



■ Innovation



■ Energy



■ Environment

## Resiliency - Backup Power Fuel Cell Solutions for critical infrastructures

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VP Marketing & Sales Fuel Cell Solutions

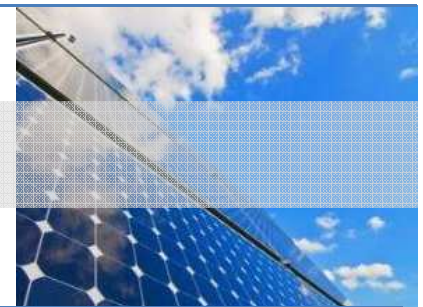
IPHE Workshop on Fuel Cell Backup Power, Wuhan, May 29th 2015

- Heliocentris - Your presenters company
  - Who we are and what we do
  
- [www.cleanpowernet.de](http://www.cleanpowernet.de) - Your presentors network
  - Support activities for backup and off-grid fuel cell solutions in Germany
  
- Examples & Learnings
  - Backup Power Fuel Cell Solutions for critical infrastructures

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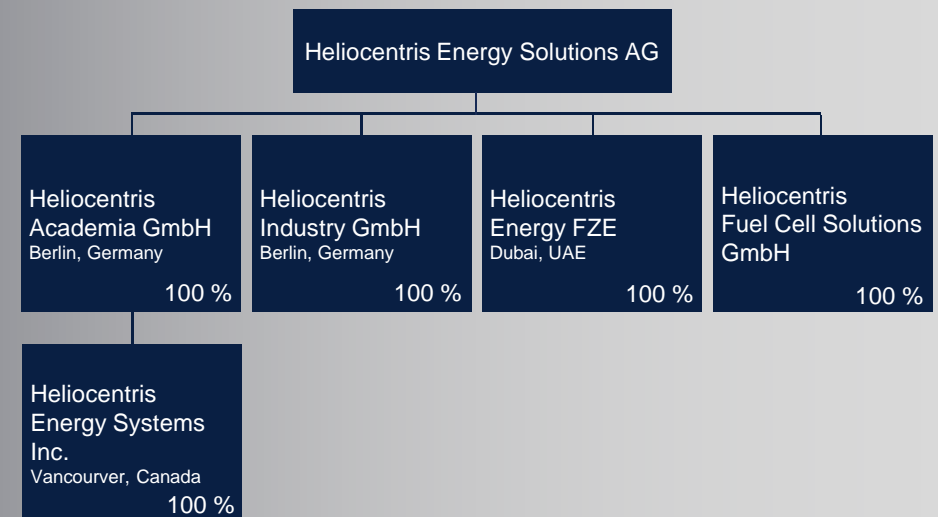
Heliocentris

