

Green H₂ Production and Delivery for Transportation Applications in Wind Regions

André Steinau, GP JOULE GmbH
Boston, 12th of September 2018



Company.

Unique all-round.

GP JOULE is the universal, innovative, authentic and successful partner in the renewable energy sector.

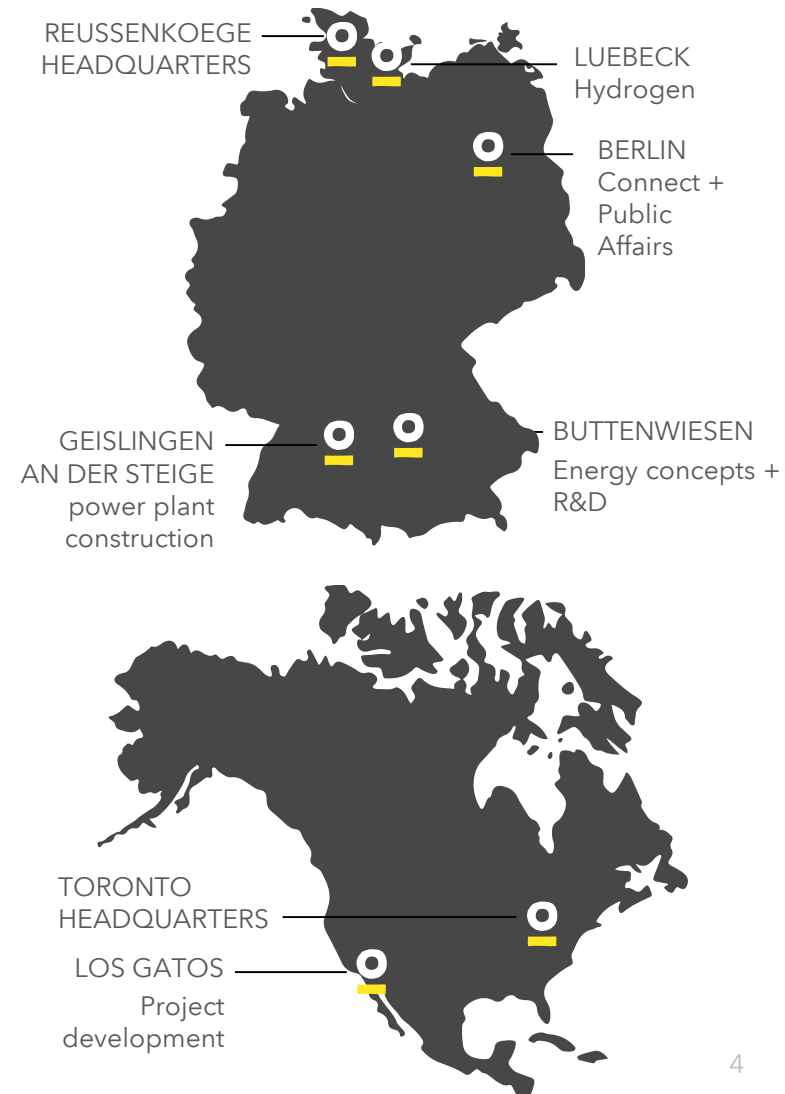
GP JOULE's goal is to ensure that **100% of the energy consumed** around our planet in the future is **produced from renewable sources.**



To the point.

Facts about GP JOULE.

- **Founded in 2009**
- **Employees:** 230
- **Installed generation capacity since 2003:**
600+ MW
- **Divisions:**
Projects, Think, IPP, Service, Connect
- **Germany:**
headquarters and 4 offices
- **North America:**
2 offices



To the point II.

Facts about H-TEC SYSTEMS.

- **Founded in 1997**
- **Acquired by GP JOULE:** 2010
- **Employees:** 20
- **Business Divisions**
 - Stack manufacturing
 - Elektrolysis systems
 - 0,14 - 140 kg/d H₂-production
 - Load range: 0,26 kW-350 kW
 - Compact Design
 - High power density

S 30/10



ME 100/350





**Hydrogen -
the golden key.**

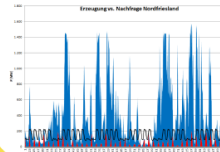
Crucial Challenges.

