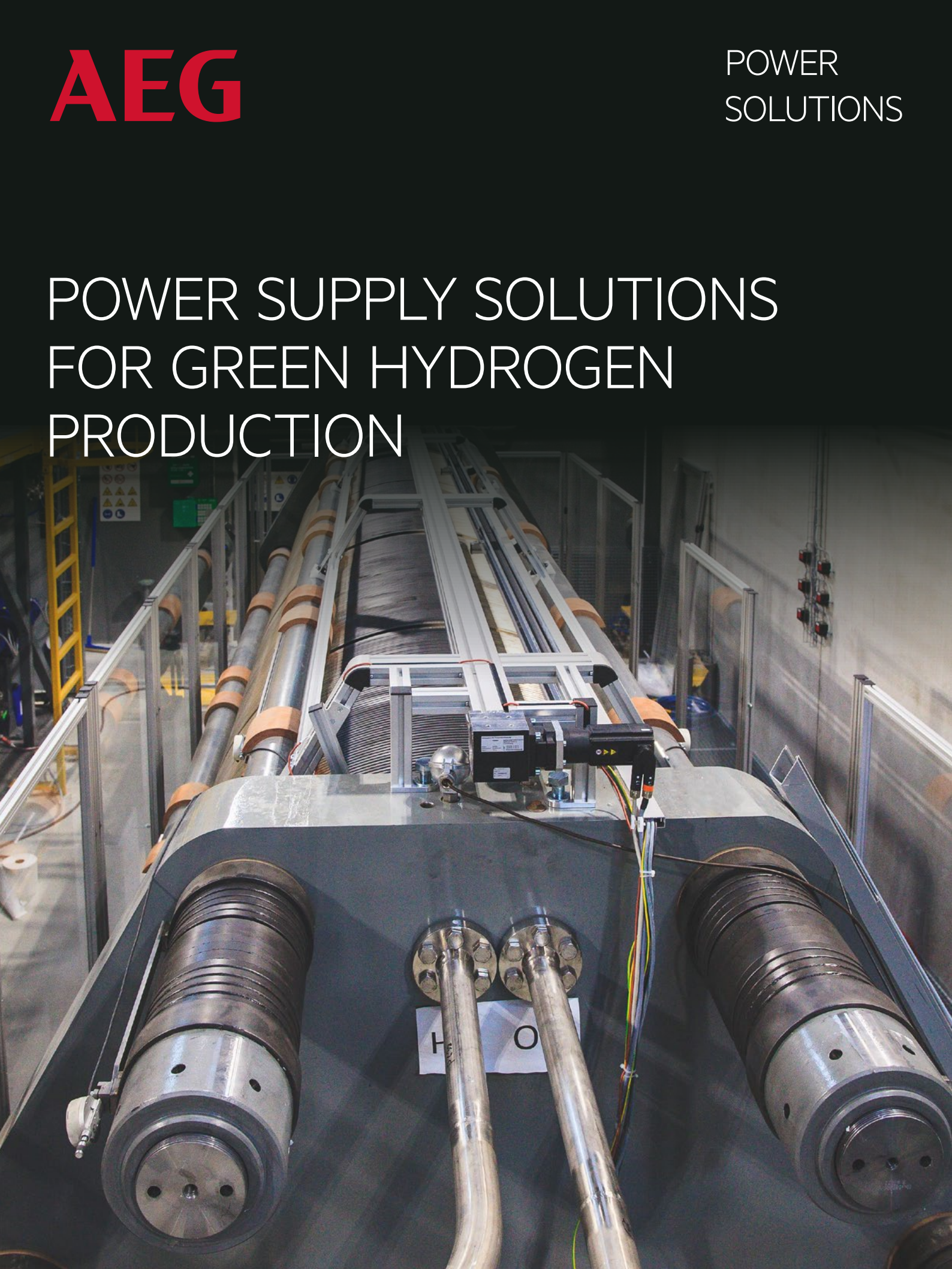
AEG

POWER
SOLUTIONS

POWER SUPPLY SOLUTIONS FOR GREEN HYDROGEN PRODUCTION




H2
HYDROGEN

GREEN HYDROGEN PRODUCTION

Shaping the future with green hydrogen

Green hydrogen has the potential to revolutionize the energy industry as we know it, offering a clean and sustainable solution for powering the future. With the increasing demand for renewable energy sources, the opportunities for green hydrogen are vast, from transportation to industrial processes. As the technology continues to advance and costs continue to decrease, we can expect green hydrogen to play a significant role in the transition to a low-carbon economy.