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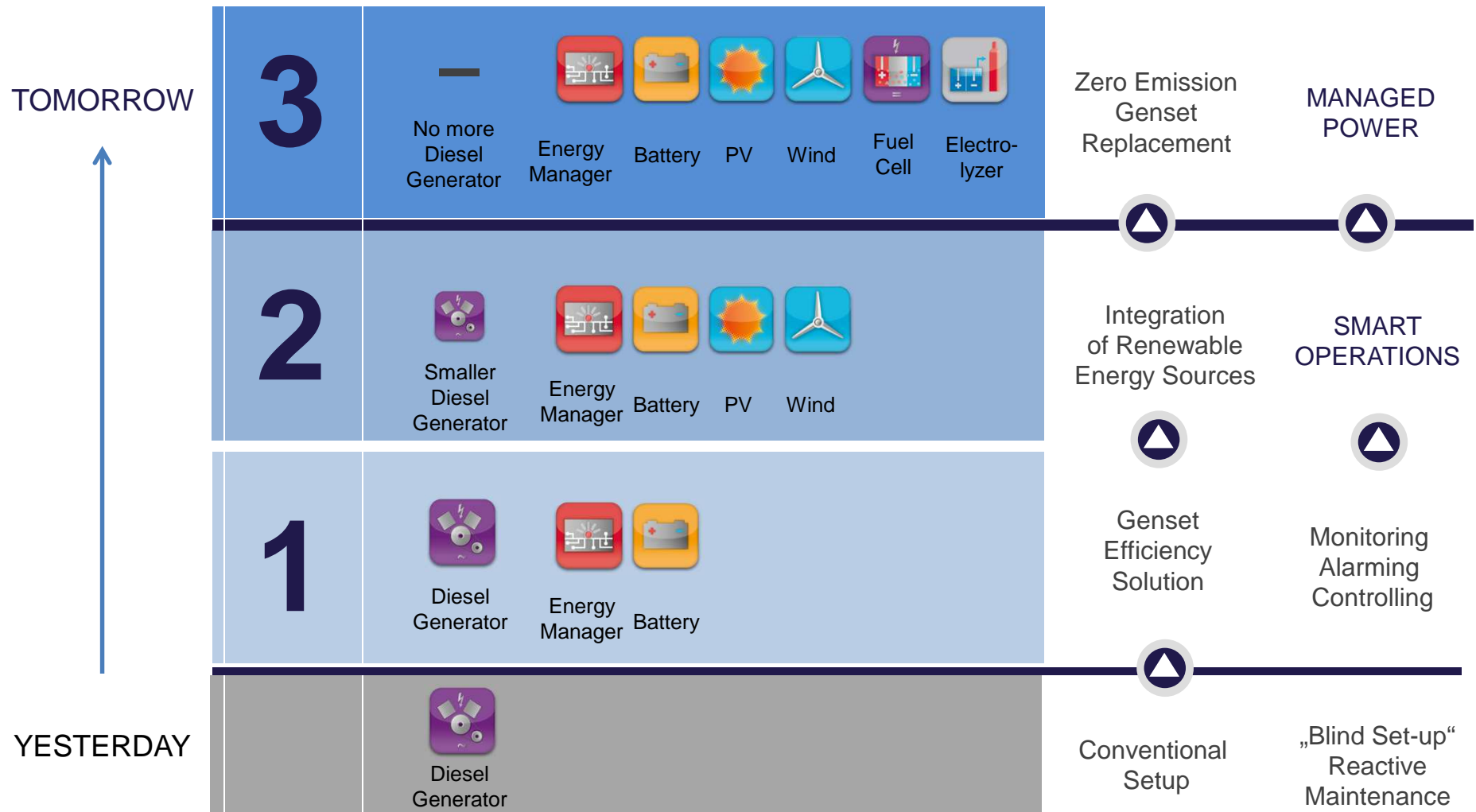
## OVERVIEW

Foundation	1995
Acquisition of P21	2011
Acquisition of FutureE	2014
Business	<ul style="list-style-type: none"> <li>Energy Management Systems</li> <li>Power Network Management</li> <li>Hybrid Power Solutions</li> <li>Zero Emission Solutions</li> <li>Fuel Cell Solutions</li> <li>Training &amp; Research</li> </ul>
Markets	<ul style="list-style-type: none"> <li>&gt; 70 countries</li> <li>Export ratio 60-80%</li> </ul>
Locations	<ul style="list-style-type: none"> <li>Berlin, Munich, Stuttgart,</li> <li>Dubai, Johannesburg, Yangon</li> </ul>
Group HQ	Berlin

