



Hydrogen is now.

H-TEC SYSTEMS

H-TEC SYSTEMS

PEM ELECTROLYSIS: A TECHNO-ECONOMICAL APPROACH FROM STACK
DESIGN TO HYDROGEN APPLICATIONS FROM RENEWABLE ENERGY SOURCES

MARIAN HIEKE

M.HIEKE@H-TEC.COM

MADE IN GERMANY 

A GP JOULE COMPANY

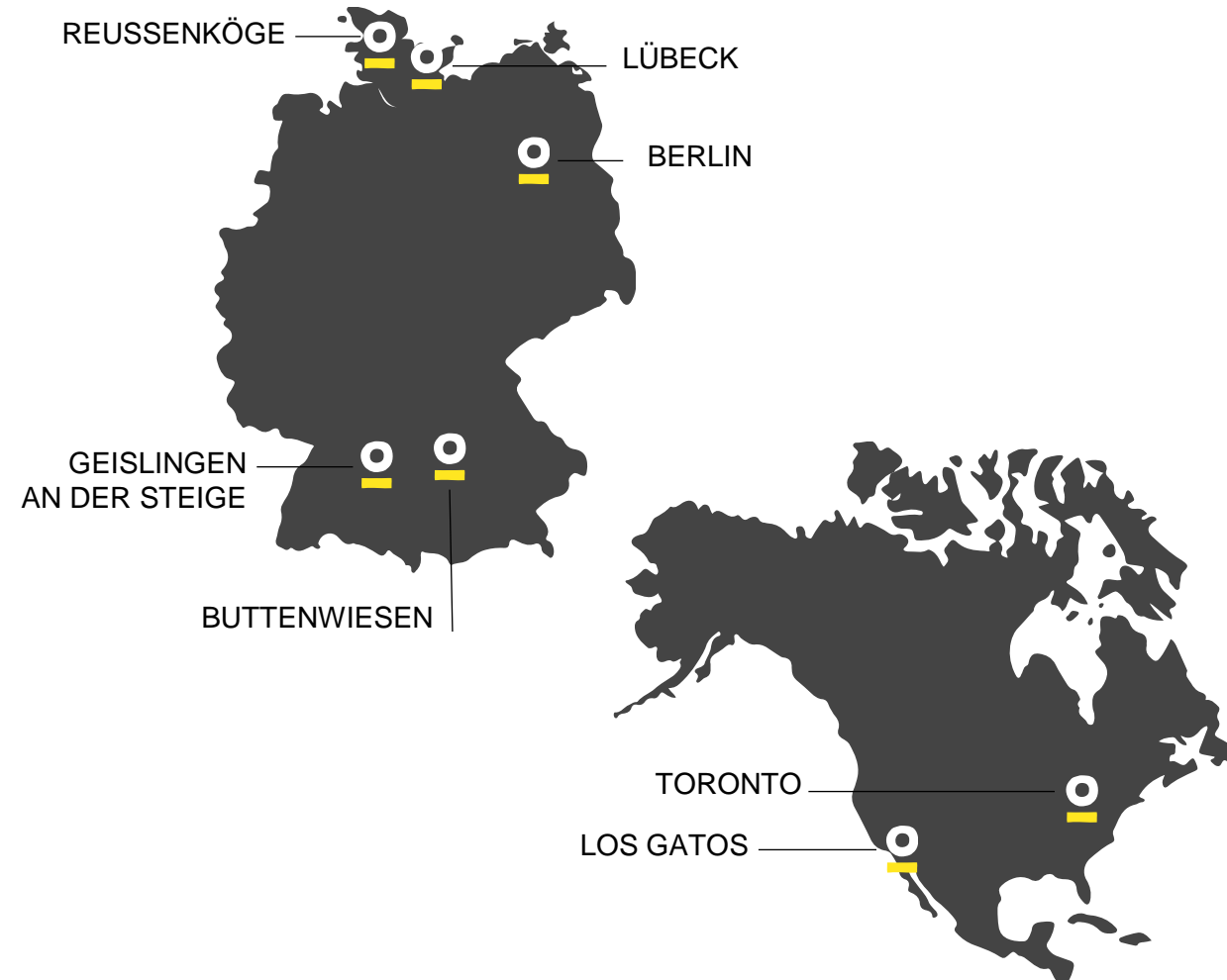
H-TEC SYSTEMS GMBH

AS PART OF GP JOULE GROUP



- H-TEC Systems GmbH
 - Since 1997 H-TEC has been involved in innovative solutions in the field of hydrogen
 - 2010 GP JOULE integrated H-TEC SYSTEMS as a subsidiary within the company
 - Two offices in Germany: Buttenwiesen and Lübeck
- Our Goal
 - The H-TEC SYSTEMS goal is the most inexpensive conversion of electricity into hydrogen using PEM electrolyzers

- **Founded in 2009**
- **Employees: 200**
- **Installed generation capacity since 2003:**
600 MW
- **Divisions:**
Projects, Products & Services, Think, Connect
- **German addresses:**
Reussenkoege (headquarters), Berlin, Buttenwiesen, Geislingen an der Steige, Luebeck
- **North American addresses:**
Toronto (ON, CAN/headquarters), Los Gatos (CA, USA)





MEURO – 70 MW_p

Photovoltaic

- **Built:** 450 MW
- **Markets:** EU and USA /Canada
- **Services:** along the entire value chain



SÜDERMARSCH – 3.6 MW_p

Wind Onshore

- **Built:** 102MW
- **Markets:** Germany
- **Services:** reconfiguration, repowering and service

LOCALLY
PRODUCED,
MARKETED AND
CONSUMED –
YOUR ADDED VALUE!



Connect

- **Electricity:** Tariffs
- **Charging:** fleet management and charging points (wallbox)
- **Service:** infrastructure, charging network, payment



BUTTENWIESEN

District Heating

- **Built:** 2012
- **User:** 130



Development & planning

Whether by order or on our own initiative – our planning and developing is detailed and trustworthy for every single project.



EPC

The all-round carefree package! From concept to commissioning – we manage the complete process.