**CLIMATE
GOALS**

**CREATING
„REGIONAL“
VALUE THROUGH
RENEWABLES**



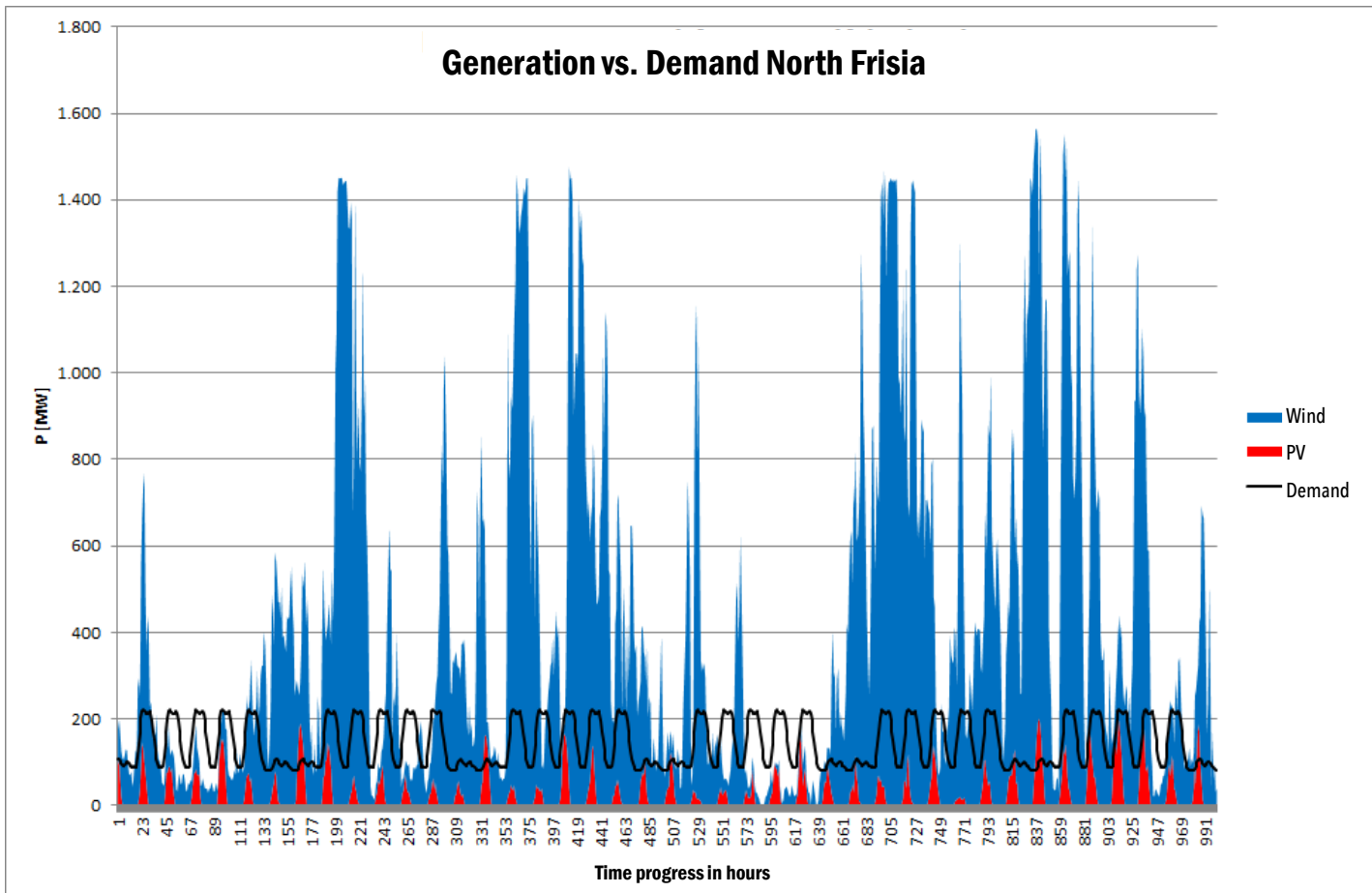
**ENERGY-GRID
BOTTLENECKS**



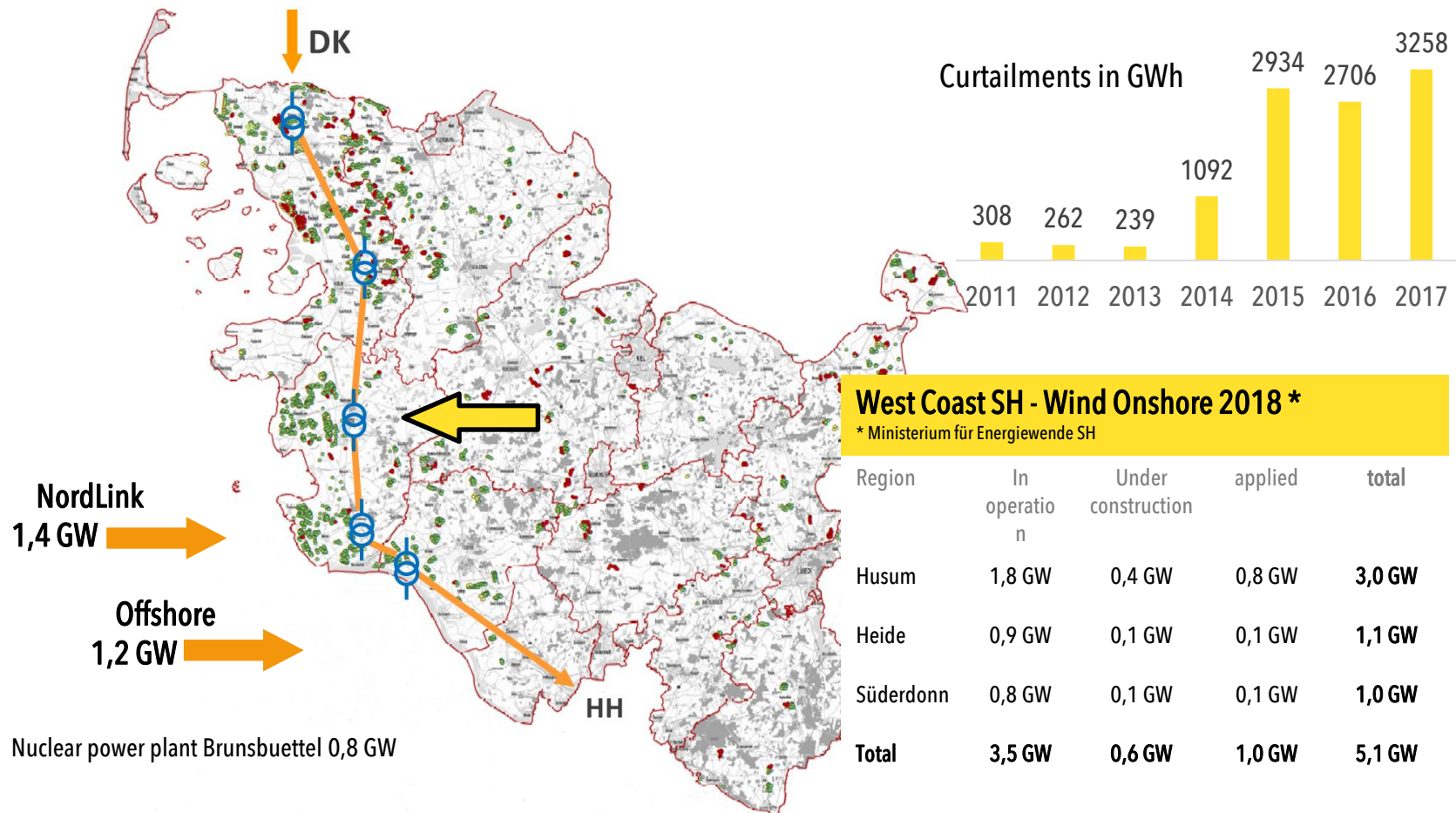
DECARBONIZATION

**ACCEPTANCE
OF RENEWABLES**

Generation Wind & PV vs. Demand (2014)



Green Hydrogen Valley.



West Coast SH - Wind Onshore 2018 *
* Ministerium für Energiewende SH

Region	In operation	Under construction	applied	total
Husum	1,8 GW	0,4 GW	0,8 GW	3,0 GW
Heide	0,9 GW	0,1 GW	0,1 GW	1,1 GW
Süderdonn	0,8 GW	0,1 GW	0,1 GW	1,0 GW
Total	3,5 GW	0,6 GW	1,0 GW	5,1 GW