AEG Power Solutions strongly believes in the potential of hydrogen as a key component in a sustainable energy future. We are committed to working with our clients to design and deliver innovative and efficient solutions that will help them achieve their goals in reducing their carbon footprint and increasing their use of clean energy.

Furthermore, we offer comprehensive project management for the integration of power supply systems for the electrolysis process of green hydrogen projects.

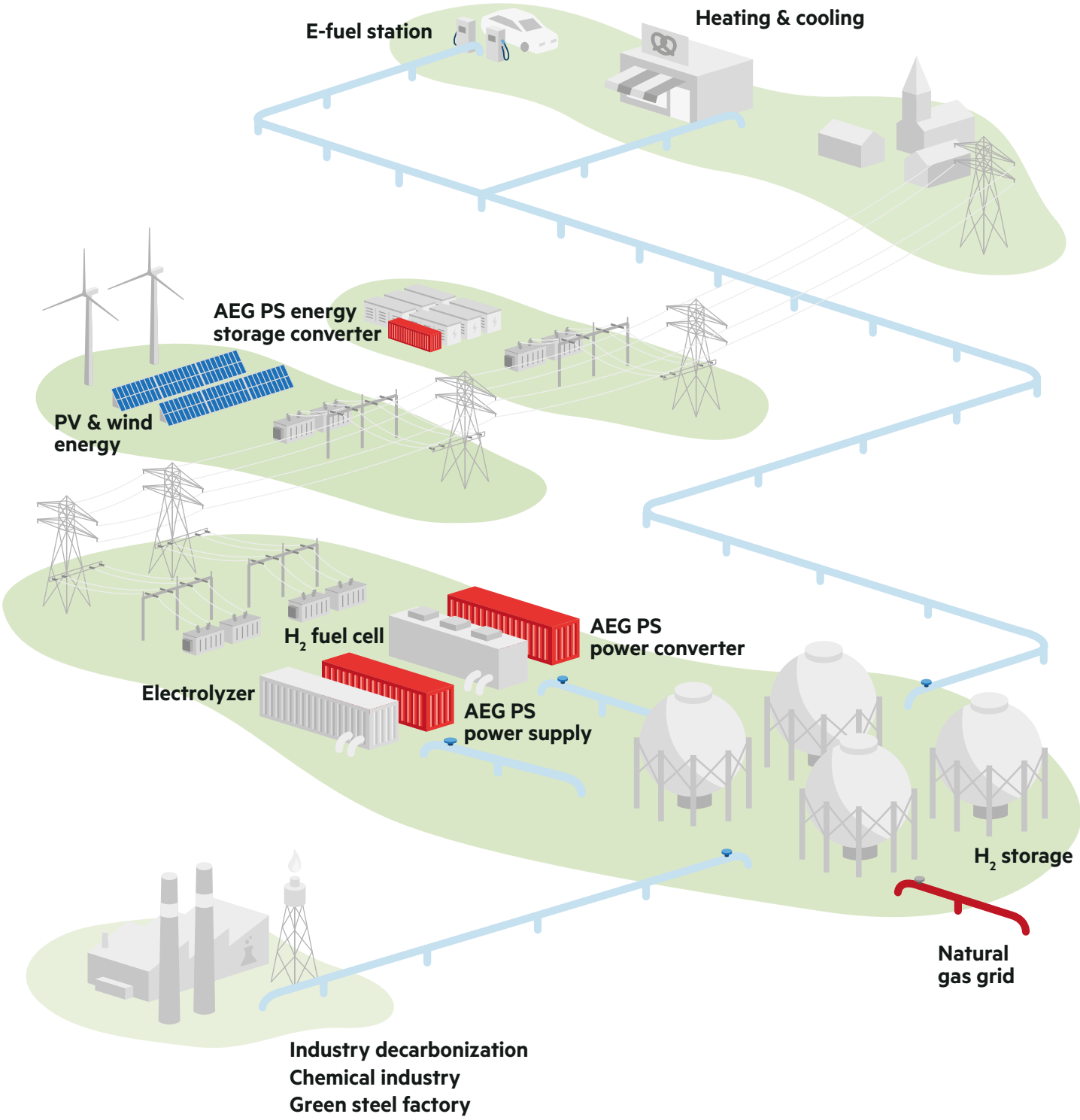
Power supply for the hydrogen electrolysis process

