Koordinierungsstelle Erneuerbare Energien „Power to Gas“ 22. Mai 2012, Berlin

Dipl. Kfm. Werner Diwald | Vorstand ENERTRAG AG

Company

ENERTRAG is a European IPP specialized in sustainable energy

and acting in all areas necessary for power generation.

Erection and maintenance of energy plants

Financing of energy projects

Construction and operation of electricity grids

Development and controlling of interlaced power stations

Technology development

Figures

900 million € investment

over 800 MW installed capacity

over 500 erected turbines

over 1200 turbines under service and maintenance

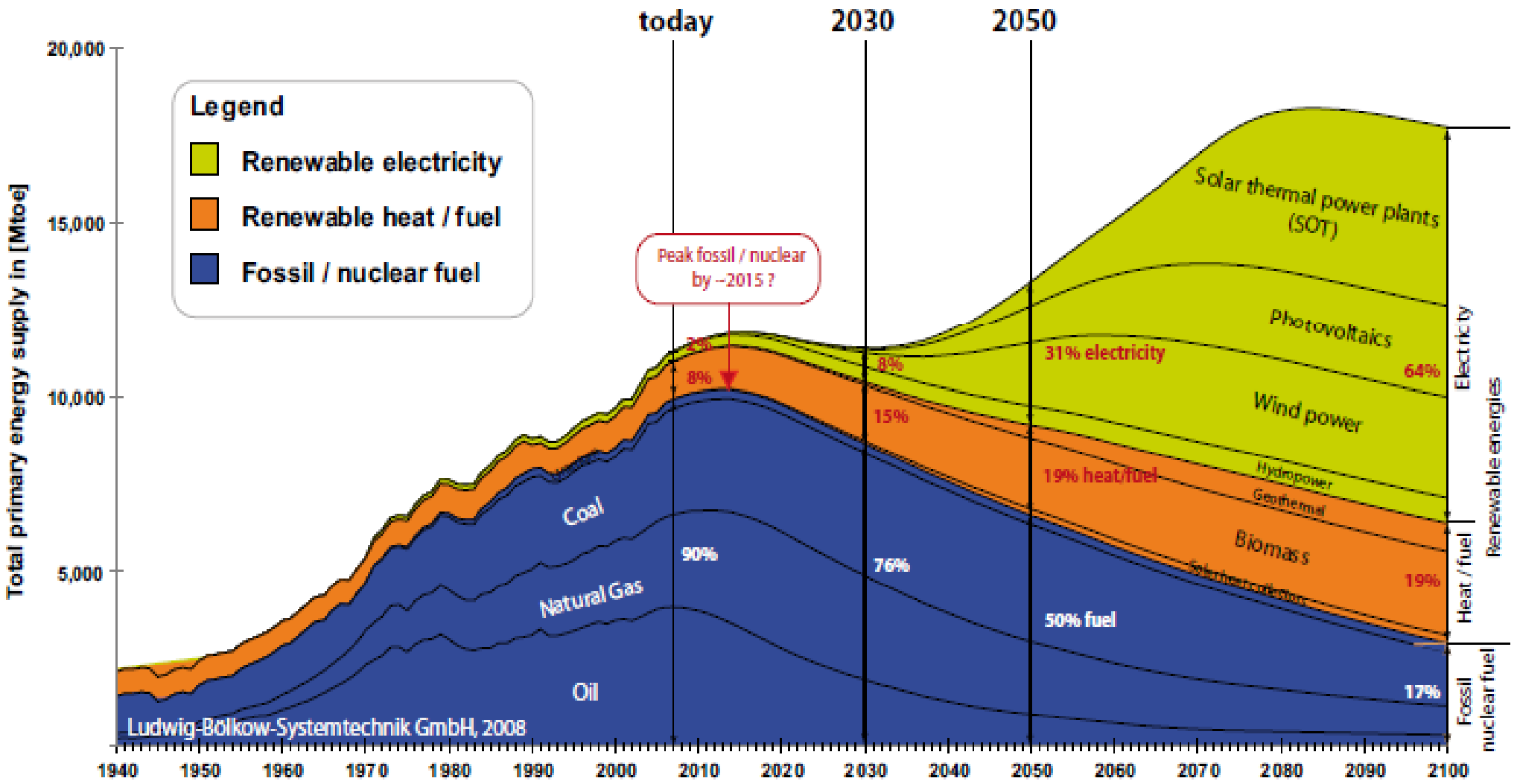
over 250 million € annual turnover

over 1.2 billion kilowatt hours per year

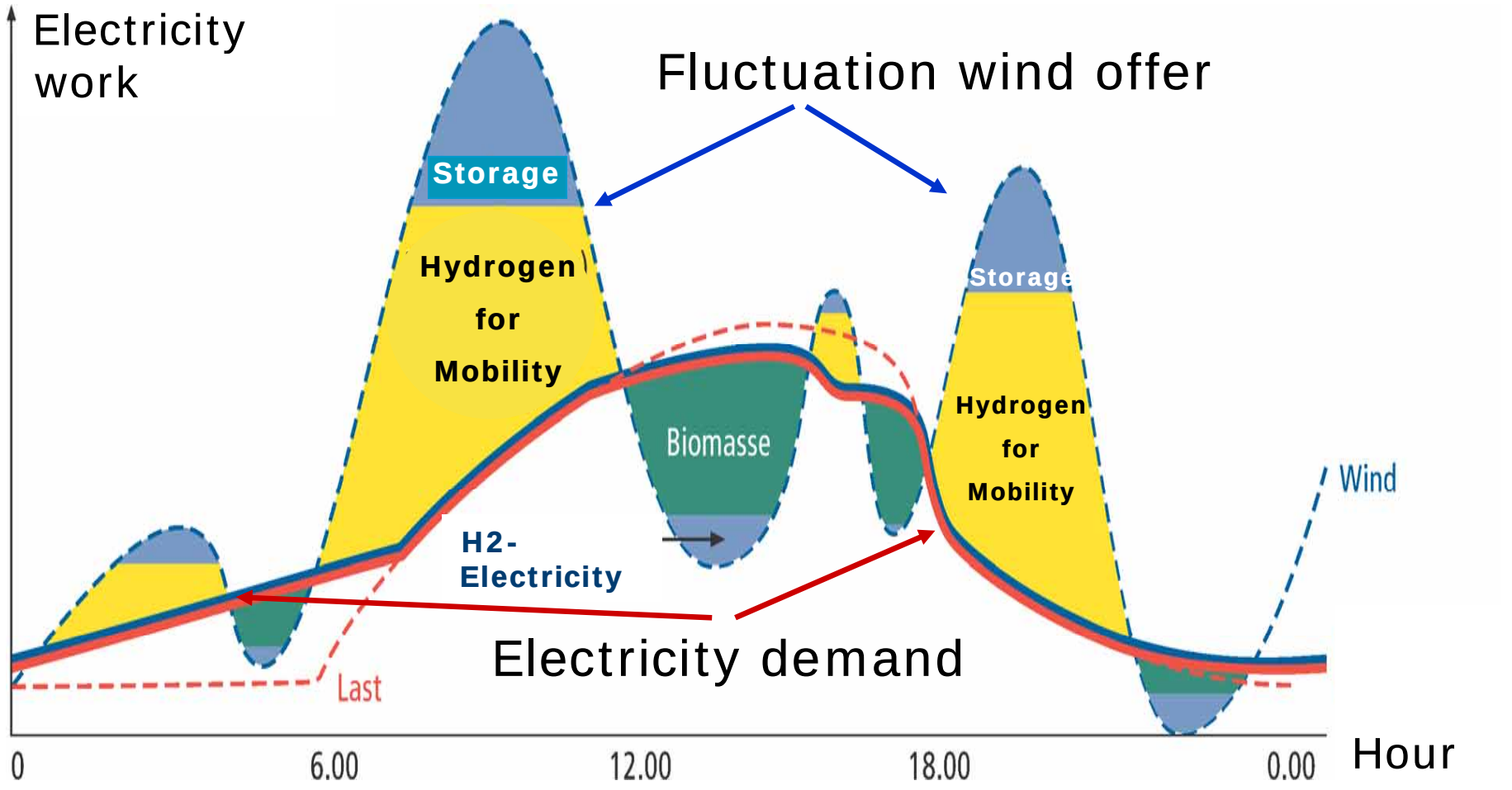
430 employees (170 of them in O&M)