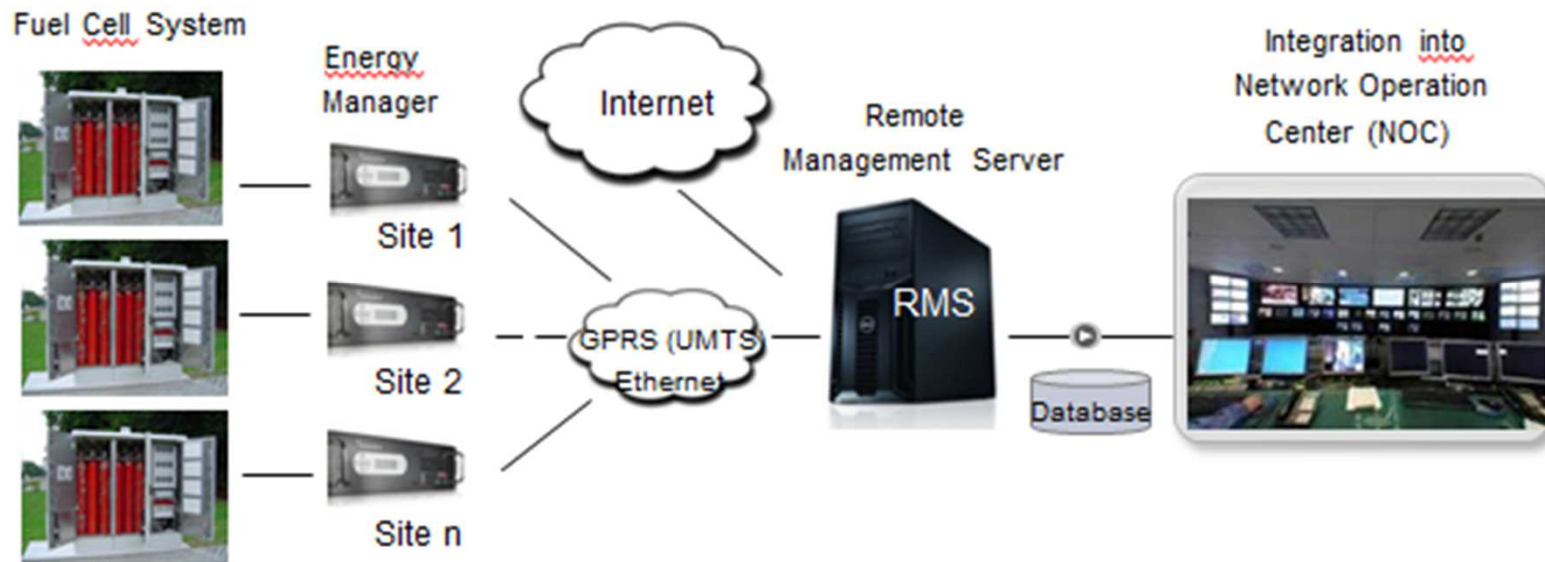


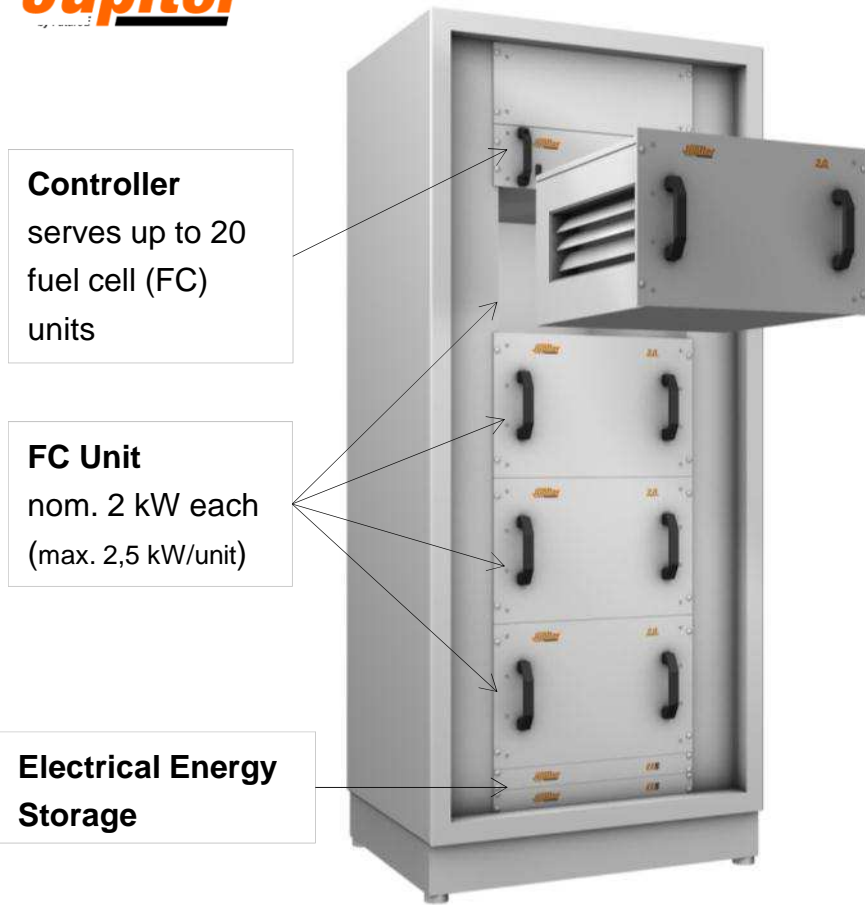
Revenue 2014	18.9 Mio. €
Employees End 2014	187
Installations End 2014	Over 2.000 Managed Power Solutions
Stock Exchange	Regulated Market (Prime Standard) of Frankfurt Stock Exchange