Green hydrogen is produced from renewable energy (e.g. solar and wind energy) to transport and store energy, to support the decarbonization of hard-to-electrify sectors such as heavy industry processes and heavy long-haul transport. Typical applications include:

Energy storage & transport
The production of hydrogen by electrolysis has been used for nearly 200 years for industrial purposes. The rapid expansion of intermittent renewable energies in the energy mix (in particular wind and solar) will increase the importance of hydrogen to store energy for long time periods when renewable energy sources are unavailable.

Hydrogen based e-fuels
Cars, trucks, trains and even airplanes powered by hydrogen or hydrogen based e-fuels are on the rise, beckoning a new, cleaner era beyond fossil-fueled mobility. Hydrogen based e-fuels offer the potential for switching from fossil fuels to cleaner, sustainable fuels for the mobility sector.

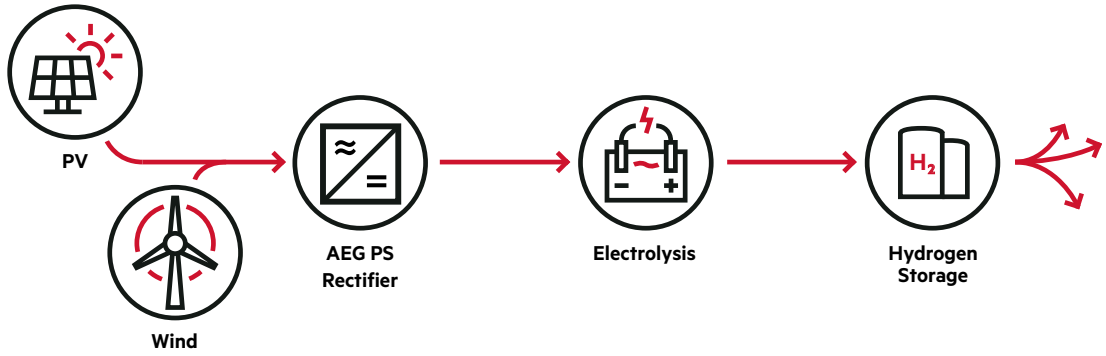
Industry decarbonization
The use of hydrogen as a subsititute for fossil sources can be of interest for the decarbonization of many hard-to-electrify industrial processes. Potential applications in industry include fossil-free production of steel, hydrogen-based furnace heating, or the production of hydrogen as feedstock for the petrochemical and refining industry.


E-fuel station
Heating & cooling
AEG PS energy
storage converter
PV & wind
energy
H2 fuel cell
AEG PS
power converter
Electrolyzer
AEG PS
power supply
H2 storage
Natural
gas grid
Industry decarbonization
Chemical industry
Green steel factory

