

Nedstack's PEM fuel cell technology in the Chlor-Alkali industry

荷兰氢电公司质子交换膜氢能发电技术在氯碱行业的应用

Jorg Coolegem

We are dedicated to designing and producing the best value for money PEM fuel cell stacks in the market.



Company Profile

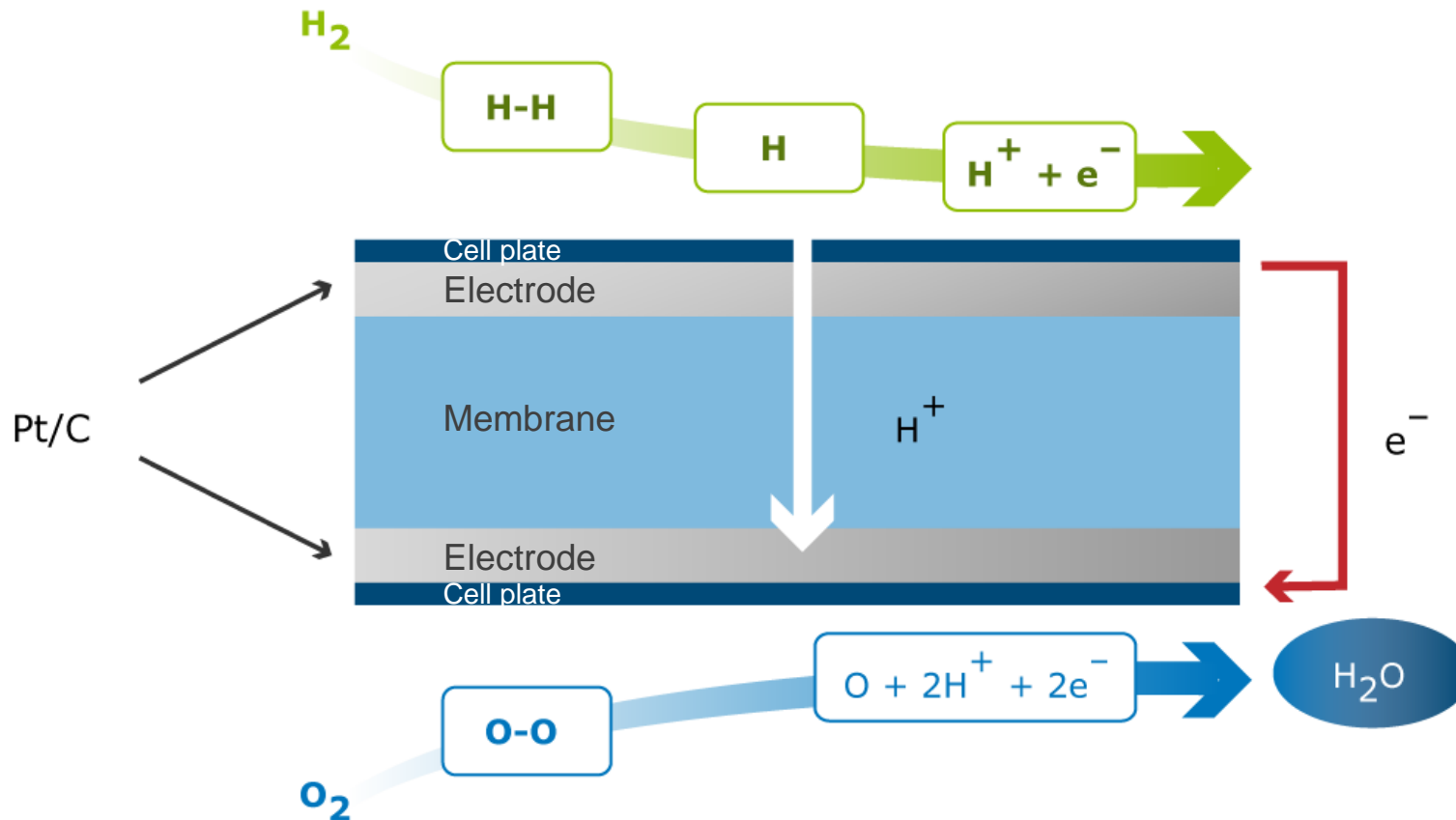
公司简介

- Founded in 1999
公司成立于1999年
- Based in The Netherlands
总部位于荷兰
- Independent fuel cell stack manufacturer
独立的燃料电池堆栈制造商
 - Supplier to system integrators, serving world-wide markets
从原料供应商到系统集成者，服务全球市场
 - Installed base in Europe, US, Africa, Asia
运行的装置遍布欧洲、美国、非洲和亚洲
 - Extensive system integration know-how
积累了大量系统集成经验与诀窍
- Member of a Dutch-based group with over 40 years worldwide experience in prime power, power generation and UPS-solutions
为荷兰基础工业集团成员，在全球范围内该集团在主动力、发电及UPS解决方案上有着40多年的经验。



Fuel cell – basic principle

燃料电池 – 基本原理



Overall reaction:
 $2H_2 + O_2 \rightarrow 2H_2O + \text{electricity} + \text{heat}$

Unique features of the Nedstack PEM fuel cell stack

荷兰氢电公司质子交换膜电池堆栈特性



Unique features 产品特点

- Product range allows for fit for purpose choice:
- 产品设计适用范围广泛：
 - Power range: 2-15 kW per stack
 - HP for low cost and back-up: > 4,000 hr & > 1250 start-stops
 - XXL for long life : > 20,000 hr
- Liquid cooled
液冷系统
- High fuel efficiency
燃料效率高
- Low parasitic losses
低内阻
- Easy to integrate, reliable and robust
易组装，可靠并耐用