# Strategic Roadmap to Smart and Zero Emission Solutions



# Integrated offering from zero emission power supply to complete network operation





**Controller**  
serves up to 20  
fuel cell (FC)  
units

**FC Unit**  
nom. 2 kW each  
(max. 2,5 kW/unit)

**Electrical Energy  
Storage**

Example: 8 kW Indoor Configuration

- Designed for back-up power in telecommunications, utilities, industry & IT

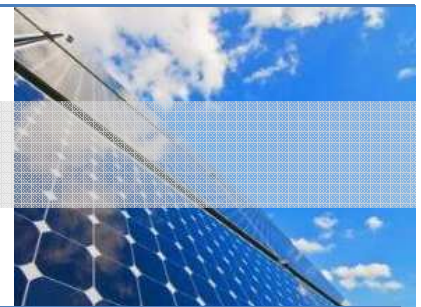
### Customers especially value the Jupiter Fuel Cell System, due to:

- High flexibility => one system for many different applications (power & voltage levels)
- Very high efficiency (> 54%)
- *"It's a commercial product"*: fulfills practical customer needs (modular, plug & play, installation, service, reliability)
- Commercially proven in numerous applications
- Backup power, optionally minute reserve, peak power shaving functionality available

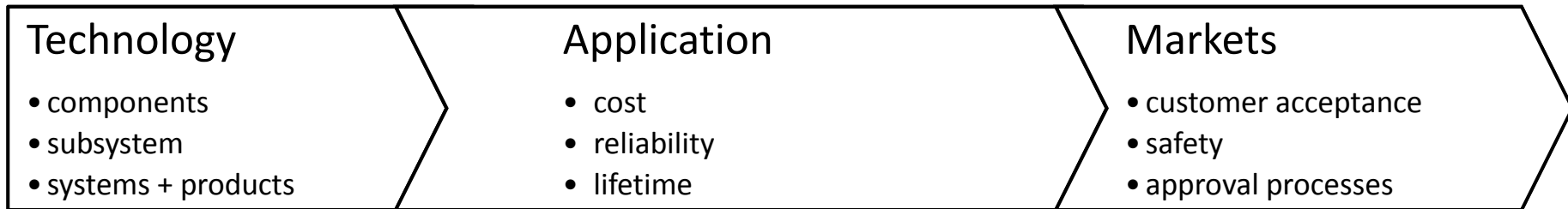
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Bosch:  
Hydrogen Gas  
Injector HGI



FCCT:  
Gas Diffusion Layer  
(GDL)



Linde:  
Ionic H2-Compressor



Steering Committee



Structure:

- Annual Assembly
- Speaker
- Working Groups

2010: 12 companies and R&D organizations constitute Clean Power Net  
 2015: 23 Clean Power Net partners from start-up to global players



**Development and facilitation of global market acceptance for fuel cells in backup power**

Markets

- IT
- Telecom
- Industry automation & control
- Traffic control
- Energy distribution

Applications

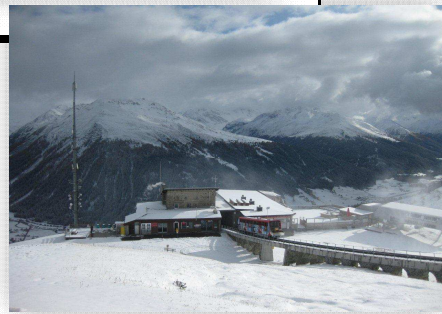
- UPS / Backup
- Smart-Grid
- Remote / autonomous power supply (Mobile base stations)
- UPS for secondary technology in power distribution
- Minutereserve (tertiary power) and peak power shaving

Autonomous power supply  
with fuel cell systems:  
efficient + intelligent + clima protecting



### UPS Uninterrupted Power Supply (Backup Power):

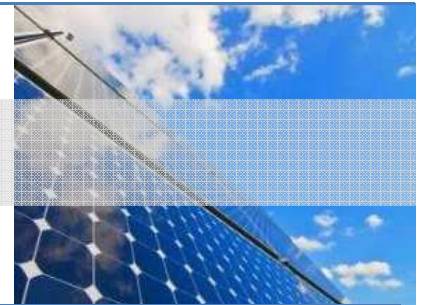
- 16 projects
- Approx. 300 fuel cell systems in supervised field operation across Germany



More information  
[www.cleanpowernet.de](http://www.cleanpowernet.de)