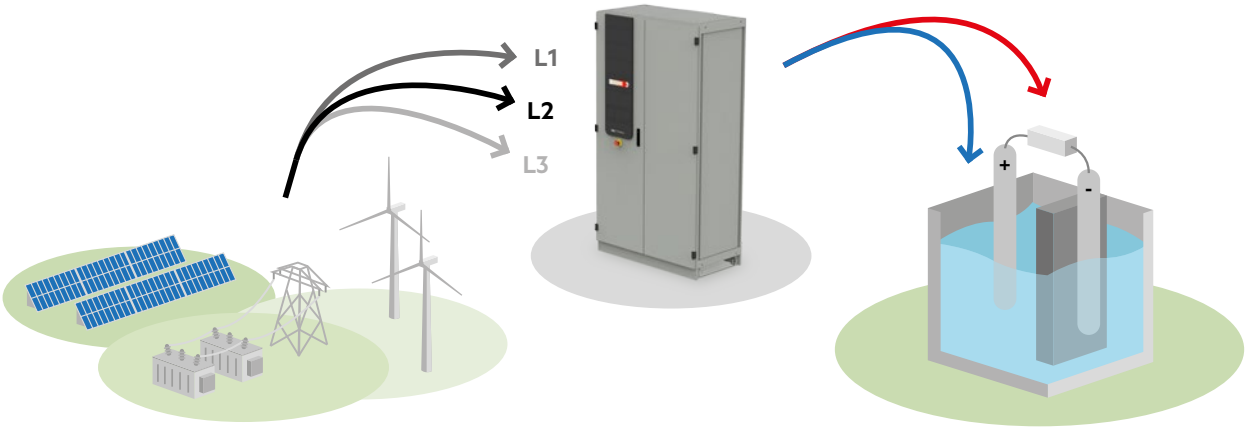
ELECTROLYSIS PROCESS

Green hydrogen for our future

The electrolysis process requires a very specific electrical power supply: one that is scalable, modular and fully grid-compliant. The production of green hydrogen needs a grid-compliant and compact DC power supply with high efficiency especially at partial load operation to minimze the levelized cost of hydrogen (LCOH).



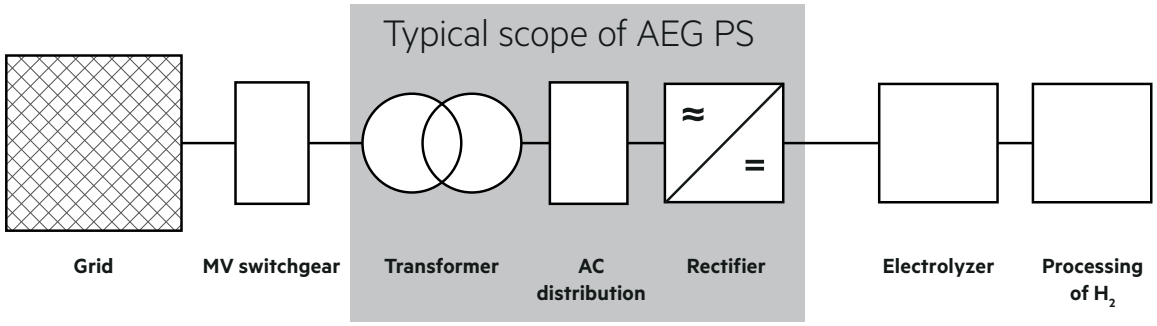
Power supply requirements for hydrogen production



Grid requirements:
- High power factor in whole operation range
- Low THDi
- Robustness against power line disturbances and overvoltages

Business case requirements:
- High power density and compactness
- High efficiency
- Scalable modular design
- Robust and reliable
- Easy to install

Electrolyzer requirements:
- Wide voltage range
- High current / high powe (up to several kA / MW)
- Low output current ripple at all loads and voltages
- High load dynamics
- Reverse current protection
- Polarization
- Precise current control