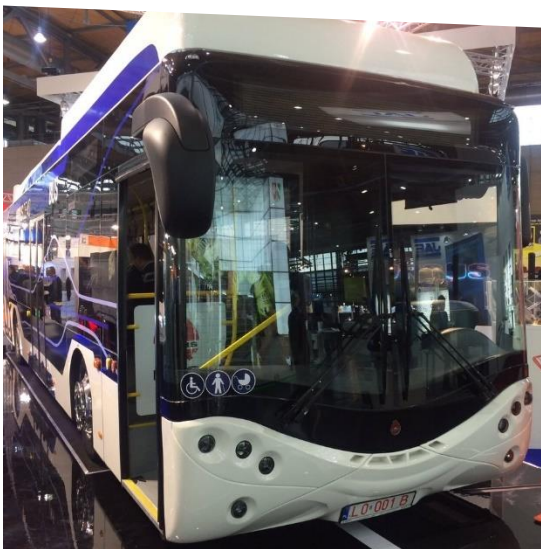
	HP High Performance	XXL eXtended Life
FCS 2	 Backup power for Telecom, Rail, Utility substation	 Baseload power for Telecom
FCS 5		
FCS 8		
FCS 10 (stackable to 1 MW and higher)	 Large scale Backup	 City Transport, material handling Chlorine power plants

Nedstack Focus Markets

荷兰氢电公司专注的市场

Nedstack Commercializes Multi-Purpose stacks with superior lifetime and reliability for heavy duty applications.

荷兰氢电公司在多用途、长寿命和高强度、可靠性的堆栈技术方面已经实现了商业化。



Commercial Vehicles

汽车发动机

(maturity status: commercialized)
(已商业化)



PEM Power Plants

工厂燃料电站

(maturity status: commercialized)
(已商业化)



Marine

船用发动机

(maturity status: Concept Development)
(技术设计阶段)

Nedstack powered FCEV Bus

荷兰氢电公司燃料电池公交车

IAA 2017 Inauguration of the Ursus FCEV Demo Bus
2017年德国燃料电池示范公交车项目启动典礼



HuaHe - Company Profile

江苏华荷氢电科技有限公司

Name	HuaHe Hydrogen Electricity Technology Co. Ltd.
Location	ZhangJiaGang City – Jiangsu Province
Founded	Dec. 12, 2017
Ownership	Sino-Dutch Joint Venture



Highlights

Business Scope:

Development, production, verification, sales and servicing of:

- PEM type Fuel Cells and;
- PEM Type Fuel Cell Engines;

Application Markets:

China Commercial Vehicle Market.

Production Capacity

3.000 PEM Fuel Cell Engines / Annum

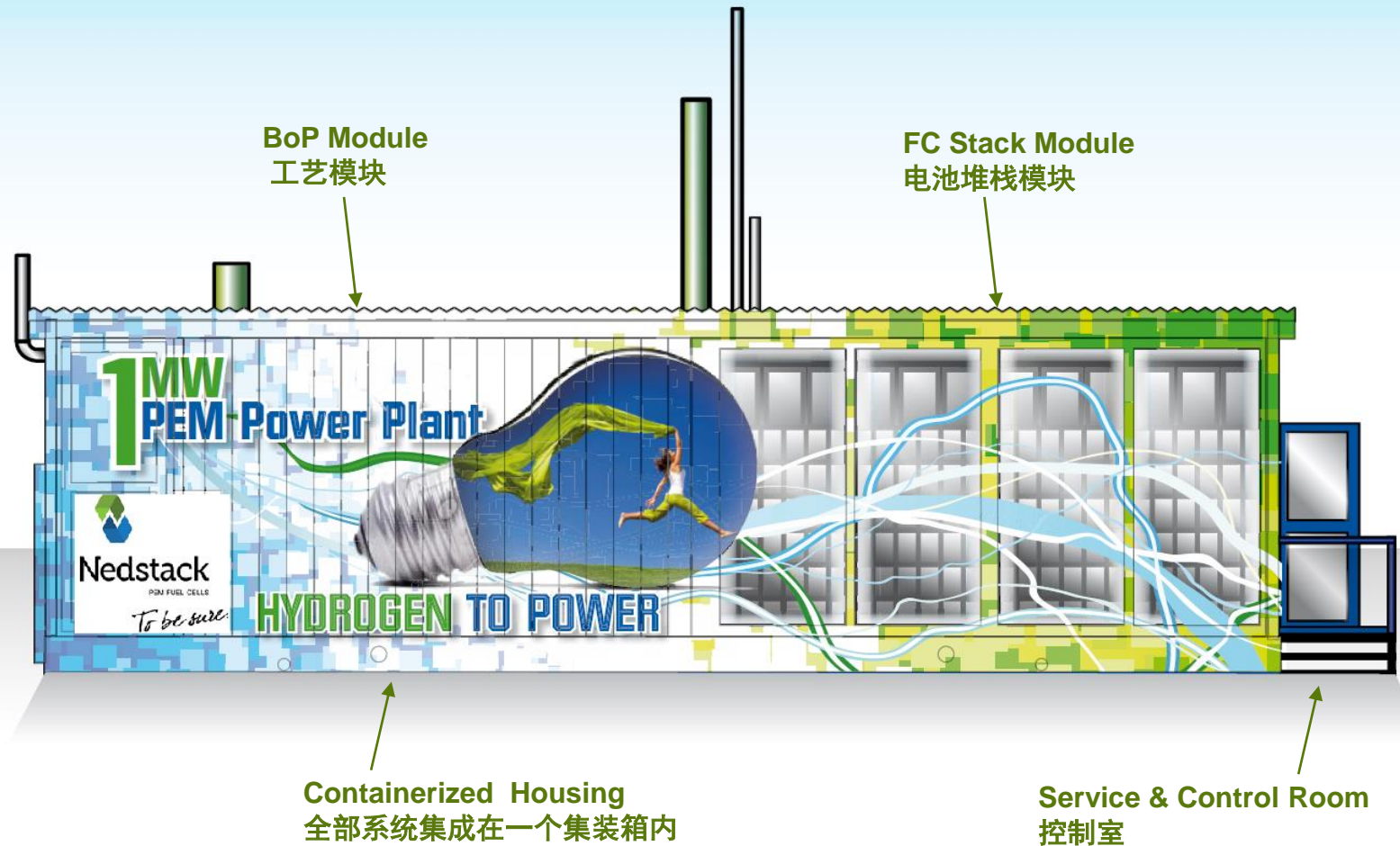
HuaHe main location



(office Address) No. 9, Guotai Rd,
Zhangjiagang City, Jiangsu
P.R.o.C.