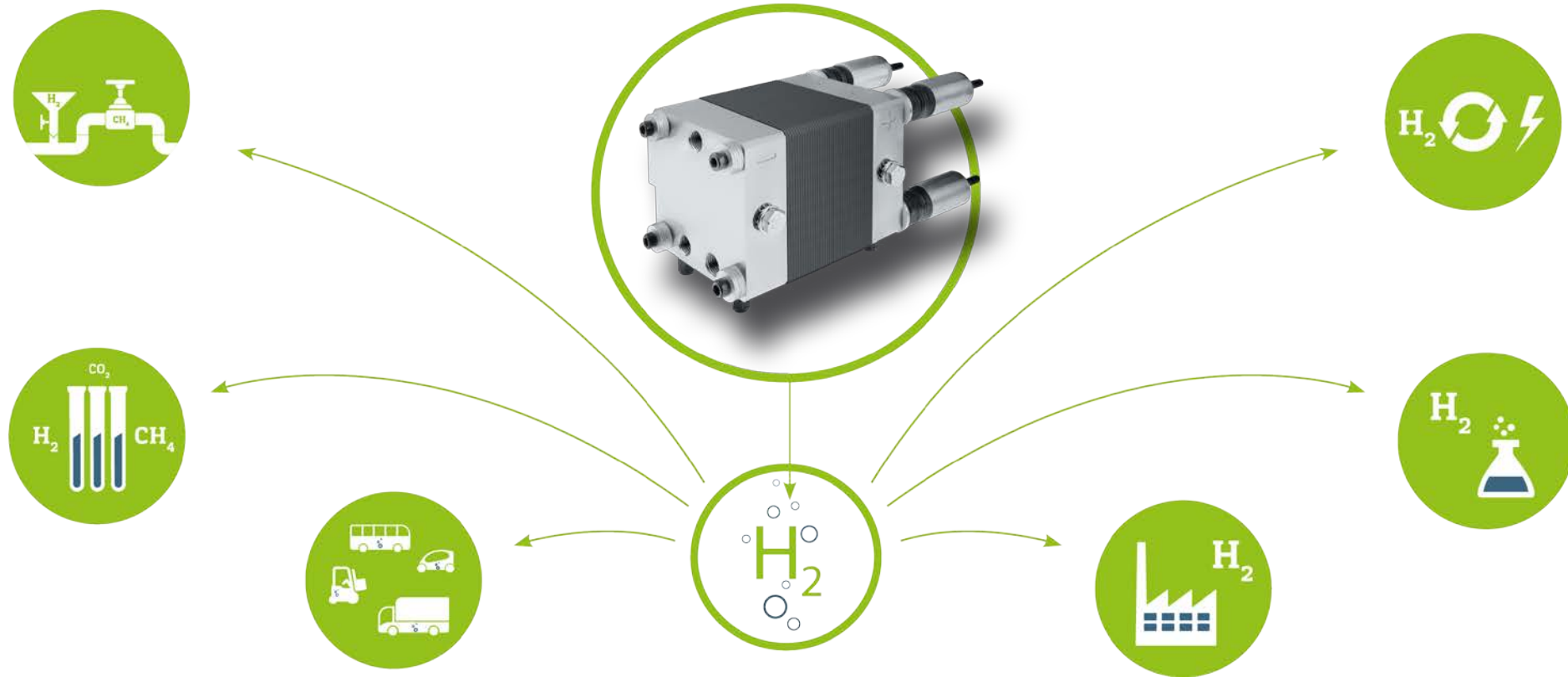


O&M

We take care of the commercial and technical management of your project to secure your profits.

H-TEC SYSTEMS GMBH

HYDROGEN IS NOW



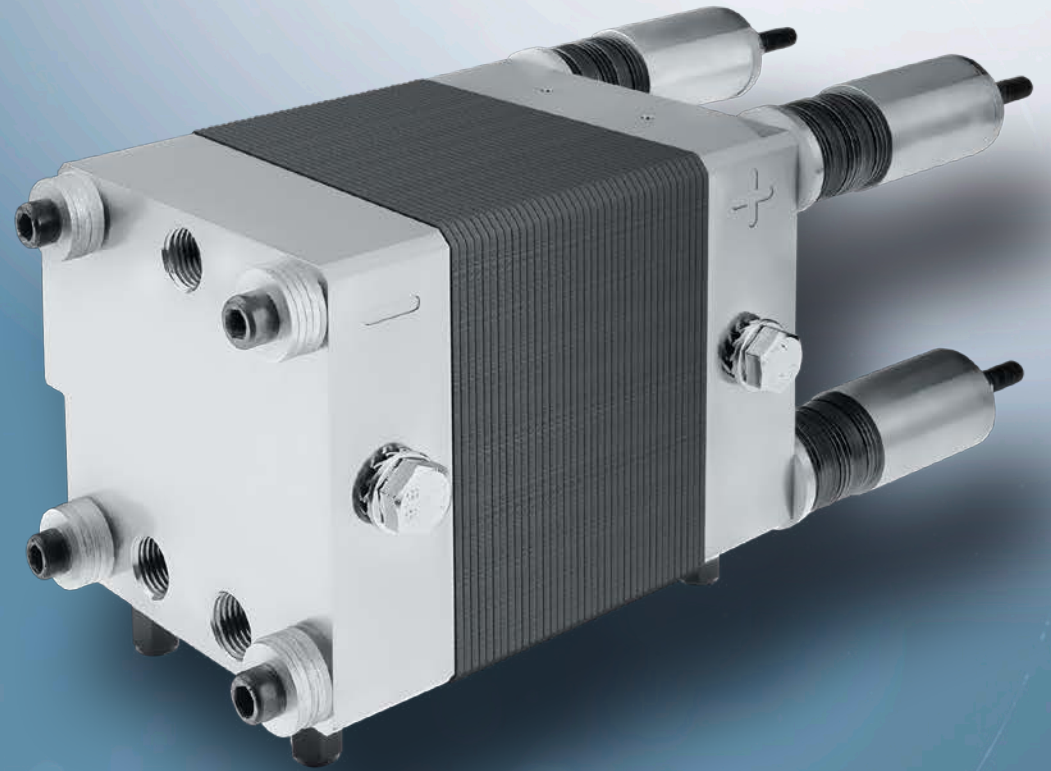


Hydrogen is now.