NordLink
1,4 GW →

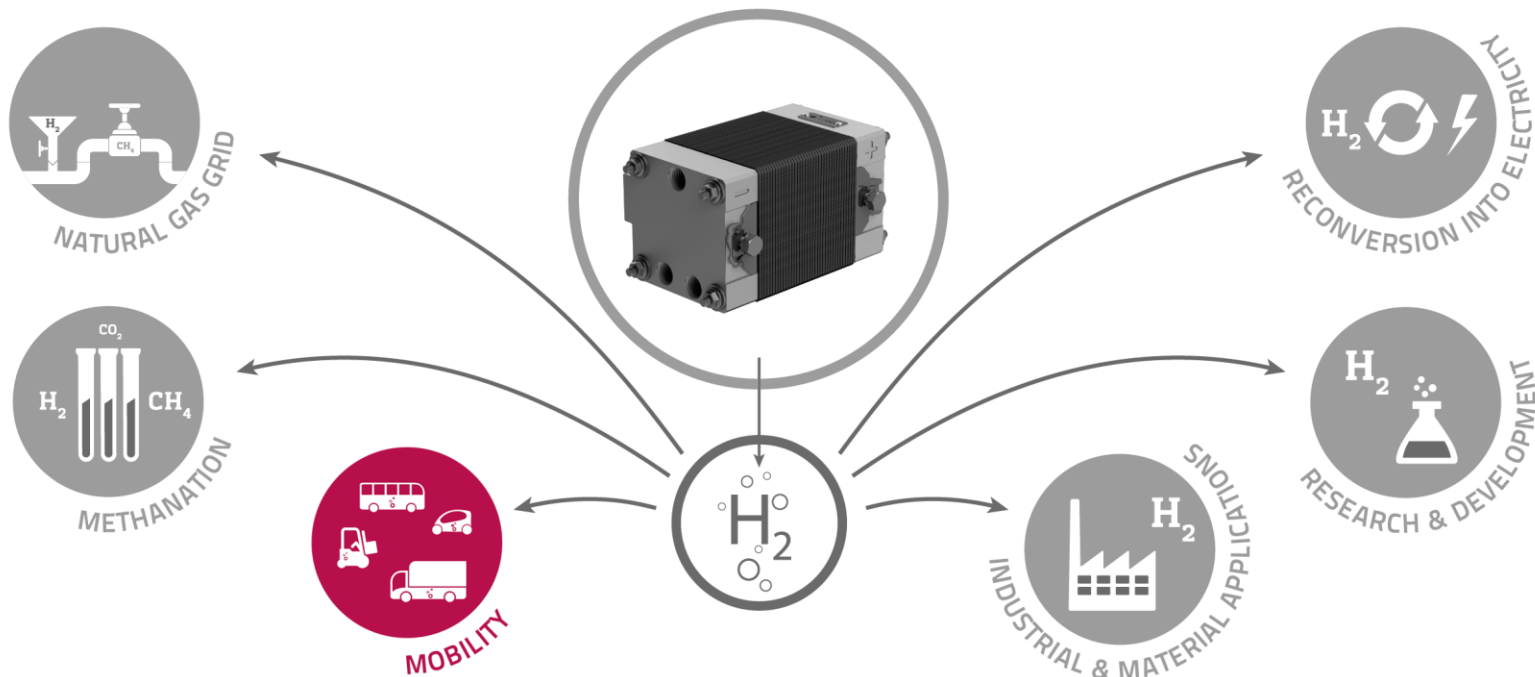
Offshore
1,2 GW →

Nuclear power plant Brunsbuettel 0,8 GW

A refinement of renewable energy.

Best opportunities for the future.

The missing link in the chain: **electrolysis technology bridges the gap** between oversupply of power and growing demand for hydrogen.



HYDROGEN MOBILITY JOINT PROJECT

Connection of production and consumption for Public transport

- **GENERATING** GREEN HYDROGEN at appropriate wind farms with 5 × 225 kW electrolysis systems and 30 MPa compression installed
 - **TRANSPORTING** GREEN HYDROGEN with swap bodys each 140 kg H₂
 - **PROCESSING** GREEN HYDROGEN at 2 hydrogen refilling stations 35/70 Mpa each
 - **USING/CONSUMING** GREEN HYDROGEN with own 2 local public transportation fuel cell buses
-
- RES power used in emissions-free mobility
 - Smart integration of decentralised hydrogen infrastructure
 - Increase in acceptance through local use of regionally produced power
 - Transferable, scalable model for the implementation of further concepts for cross-sector market integration of RE in regions and countries.

JOINT LOCAL PARTNERSHIP

Organisation of the cooperation

Joint project shareholders engage in self investment

GP JOULE

**Wind farm
operators**

**Manufacturers/
operators of
H₂ technology**

**H₂
filling station
operators**

**Public
transport
operators**

**H₂
tank truck
operators**

Others
- Heat users
- H₂ marketers

Citizens



NORTH FRISIA



GERMANY

Creating the local value chain.



225 kW electrolysis system



Hydrogen swap body concept



Hydrogen refilling station (Linde AG, 2018)



Fuel cell bus (Solaris, 2018)

Upcoming value chain drivers.