PEM Fuel Cell Power Plants in CA industry

质子交换膜氢能发电站在氯碱行业的应用



70 kW PEM demonstration Power Plant

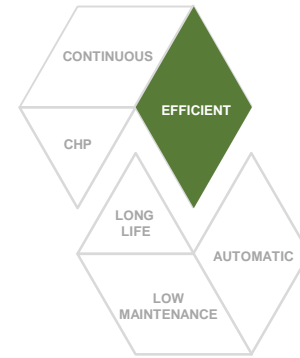
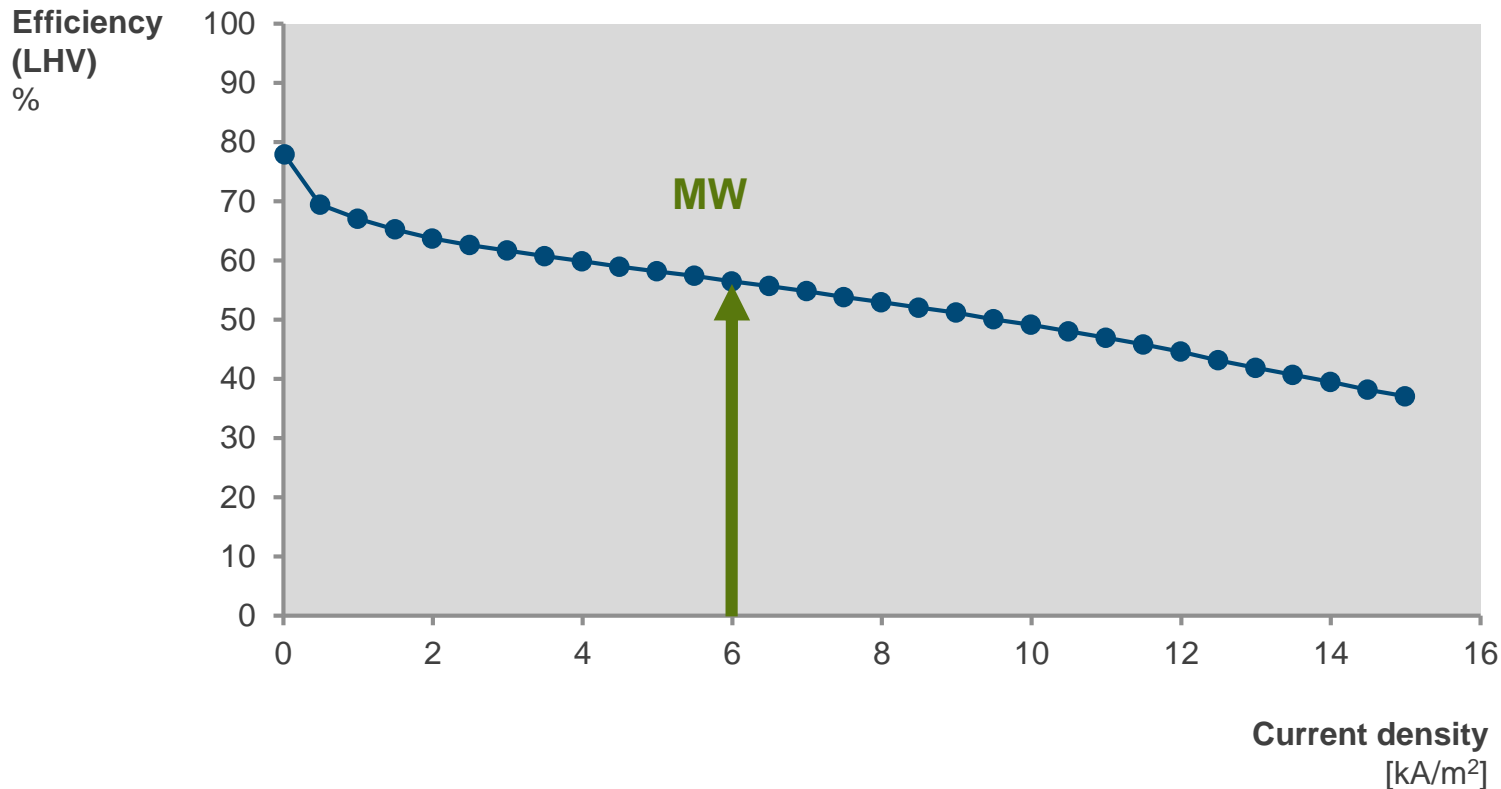
70千瓦质子交换膜氢能发电站示范项目



- > 60,000 hours on grid
- Stack life in field conditions over 23,000 hours
- Uptime > 90%
- Reliable operation (10 yrs)
在网运行大于6万小时，堆栈寿命超过2万3千小时，运行率大于90%。
- Very low maintenance costs
- Fully automated, remote monitoring
- Mobile set-up
维护费用低，全自动操作，远程监控，移动设计。

High fuel cell efficiency, low auxiliary losses 高电效，低内阻

Operating point for MW PEM Power Plant at 55 % efficiency
兆瓦级电站运行控制点选择在能量转化效率为55%