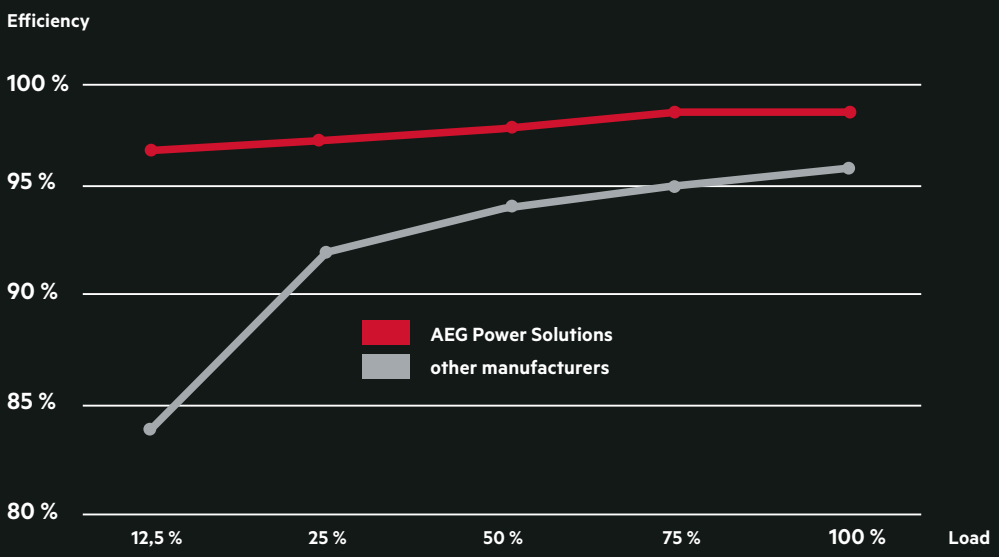


TECHNOLOGY OVERVIEW

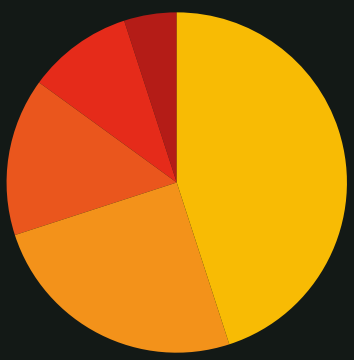
AEG Power Solutions has a unique hybrid technology, combining IGBT and thyristor technology for integrated grid compliance, and maximum flexibility, robustness and efficiency at all operating conditions.

	IGBT	Hybrid (AEG PS)	Thyristor
Footprint	++	+++	++
Efficiency over full load range	+	+++	++
Robustness	+	+++	+++
Grid compliance	+++	+++	+
DC current ripple over full load range	++	+++	+
Total Cost of Ownership (TCO)	+	+++	++

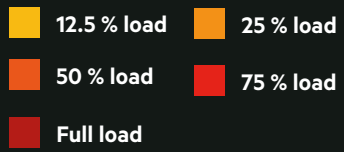
Taking the load profile into account to minimize the total cost of ownership



Rectifier & transformer efficiency



Annual load distribution



When you calculate the total cost of ownership (TCO) for a green hydrogen production power supply system, you should take into account the fact that the system might run most of the time in part load, since renewable energy sources for the conversion process will not be available at full load over its whole lifetime.

With a realistic load profile scenario over a time period of 15 years, the systems will run only 5% of the time at full load and 45% of the time at just 12.5% load. The savings of an efficient system in part load operation are enormous and will make a huge difference in your TCO calculation.

Why choose DC power supplies from AEG Power Solutions?

For decades, AEG Power Solutions has been designing and manufacturing reliable, first-class DC power supply systems that meet the requirements of all types of industrial applications under the toughest conditions. Heavy-duty build quality, proven microprocessor-controlled thyristor and IGBT technology and modular design are key characteristics of our DC power supply systems.

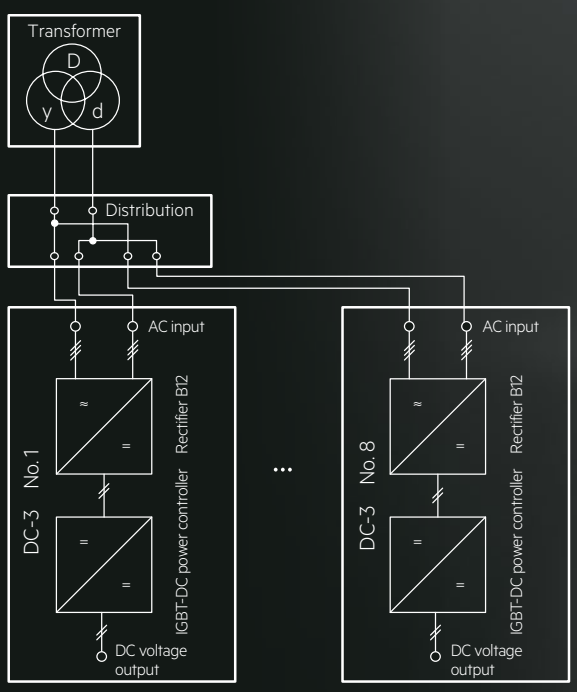
DC-3 High Performance Hybrid Rectifier

Advantages
- Integrated grid compliance (THDi & PF)
- High quality
- Robust topology against power line disturbances (PLD)
- High efficiency
- Small footprint
- Modular and scalable
- Global service network 24/7
- Customized solutions