H-TEC SYSTEMS

H-TEC SERIES S

STACKS – THE EVOLUTION OF ENERGY



MADE IN GERMANY 

A GP JOULE COMPANY

H-TEC SERIES S30

PRODUCT SPECIFICATION OVERVIEW

- OEM Stack
- Dimensions (S30/50): 279 x 107 x 110 mm
- Compact design
- High power density – 100W per cell
- 30 cm² active area
- Nominal load ranges of 1 kW, 3 kW, 5 kW
- Nominal efficiency 75%
- > 150.000 h (cumulated) tests without failure
- No significant degradation at nominal operation conditions
- MTTF: 40 000 h

10.10.2017 · PAGE 10 · COMPANY PROFILE 2017



H-TEC SERIES S

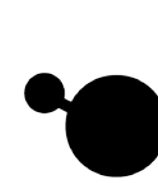
PRODUCT SPECIFICATION OVERVIEW



	H-TEC S 30/10	H-TEC S 30/30	H-TEC S 30/50
Nominal load	1,00 kW	3,00 kW	5,00 kW
Load range	0,26-1,88 kW	0,77-5,63 kW	1,28-9,38 kW
Load change	26-100 % nominal load = 1 s	26-100 % nominal load = 1 s	26-100 % nominal load = 1 s
	100–188 % nominal load = 1 s	100–188 % nominal load = 1 s	100–188 % nominal load = 1 s
Voltage max.	25 VDC	75 VDC	125 VDC
Power	15-75 A	15-75 A	15-75 A
Nominal efficiency	75%	75%	75%
H ₂ nominal production	0,47 kg d ⁻¹	1,42 kg d ⁻¹	2,37 kg d ⁻¹
	0,22 m ³ h ⁻¹ @ STP	0,66 m ³ h ⁻¹ @ STP	1,10 m ³ h ⁻¹ @ STP
H ₂ production range	0,14–0,68 kg d ⁻¹	0,41–2,03 kg d ⁻¹	0,68-3,38 kg d ⁻¹
	0,06–0,31 m ³ h ⁻¹ @ STP	0,19–0,94 m ³ h ⁻¹ @ STP	0,31-1,57 m ³ h ⁻¹ @ STP

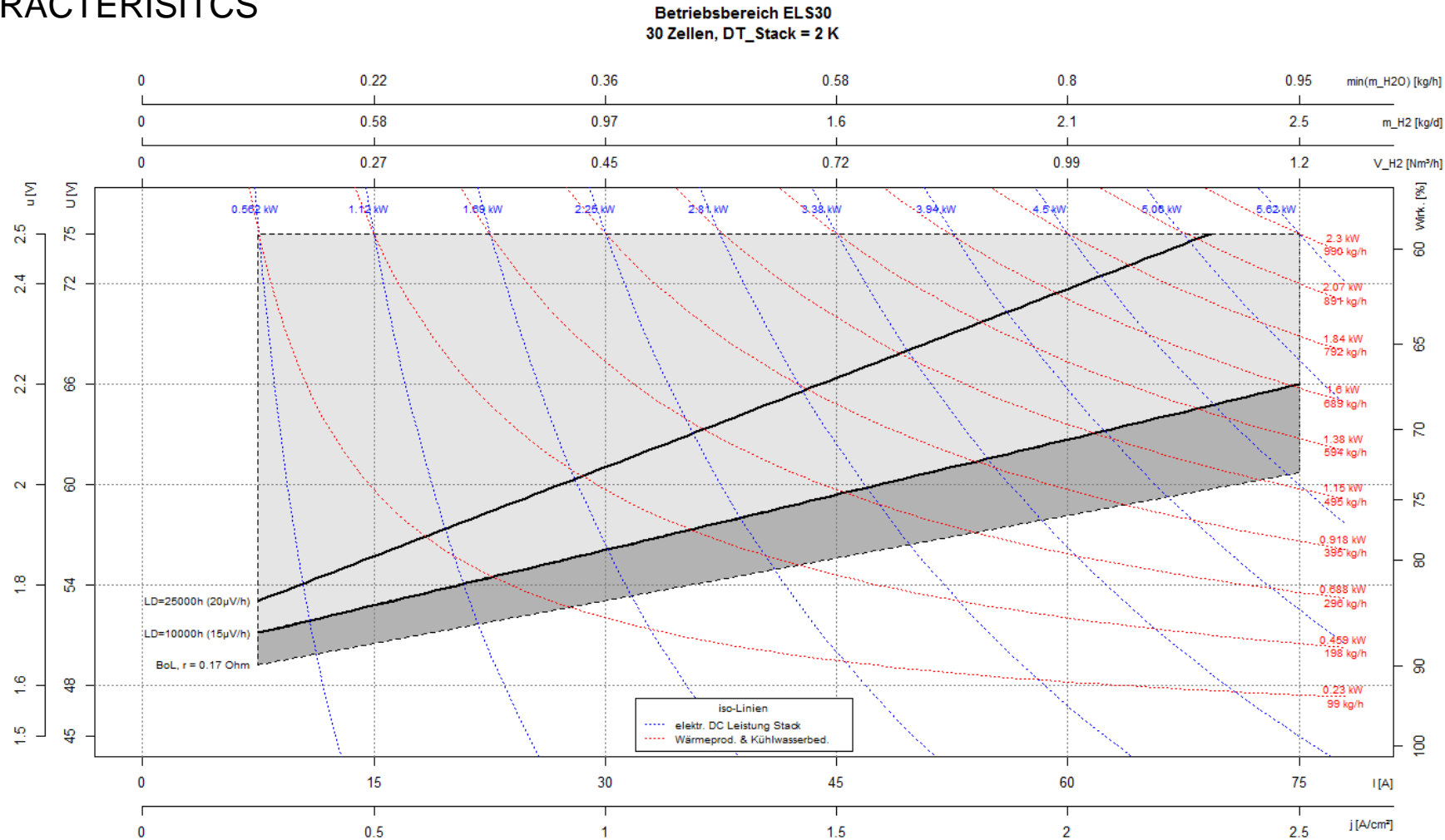
H-TEC SERIES ME

U-I CHARACTERISTICS



Hydrogen is now.