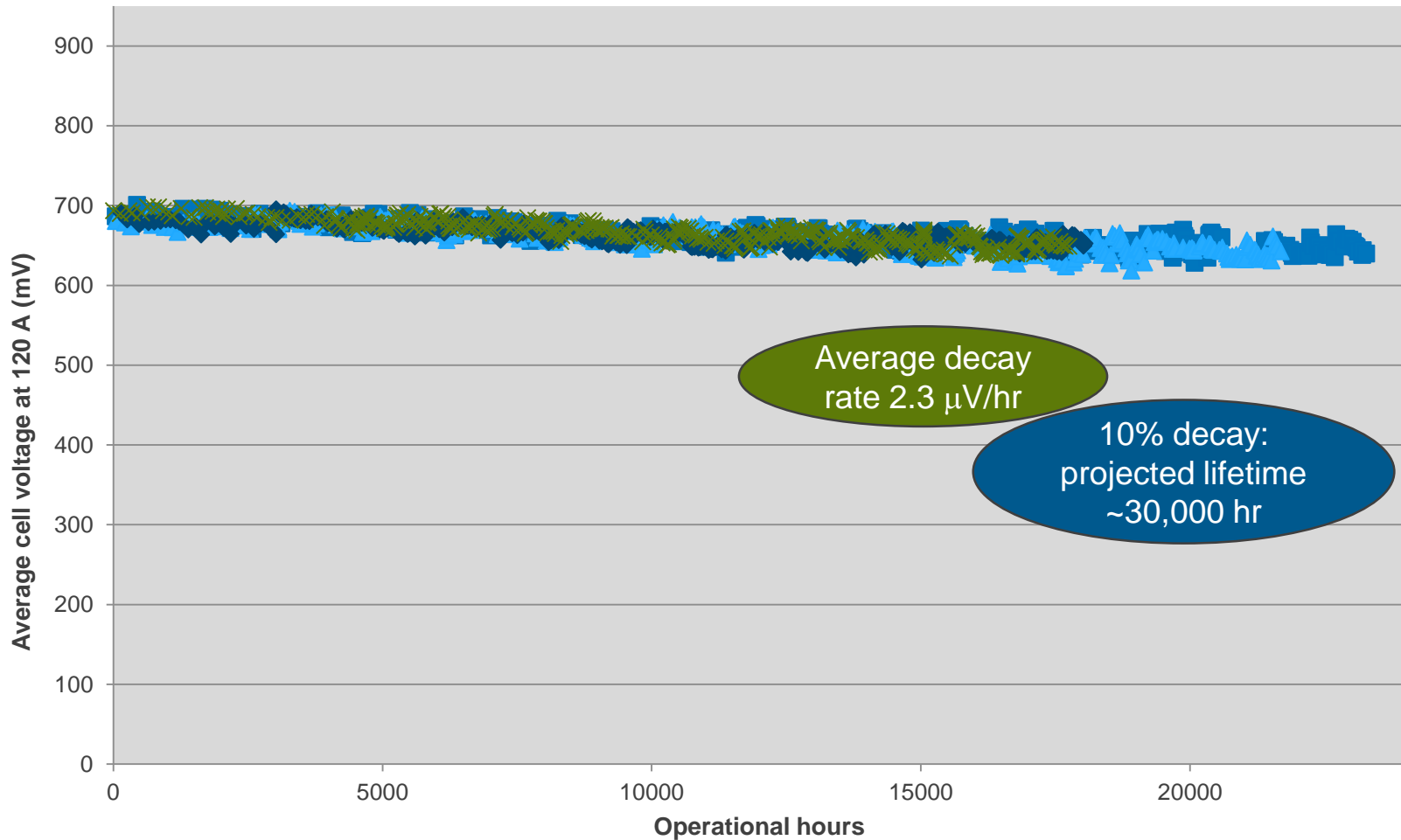


FCS-XXL stacks: stable performance, long life

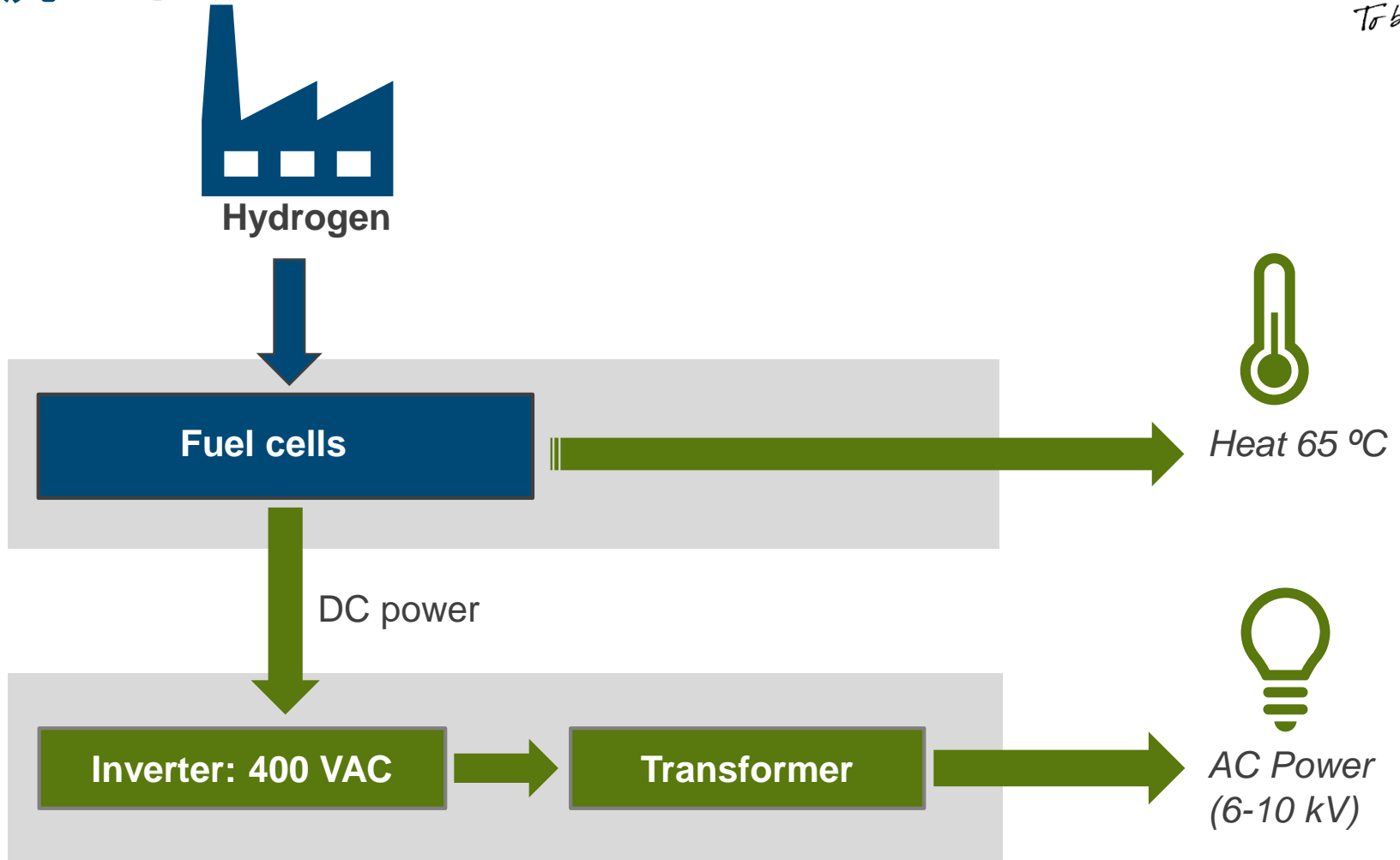
FCS-XXL电池堆栈：效率稳定，长寿命

- Unique stack performance and lifetime under real, industrial conditions (Delfzijl)