Mercedes Benz GLC F-CELL



Hyundai Nexo



FAUN Commercial vehicle



Mercedes FC truck

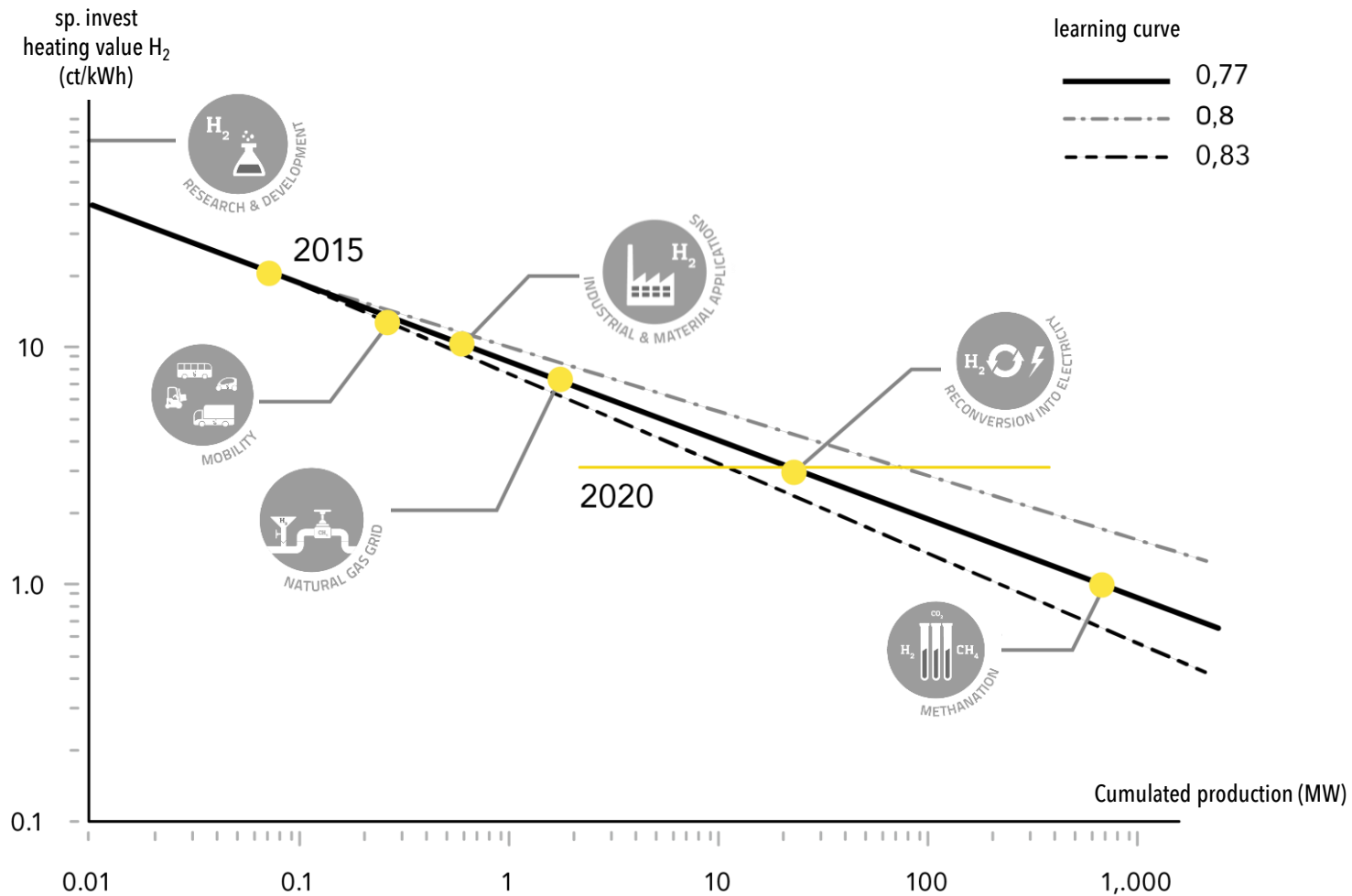
Outlook

Hydrogen mobility rollout: HY.TRAIN

- 50+ trains for SH local transportation by 2021/2022
- Contract for 30 years 8-10to/d minimum 50% Green H₂



Cost degradation and markets.



Thank you for your attention!

GP JOULE GmbH
Cecilienkoog 16
25821 Reussenkoege
T+ 49 4671 6074-0
F +49 4671 6074-199
info@gp-joule.de
www.gp-joule.de