12 trainees

Peak Oil

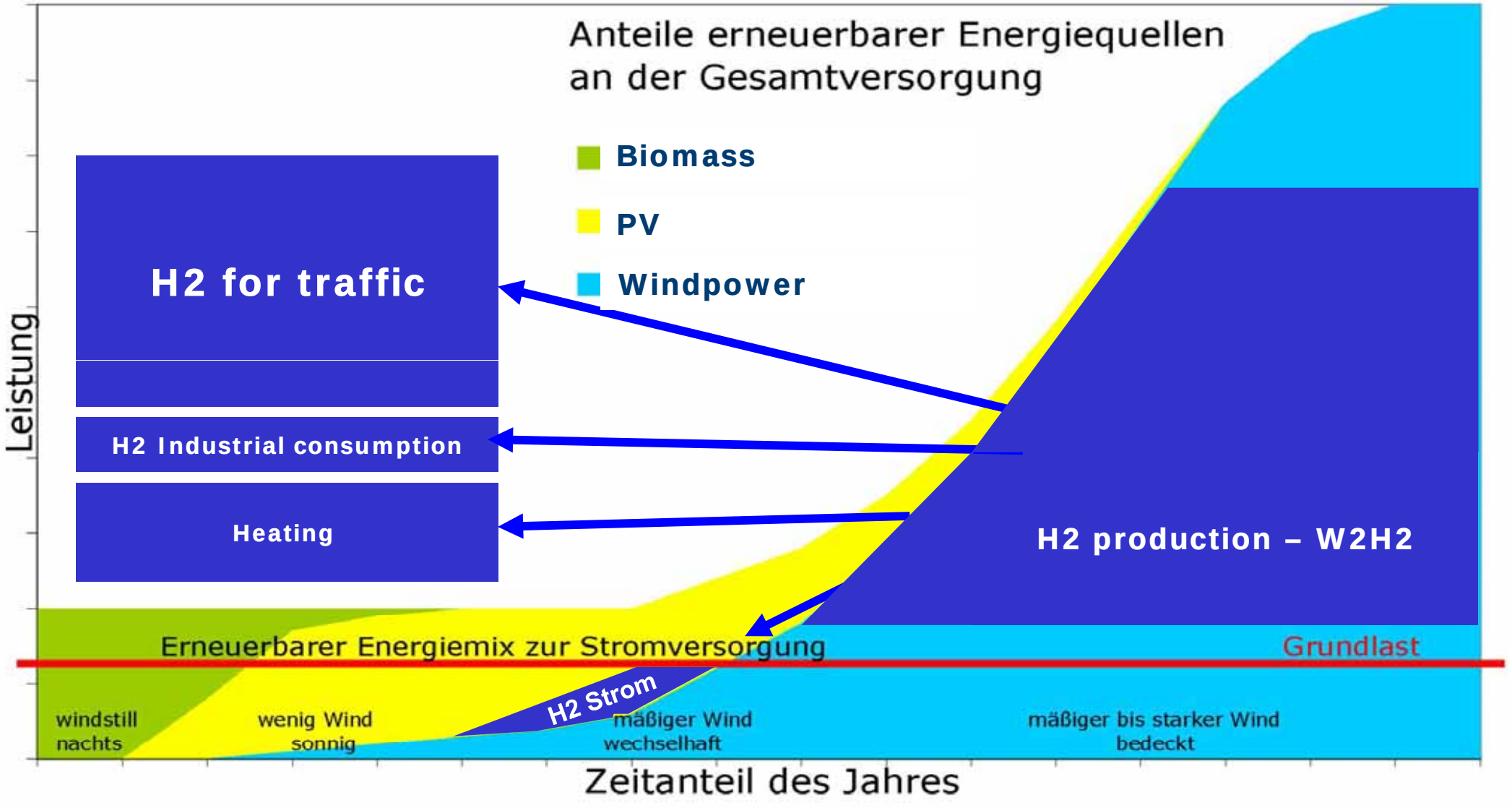

today
2030
2050
Legend
Renewable electricity
Renewable heat / fuel
Fossil / nuclear fuel
Peak fossil / nuclear by ~2015 ?
Total primary energy supply in [Mtoe]
20,000
15,000
10,000
5,000
Coal
Natural Gas
Oil
Solar thermal power plants (SOT)
Photovoltaics
Wind power
Hydropower
Geothermal
Biomass
31% electricity
64%
19% heat/fuel
19%
50% fuel
17%
8%
15%
90%
76%
Electricity
Heat / fuel
Renewable energies
Fossil nuclear fuel
Ludwig-Bölkow-Systemtechnik GmbH, 2008
1940
1950
1960
1970
1980
1990
2000
2010
2020
2030
2040
2050
2060
2070
2080
2090
2100

ENERTRAG Generation Management



Energy Mix