在真实工业条件下（Delfzijl工厂）独特的电池堆栈实现了稳定的效率和长寿命



Cogeneration of AC-power and heat 交流电与热量伴生



Recover the energy content of waste hydrogen

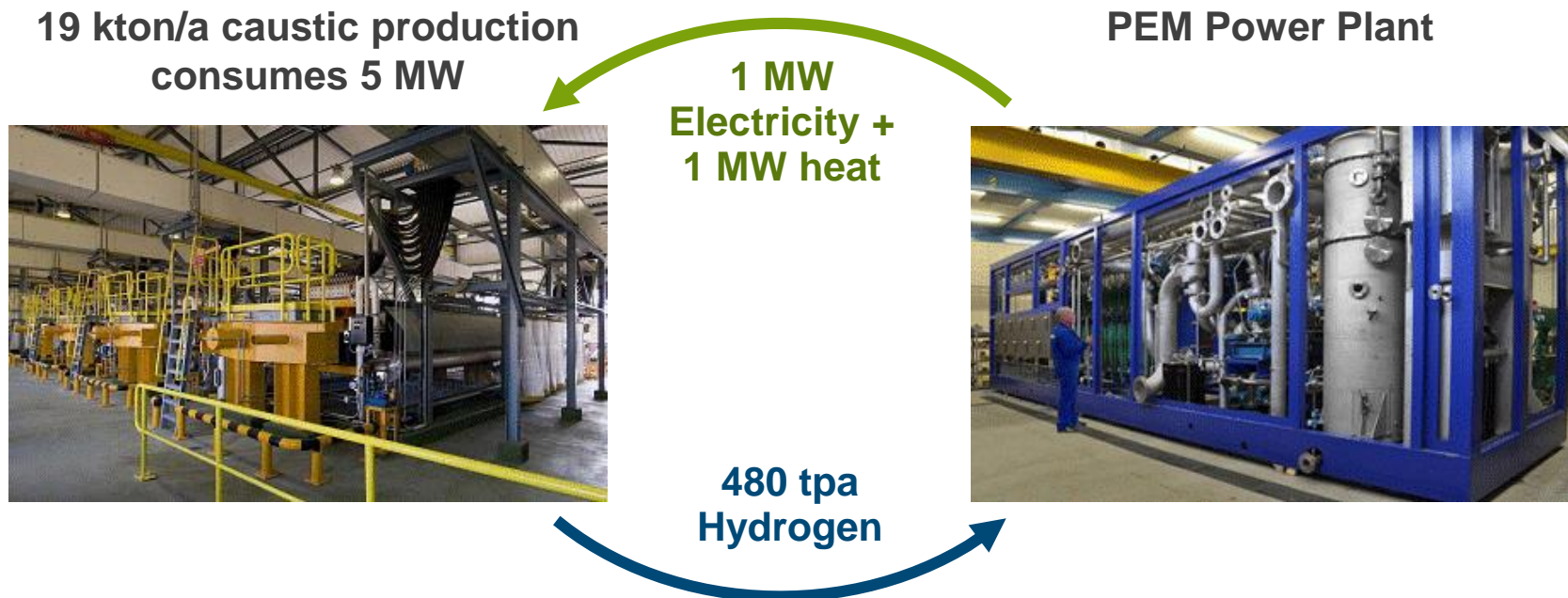
从废弃的氢气中重新获取能量

- 20% of a chlorine factory's electricity consumption can be recovered through fuel cells