H-TEC SYSTEMS



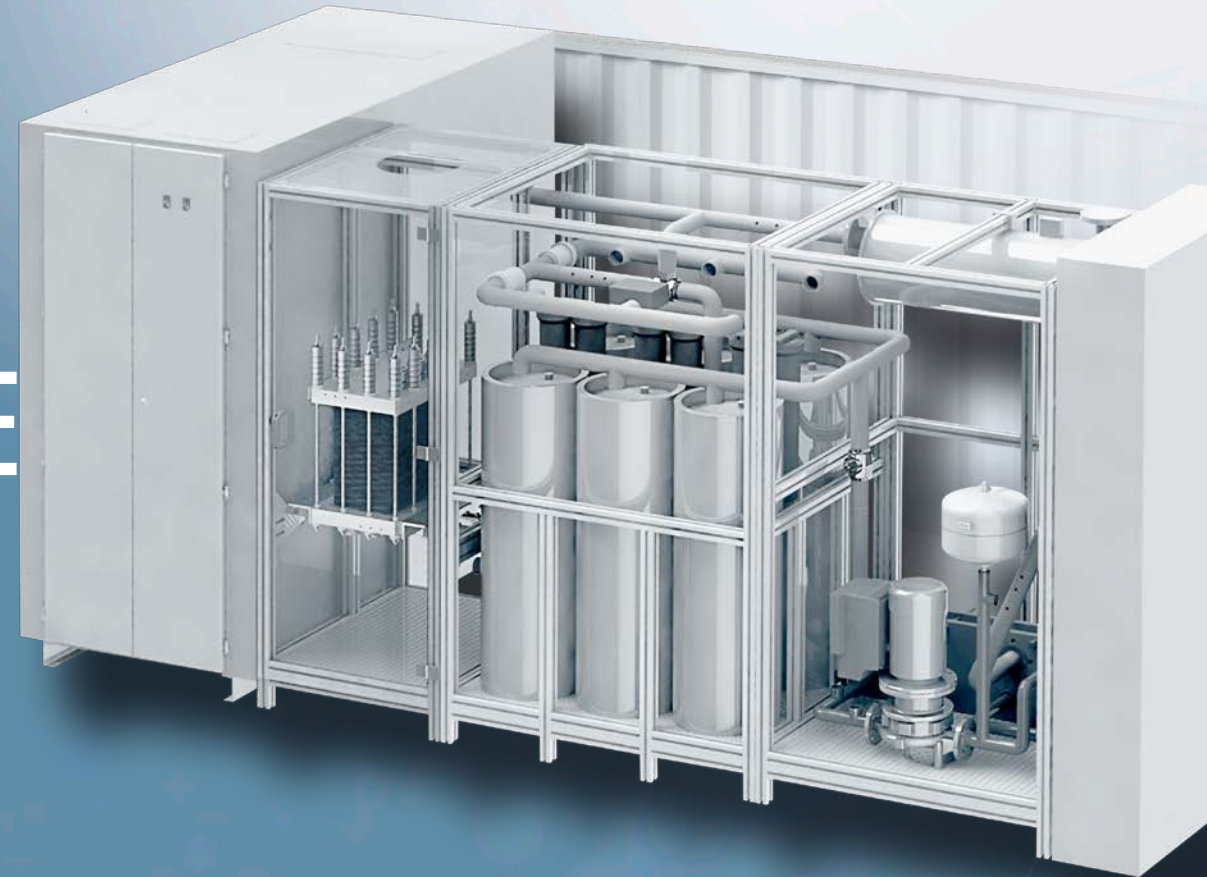


Hydrogen is now.