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## Examples & Learnings



## Issues with battery bank and Diesel genset backup-systems

- **Diesel Genset needs regular maintenance to keep its availability (4-12 site visits/year)**
- Diesel Genset is noisy during operation
- Diesel Genset has toxic emissions (particles, SOx, NOx)
- Weight and vibrations prevent many rooftop installations
- Genset, diesel fuel and batteries are often subjected to thefts
- Battery bank needs cooling
- Battery has limited life span (often 3-5 years)
- Disposal of lead acid battery is hazardous to the environment if not properly handled

## Achievements through fuel cell technology

- **Improvement of network availability & resilience**
- Reduction of OPEX due to fewer site visits
- Reduction of CO2 emission
- Reduction of noise emission
- Installation at sites where Gensets are not possible/allowed
- Reduction of cooling requirements (due to smaller batteries)
- Reduction of potential hazards from battery disposal (due to smaller batteries)





## APPLICATION

Uninterrupted power supply

## SYSTEM

“Jupiter” FC-System: 6 kW @ 380 VAC

## HOUSING

Outdoor cabinet (RC4)

## LOCATION

Germany

## INAUGURATION

2014



## APPLICATION

Backup power supply for radar

## SYSTEMS

“Jupiter” FC-System: 6 kW @ 380 VAC

## HOUSING

Outdoor cabinet

## LOCATION

Hamburg/Germany

## INAUGURATION

2013





## APPLICATION

Backup power supply with peak-power shaving and minute reserve

## SYSTEM

„Jupiter“ FC-System: 14 / 28 kW @ -60 VDC

## HOUSINGS

Indoor, Outdoor and Container

## LOCATIONS

Germany / Czech Republic

## INAUGURATION

2009 - 2011



Landkreis Göppingen

Herzlich willkommen im Stauferkreis

## APPLICATION

Backup power for IT Center

## SYSTEM

“Jupiter” FC-System: 20 kW @ 380 VAC

## HOUSING

Container solution

## LOCATION

Göppingen, Germany

## INAUGURATION

2012



## APPLICATION

Range extender for electrical energy storage for signal box

## SYSTEM

“Jupiter” FC-System: 6 kW @ 60 VDC

## HOUSING

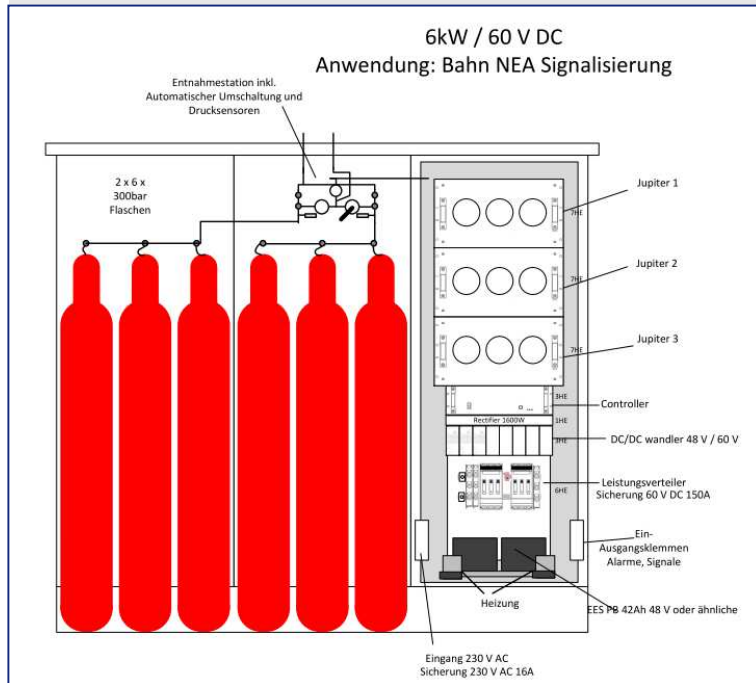
RC2 outdoor cabinet

## LOCATION

Germany

## INAUGURATION

2015





## APPLICATION

Grid Independent Power supply (100% zero emissions)

## SYSTEMS

“Jupiter” FC-System: 2/4 kW @ -48 VDC

## ENCLOSURE

Container

## LOCATION

Versmold and Büren, Germany

## INAUGURATION

2011 and 2012

**With few moving parts, lower system complexity and reduced maintenance requirements compared to gensets and longer autonomy times compared to batteries fuel cell solutions are a superior alternative to incumbent backup power solutions for resilience.**

### **Heliocentris fuel cell solutions for backup power**

- ✓ **improve network availability & resilience**
- ✓ **lower operating costs and**
- ✓ **benefit the environment**