通过燃料电池20%的氯碱工厂电能消耗将被回收。

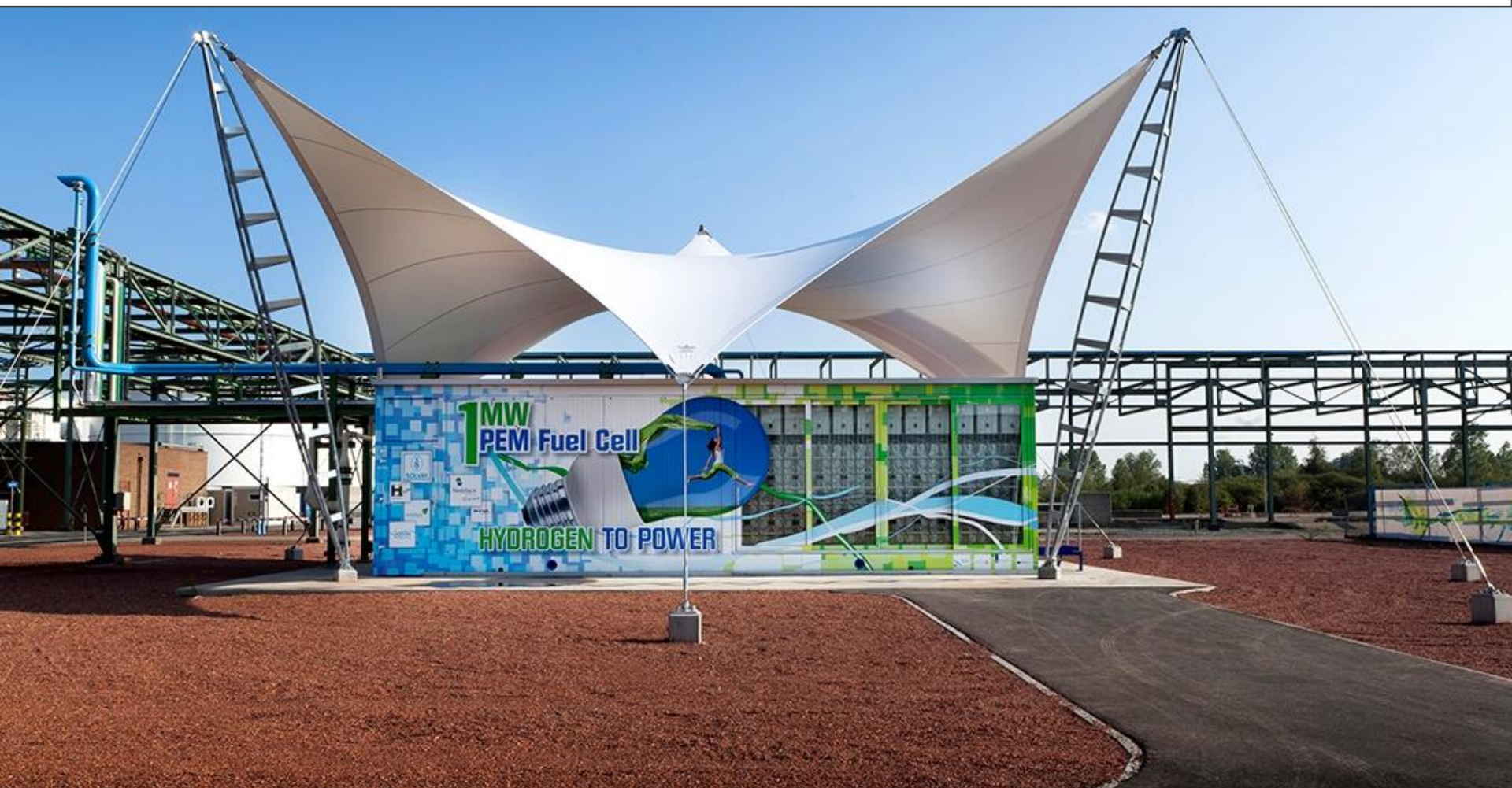
- Heat from the fuel cell can be used to preheat the brine.

燃料电池产生的热能可以被用来预热盐水。





1MW PEM Power Plant





2MW PEM Power Plant



2 MWe PPP consists of 6 fuel cell groups

2兆瓦氢电池电站---包含6组堆栈

Stack container



Process container



Fuel cell group



EPC/Construction



(Remote) monitoring & control

(远程) 监控

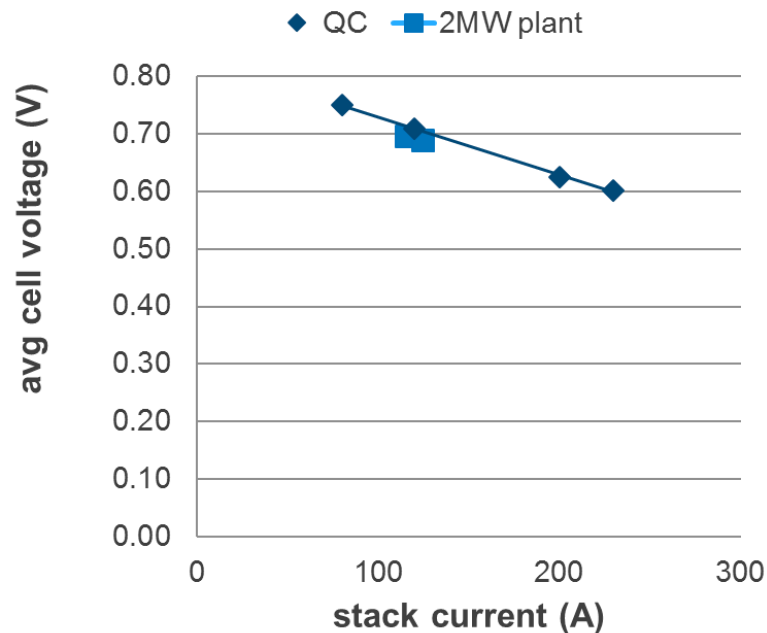
- System can be remotely monitored and operated
系统可远程操作与控制
- Stack performance in the plant can be individually monitored:
电站的每个堆栈状态可以单独监
控