H-TEC SYSTEMS

H-TEC SERIES ME

ELECTROLYSERS – READY SET SUPPLY



MADE IN GERMANY 

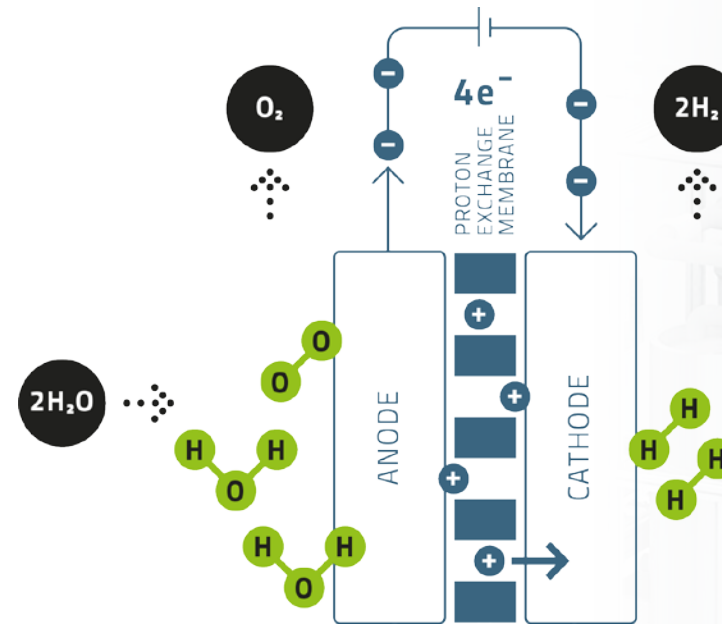
A GP JOULE COMPANY

H-TEC SERIES ME

PRODUCT SPECIFICATION OVERVIEW

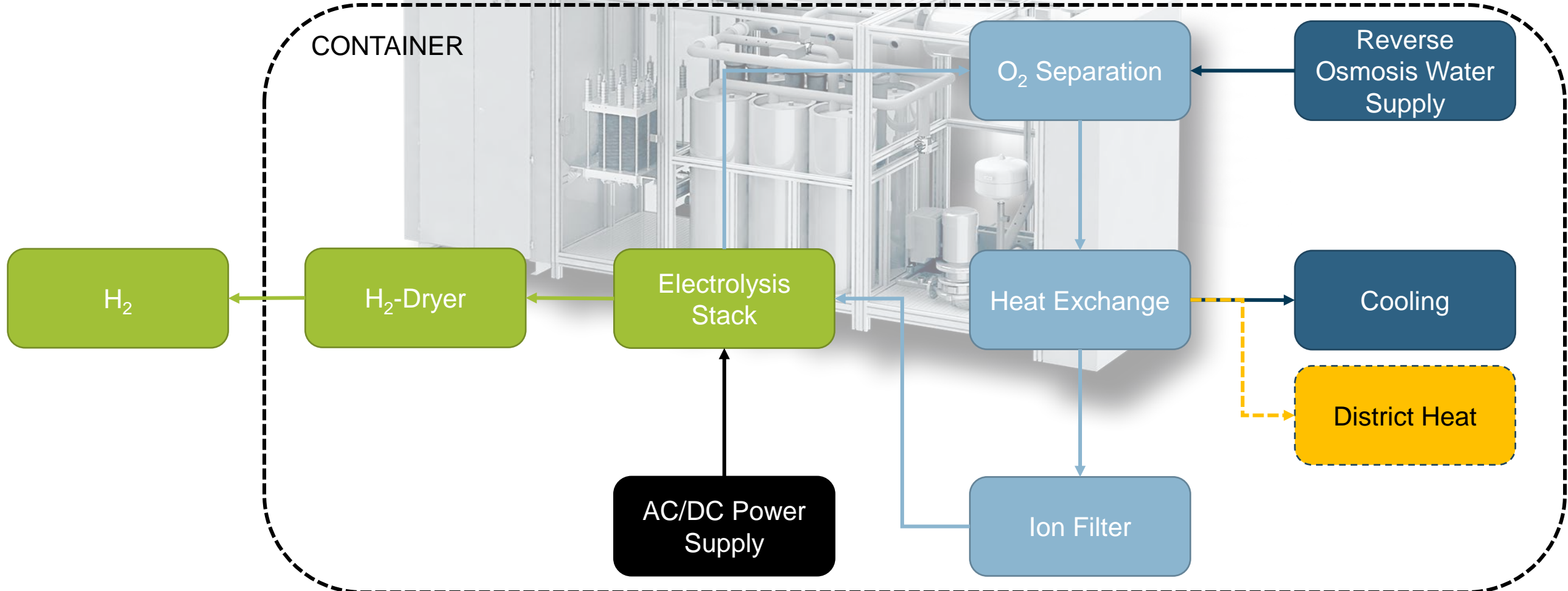
ME100/350

- Megawatt scale electrolysers
- Containerised solution
- **Nominal output:** 100 kg d⁻¹ @ 225 kW
- **H₂ pressure:** 30 bar
- **H₂ quality:** ISO 14687-2, SAE J2719
- **Nominal system efficiency:** 74%
- **Energy consumption:** 4,8 kWh Nm⁻³ or 54 kWh kg⁻¹