Benefits
- Low operating expenses (OPEX)
- Low capital expenditure (CAPEX)
- Low Total Cost of Ownership (TCO)
- Low Levelized Cost of Hydrogen (LCOH)

Highlights
- Module: 1000 V_{DC} max, 2000 A_{DC} max, 1.25 MW max
- High quality and dynamic DC supply (e.g. current ripple <1%)
- High efficiency (98.8% peak)
- High power factor (up to 1)
- Low THDi: < 3% for MW systems
- Robust design, highly reliable
- Modular design for MW and GW installations
- Each module operates on its own, n+x redundancy possible
- Equal load sharing and ECO mode
- Project-specific parameter optimization possible

Options
- Various communication interfaces
- Special instrumentation and software
- Different configurations for cooling water, DC and AC connections possible
- Different AC distributions possible
- Additional services



Perfect scaling opportunities for all types of installation:

A single DC-3 unit has up to 1.25 MW power output and can be put in parallel operation (up to 8 units), scaling the output up to 10 MW.
This modular approach is key since power requirements vary by project.

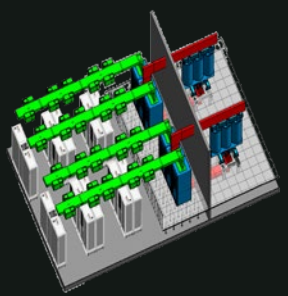
Module ≤ 1.25 MW

Power Frame ≤ 2.5 MW

Power Block ≤ 10 MW

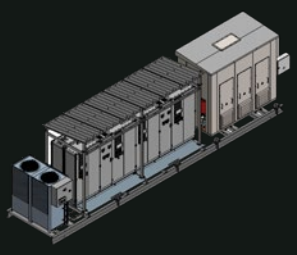
Available as Transformer-Rectifier Unit (TRU) in different variations

Integrated solution for hydrogen factory



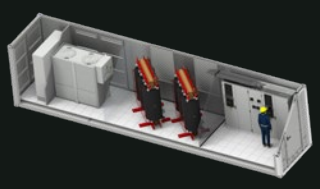
≤ 10 MW

Outdoor plug & play skid solution



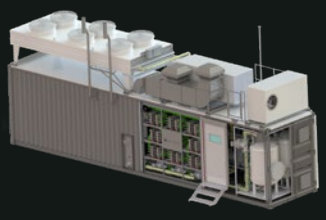
≤ 5 MW

Outdoor plug & play container solution



≤ 1 - 2 MW

Integrated electrolyzer container solution



Modular and scalable solutions can be fit in all types of installations!

PRO CARE ETS

OPTIMIZATION
Refurbishment
Training & support

OPERATION
Maintenance

PLANNING
Consulting
Analytical service

INSTALLATION
Installation & commissioning

RENEWAL
Spare parts
In-house repairs

With Pro Care Safe ETS, your AEG PS service team provides an on-site, annually scheduled preventive maintenance program developed to secure your systems' operations at all times.

With physical inspections, functionality and performance assessments and on-site analytical diagnostics, our service engineer experts do everything needed to keep your system operating at peak performance. In case of failure, a Pro Care Safe ETS contract provides customers with the guarantee that an expert will be available on-site. The repair service for our Pro Care Safe ETS customers is our first priority. The maximum starting time for initiating an on-site intervention is defined in our Pro Care package contract.

This annually repeating contract also includes a 24/7 priority hotline and complete reporting. This gives you peace of mind by ensuring the cost control, security and uninterrupted power supply for your most critical processes.

The maintenance package is fully customizable and can be adapted to your requirements.