Performance data

性能数据

Stack performance: plant vs. QC test



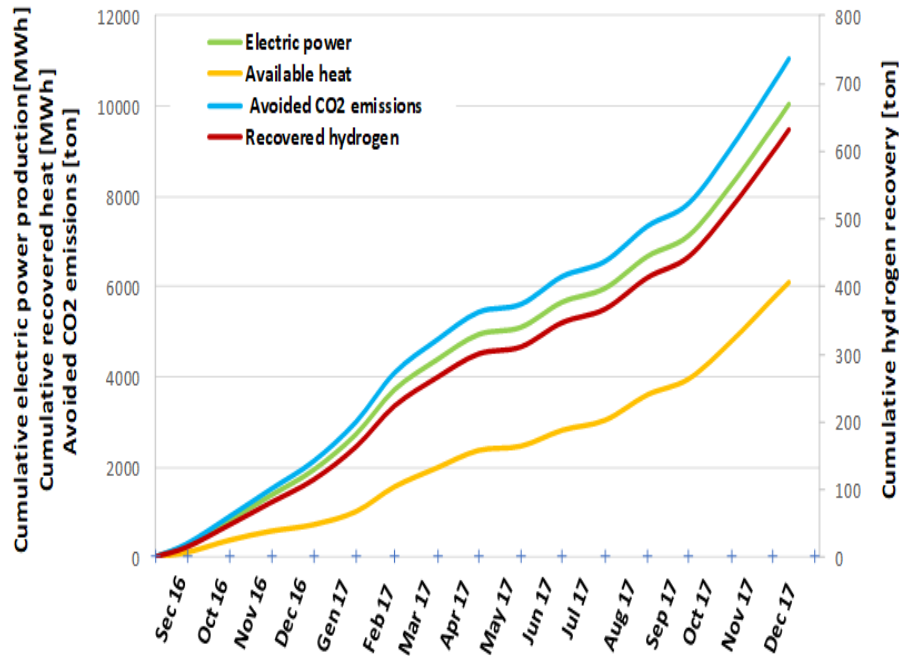
Plant performance (BoL)

- Nominal fuel cell output: 2000 kW
- Fuel cell efficiency (LHV): 55 %
- Auxiliary consumption: 120 kW
- BoP efficiency: 90 %
- Electrical efficiency: 50 %
- Available heat @ 60°C: >1000 kW
- Total efficiency: 80 %

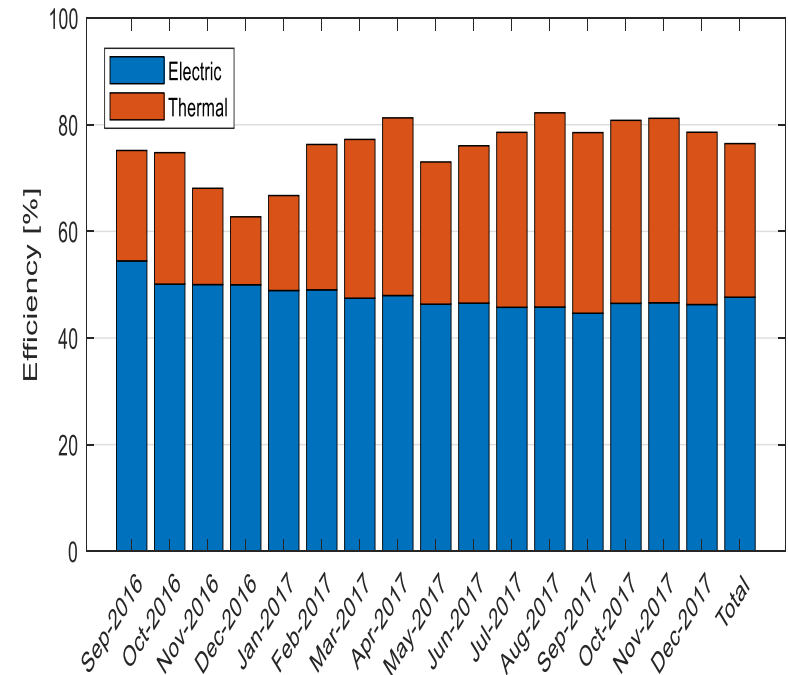
Cumulative 0-emission energy production up to 2018