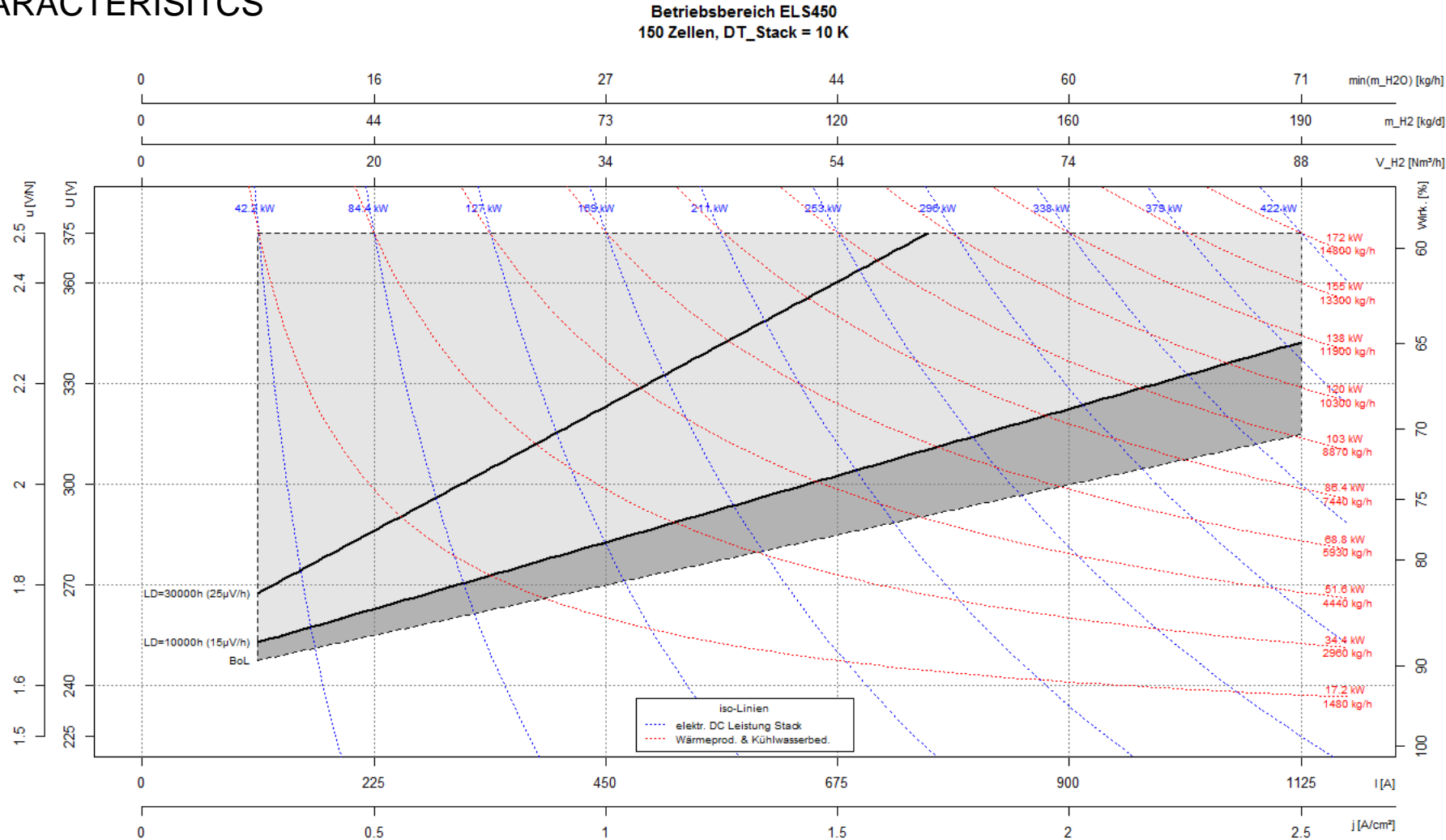
ELECTROLYSER SETUP

ME100/350



H-TEC SERIES ME

U-I CHARACTERISTICS

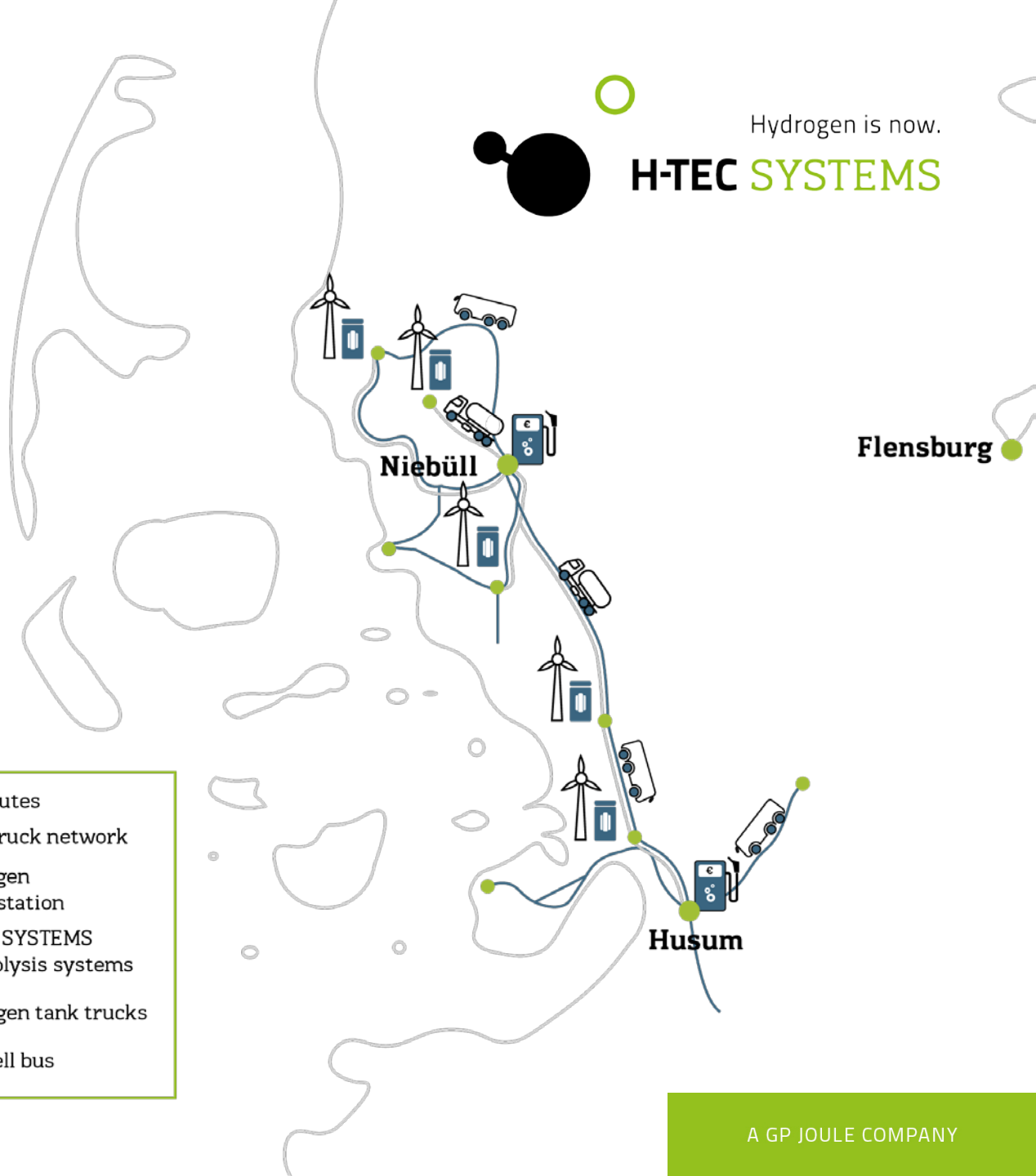
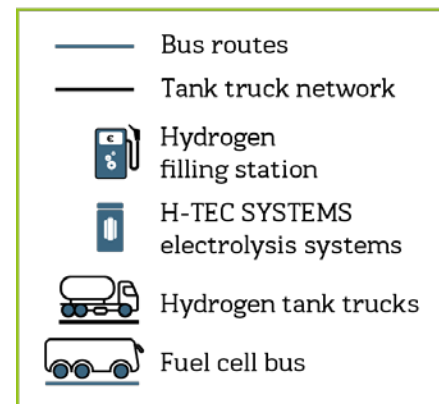


PROJECTS

JOINT PROJECT - SECTOR COUPLING

- **Concept:** Locally excess RES power is converted into emission-free mobility as a model for the smart integration of decentralised hydrogen infrastructure
- **Public Transport:** 2x Hydrogen busses
- **Production:** 5x ME100/350 Electrolyser
- **Fuelling:** hydrogen trailer truck to fuelling station
- **Theory*:** Acceptance for renewables through
 - Meaning
 - Necessity
 - Fairness
 - Equity