PREVENTIVE MAINTENANCE	
WORK ON SITE	**INCLUDED, 1 MAINTENANCE VISIT PER YEAR**
Visual inspection	System, installation
Organic and inorganic contaminants removal	System
Thermal scanning	Critical parts in the system and installation
Events log analysis and analytical diagnostics	System
Checking of measured values	System
Software update	System, when available
Parameter adjustment and optimization	System
Functional check and assessments	System, installation
PARTS	
Periodic maintenance parts	Discounted
Limited life time parts	Discounted
– Cooling fans	Every 5 years or as needed
– Capacitors	Every 10 years or as needed
TRAVEL	**INCLUDED**
REPORTING	**INCLUDED**

CORRECTIVE MAINTENANCE	**AS NEEDED**
Guaranteed response time	Engineer on site within 3 standard working days, depending on location
WORK ON SITE	**STANDARD HOURLY RATES**
Fault finding	Standard hourly rates
Repair, replacement of parts and testing	As needed
Events log analysis and numerical diagnostics	System
Parameter adjustment and optimization	System
Functional walk through and assessments	System, installation
PARTS	**REPAIR PARTS**
TRAVEL	**AT COST + 10%**
REPORTING	**INCLUDED**

OTHER SERVICES	
24/7 hotline for Pro Care customers	Included
Complete reporting history	Included
Scheduling and preparation of site visits	Included

OPTIONS
Additional preventive maintenance visits
Preventive maintenance performed outside standard office hours/weekend
Response time options
Remote monitoring of system

REFERENCES

We are pioneers in green hydrogen production since 2009

AEG PS is a market leader with a proven track record of powering hydrogen capacity in operation.
Our solutions are compatible with all major electrolyzer manufacturers and technologies.

Haurup Wind Farm, Germany

Partners

H-TEC SYSTEMS

GP Joule

AEG Power Solutions powering H-TEC SYSTEMS electrolyzers at Haurup wind power site
Plant to convert up to three million kilowatt hours of electricity per year from excess wind power to hydrogen and feed into the natural gas grid.

Solution
- 6 x DC-3

MPREIS Project, Austria

Partners

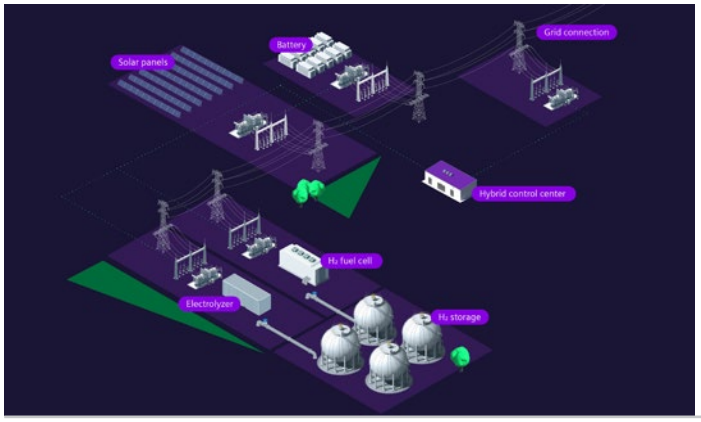
MPREIS

Sunfire

Power supply for hydrogen production used for fuel cell electric trucks and CO_2 neutral heating
MPREIS minimizes its CO_2 emissions with the production of green hydrogen, which will be used for CO_2 neutral bread baking ovens and as fuel for fuel cell electric delivery trucks.

Solution
- 8 x DC-3

CEOG Project, French Guiana



Partners

HDF Energy

Siemens Energy

McPhy

World's largest green hydrogen plant The base-load power plant located in French Guiana combines photovoltaic with green hydrogen production (16 MW of installed electrolyzer capacity), storage and re-electrification through fuel cells.

Solution
8 x Transformer Rectifier Units (TRU) each consisting of:
- 4 x DC-3 on base frames
- Transformer
- AC unit

ABOUT AEG POWER SOLUTIONS

AEG Power Solutions ensures continuous availability of power and the safe operation of critical applications in all environments thanks to a wide portfolio of power supply systems and services: AC and DC UPS, battery chargers, rectifier systems, service and maintenance on a 24/7 basis and customized UPS systems that meets customer specifications.

Our distinctive expertise spans AC and DC technologies. We design and provide power supply and power conversion systems for oil & gas operations, power generation, industrial processes, transportation, data & IT and renewable energy.

