EPC 2k2 324i	✓	280-450	19-30	2.2
EPC 4k8 6125i	✓	430-830	110-165	4.8
EPC 7k 670i	✓	510-848	40-80	7
EPC 8k 8380i	✓	650-800	280-600	8
EPC 50A 0848		50-848	0-798	up to 40
EPC 50A 1200		50-1200	0-1150	up to 57