*from Renn (2015)



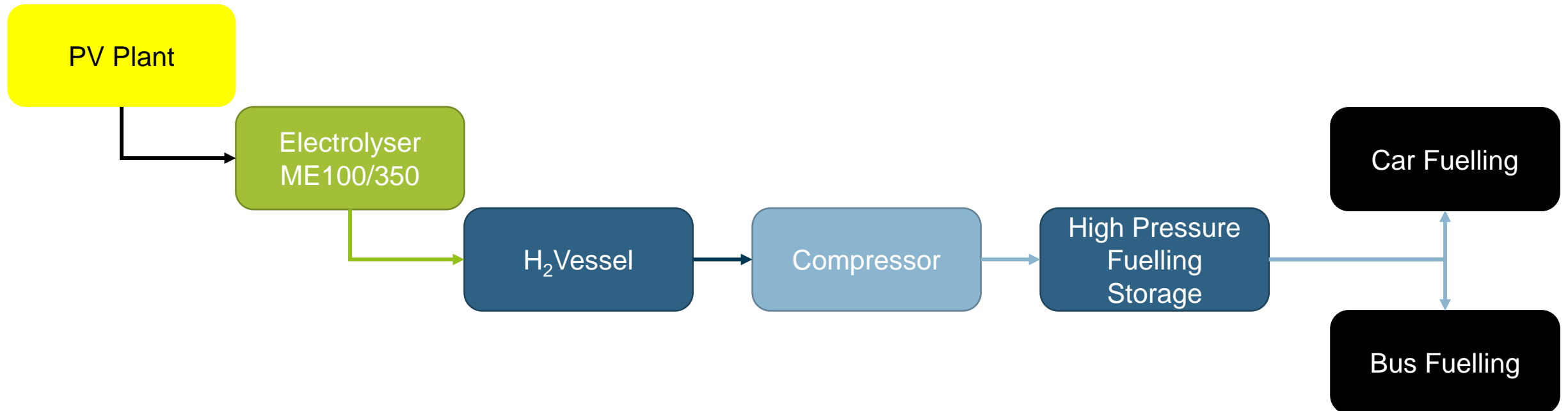
PROJECTS

VERBUNDPROJEKT – JOINT PROJECT



SCENARIO OF USE

RENEWABLY POWERED H₂ FUEL STATION



SCENARIO OF USE

REGENERATIVELY POWERED H₂ FUEL STATION - ASSUMPTIONS

Device	Parameter
PV Plant	600 kWp
Electrolyser	350 kWp
H ₂ Vessel (30 bar)	900 kg
Cars per day	40
Daily fuelling	40 kg
Invest	2.2 Mio €
Subsidies	50%
Fuelling capacity	25 kg h ⁻¹
Depreciation	10 years

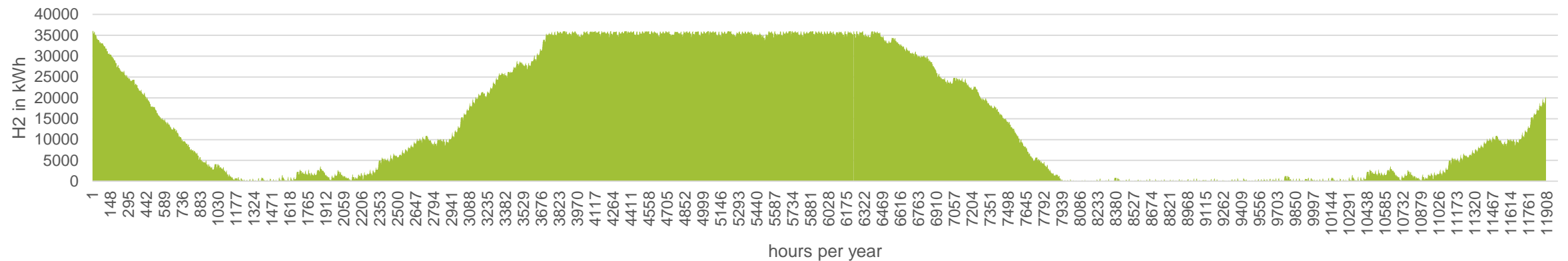
- PV Plant in Central Germany
- Realistic demand projection of hydrogen cars
- No major repairs
- No interest

SCENARIO OF USE

REGENERATIVELY POWERED H₂ FUEL STATION

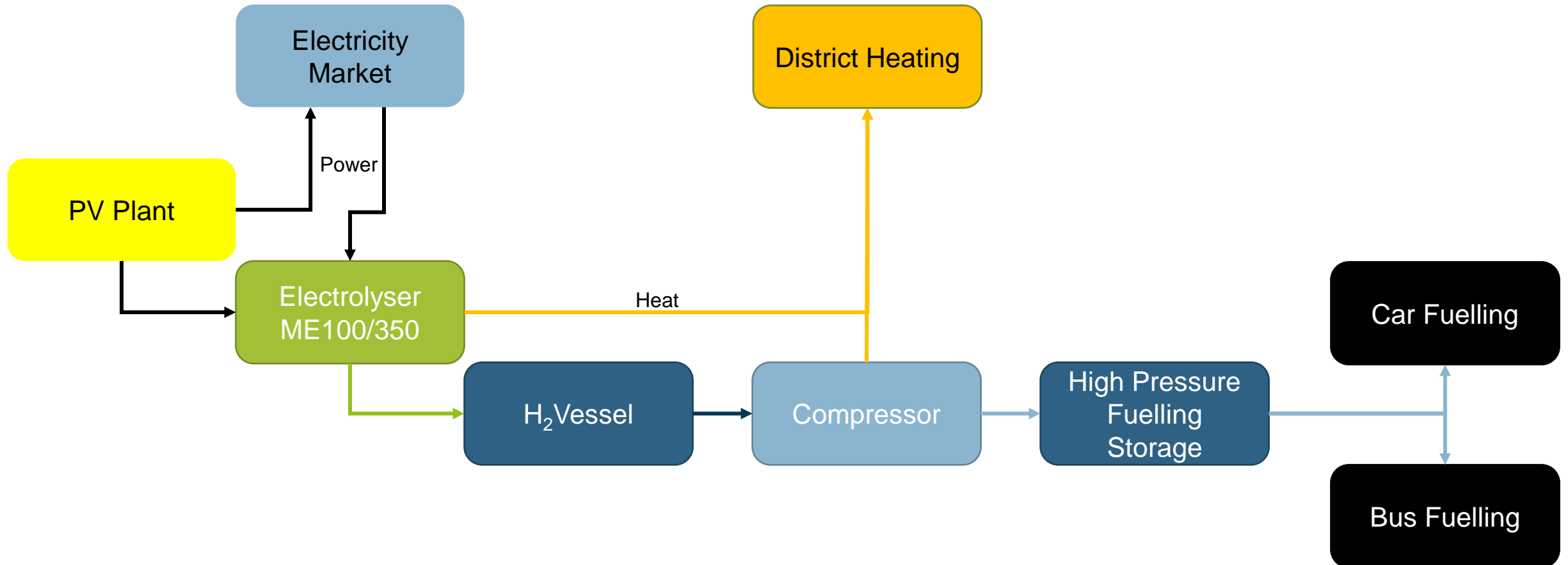
Parameter	Value per year
H ₂ production	10.5 t
H ₂ availability	78 %
Electrolyser operating hours	4200 h
Price € kg ⁻¹	10,75 € kg ⁻¹