Since its foundation more than a century ago, AEG Power Solutions has stood for rugged reliability and world-class engineering, including 60 years' experience in power electronics and UPS. Our customers know that they can rely fully on AEG PS for innovative power solutions that protect people, investments, data and businesses. AEG Power Solutions leverages their unique power electronics, grid integration and conversion expertise to develop and offer solutions for energy storage applications.

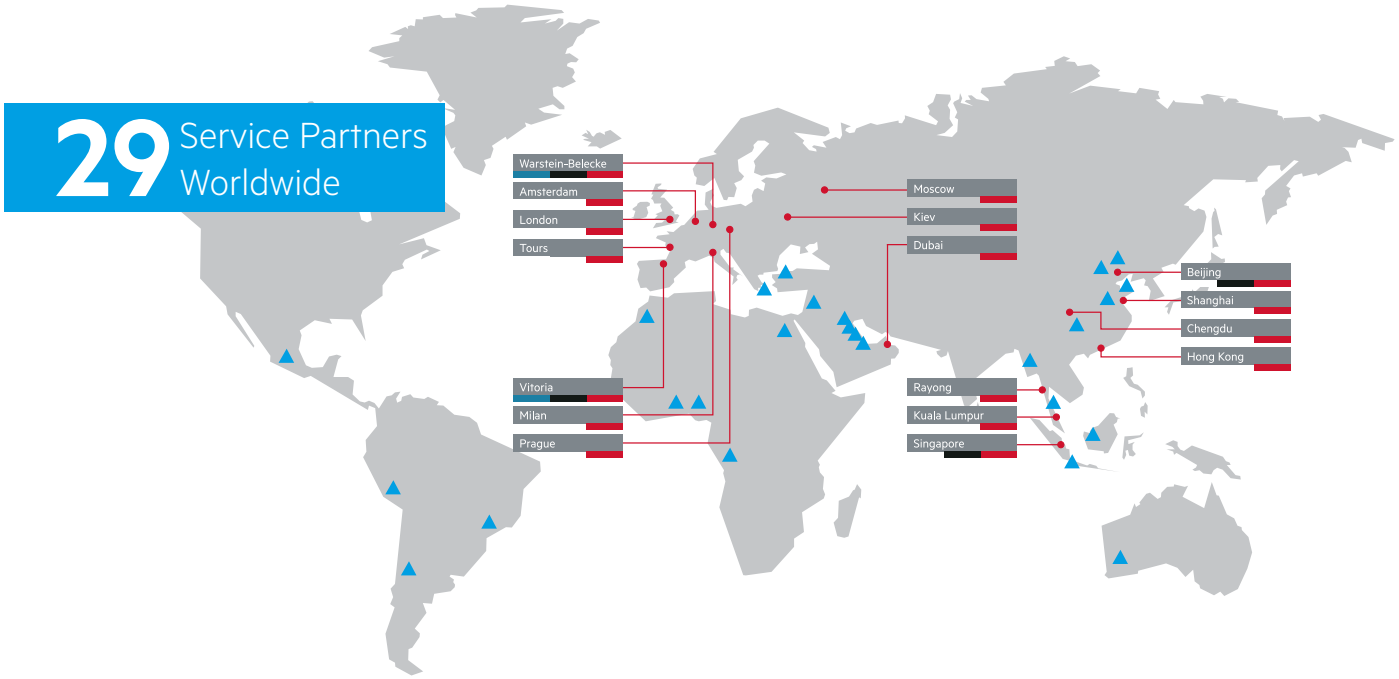
Our service organization, with service centers in Europe, Middle East and Asia and an extensive partner network, offers life-cycle service solutions from commissioning to product replacements in close proximity to our customers world-wide.

Our vision is to be a truly customer-oriented business with world-class UPS and conversion solutions and services.

Thanks to its long history, AEG Power Solutions is represented in key markets, with offices and competence centers around the globe.

OUR GLOBAL FOOTPRINT

29 Service Partners Worldwide



- Service Partners
- R&D
- Manufacturing
- Sales and/or service offices

AEG Power Solutions
Approach your local AEG Power Solutions representative for further support.
Contact details can be found on:
www.aegps.com

www.linkedin.com/company/aeg-power-solutions

www.facebook.com/aegpowersolutions

twitter.com/AEGPS