至2018年产生的能量为零排放

Energy / H2 recovery / CO2 reduction

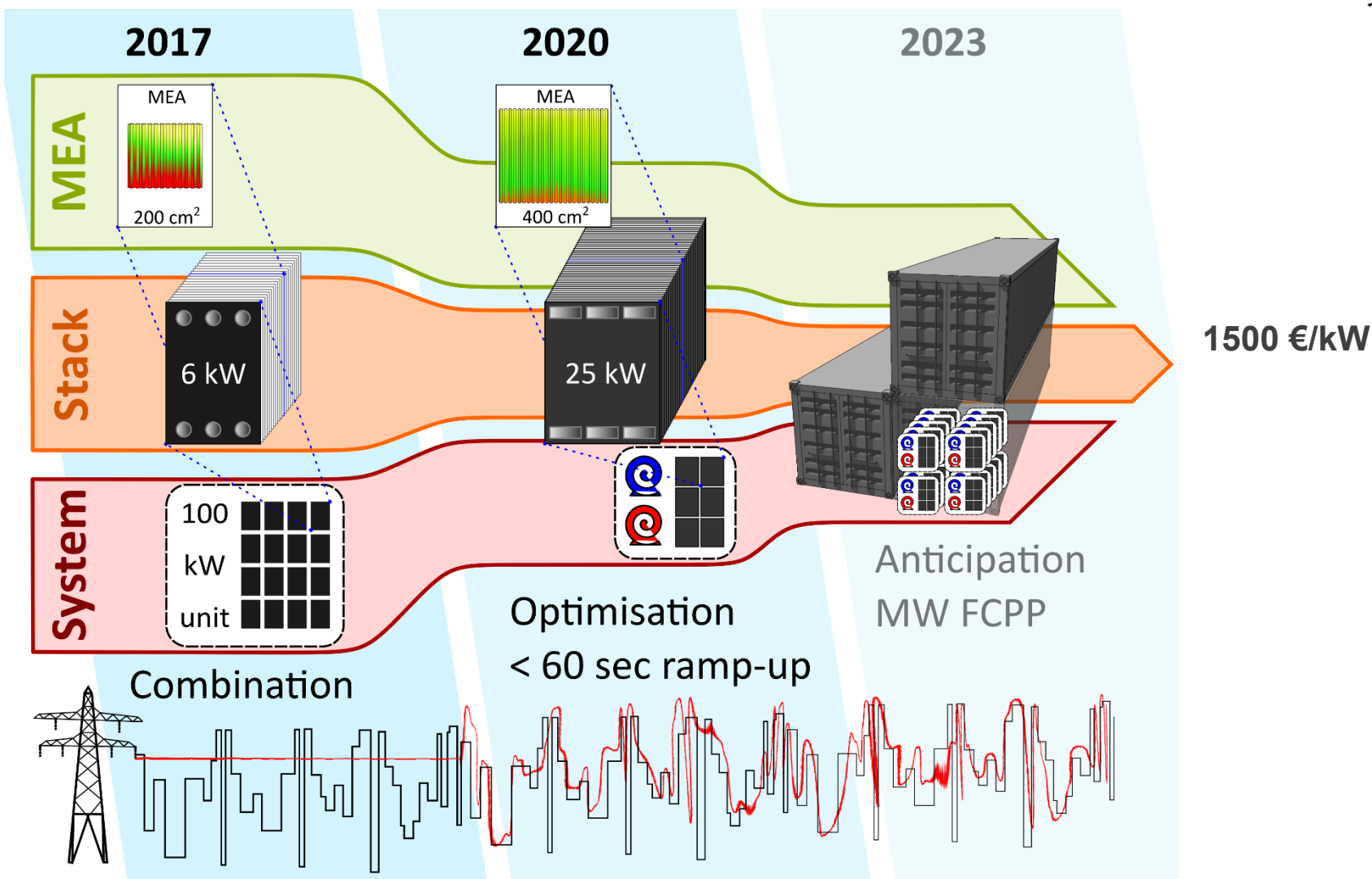


Electrical and thermal Efficiency



Nedstack's PPP development

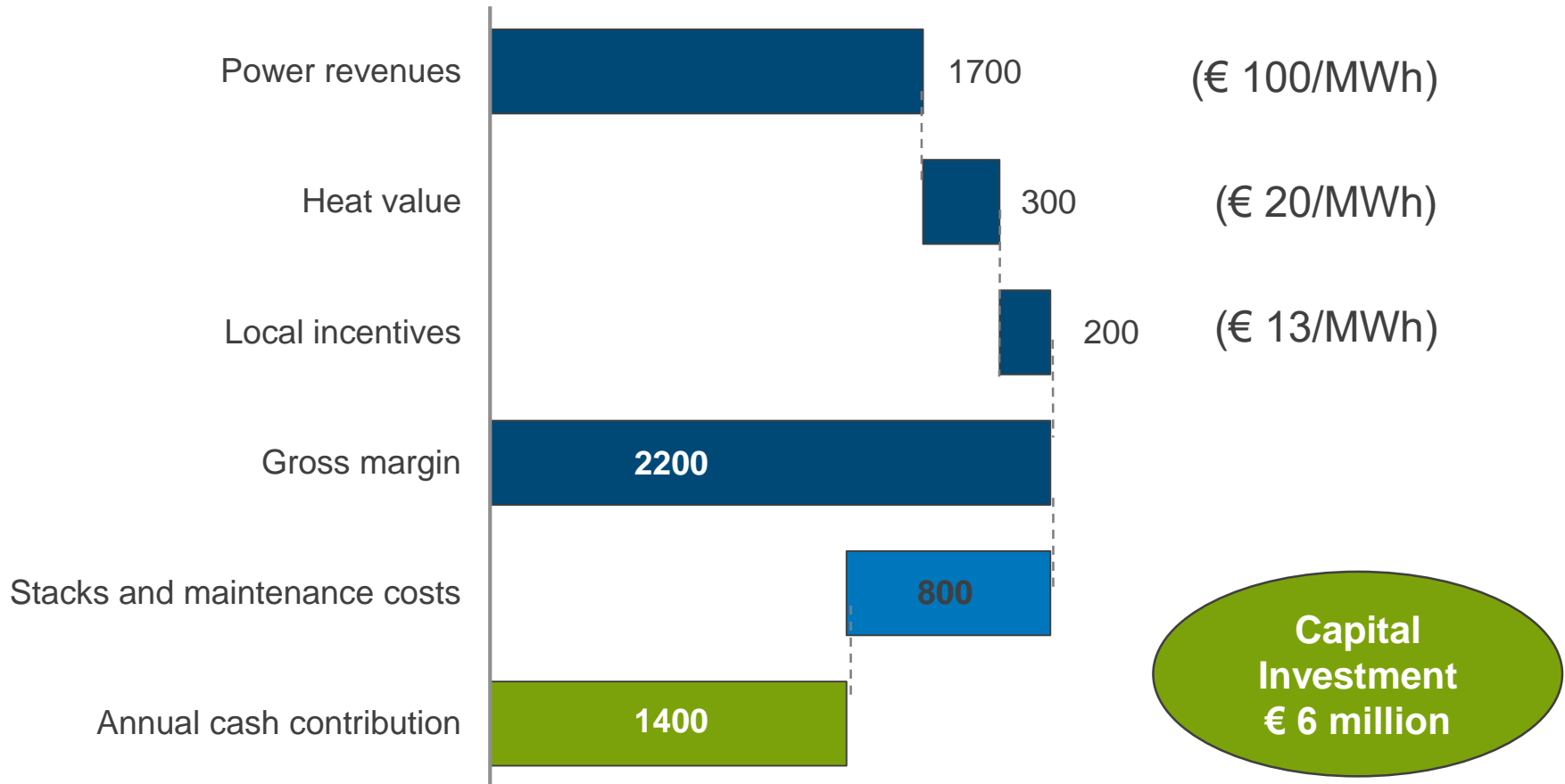
荷兰氢电公司电池电站技术发展



Example for 2 MW PEM Power Plant

2兆瓦电站案例

Annual cash, € '000, example only (金额单位 : k, 仅供参考)



Thank you

謝謝



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