Vessel filling level



SCENARIO OF USE

RENEWABLY POWERED H₂ FUEL STATION



SCENARIO OF USE

REGENERATIVELY POWERED H₂ FUEL STATION - ASSUMPTIONS

Device	Parameter
Availability	100 %
Cost per kWh	0,17 €
PV power marketing	0,065 € kWh ⁻¹
Heat marketing	0,03 € kWh ⁻¹

- Same configuration as before
- Missing H₂ demand is generated through grid power
- Surplus of PV power is sold
- Generated heat is sold

SCENARIO OF USE

REGENERATIVELY POWERED H₂ FUEL STATION



Parameter	Value per year
H ₂ production	13,5 t
H ₂ availability	100 %
Electrolyser operating hours	5100 h
PV surplus	132.000 kWh
Heat generation	214.000 kWh
PV + Heat revenue	15.000 €
Price € kg ⁻¹	8,85 € kg ⁻¹

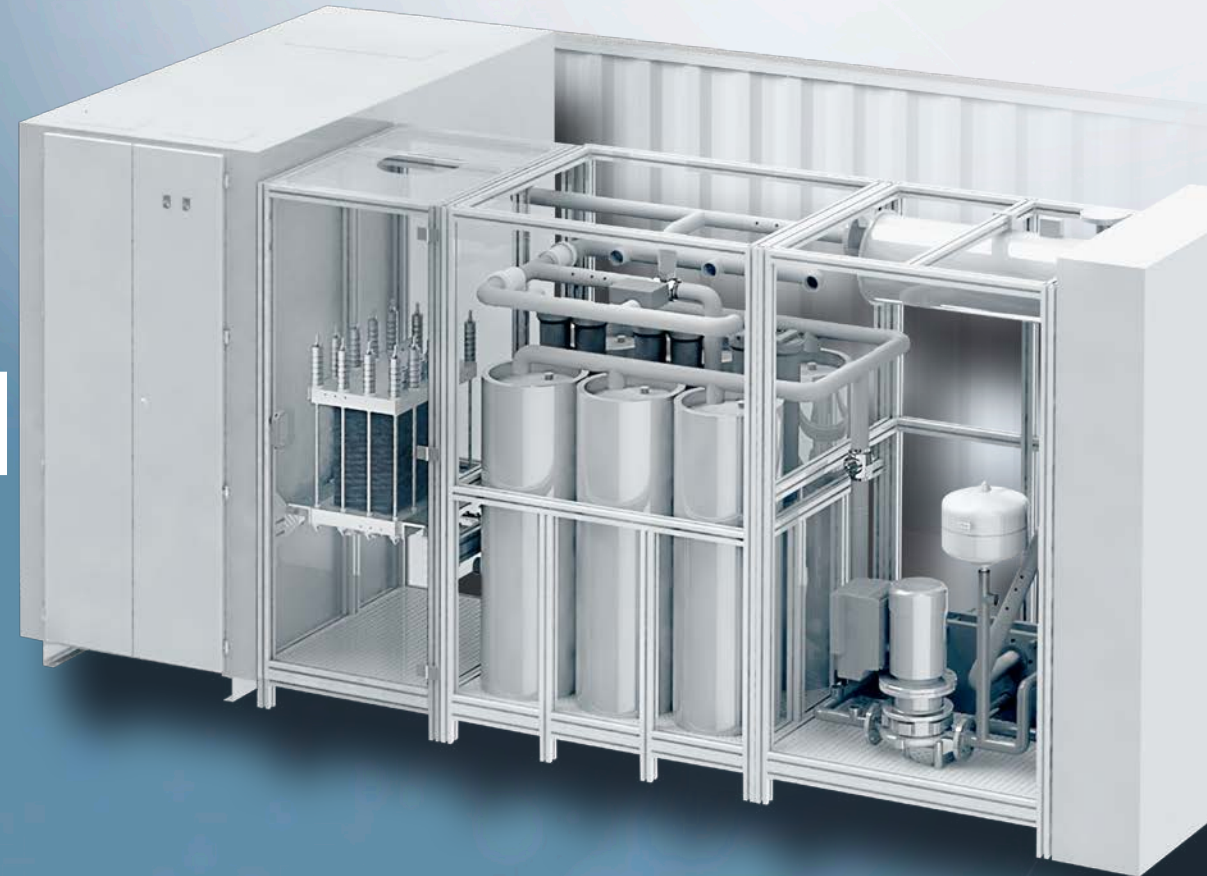


Hydrogen is now.

H-TEC SYSTEMS

THANK YOU FOR YOUR ATTENTION

WWW.H-TEC-SYSTEMS.COM



MADE IN GERMANY 

A GP JOULE COMPANY