Mix of Wind-, Solar- und Biomass - Energy replace complete conventional Power Plants.



HYBRID-ENERGY-PLANT

World‘s **first industrial-scale Hybrid-Energy-Plant**

500 kilowatts outlined “green” capacity

Partnership with University of Applied Sciences in Stralsund, Technical University in Braunschweig, Brandenburg-Technische-Universität

Over **4 million € direct investment and over 3 million €** research investment

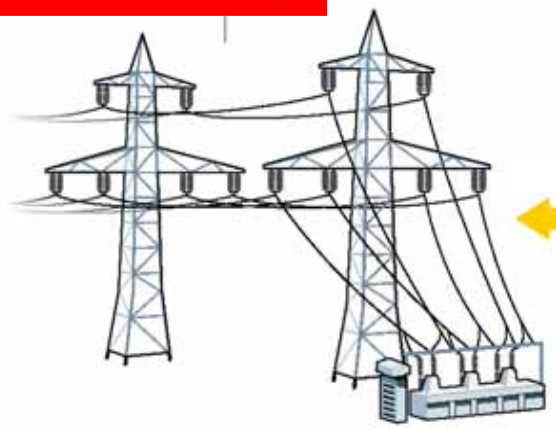
Supply of Energy, Heat and Fuel at all times, even if the wind isn’t blowing

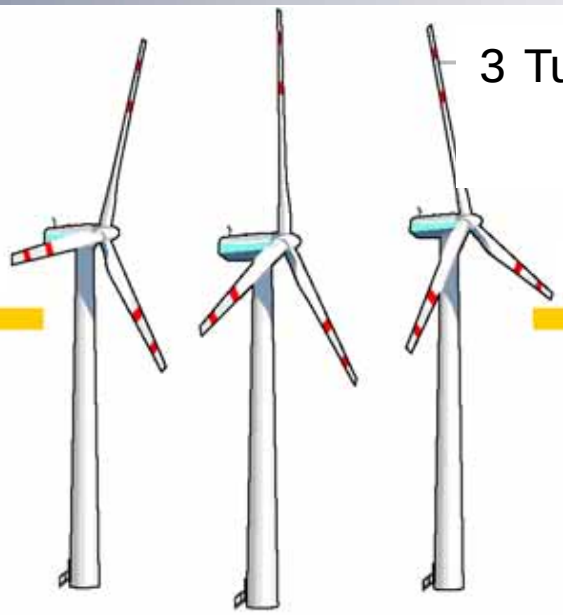
Industrial Partners: TOTAL, Vattenfall, Deutsche Bahn

Functional principle HYBRID-POWER-PLAN

ENERTRAG

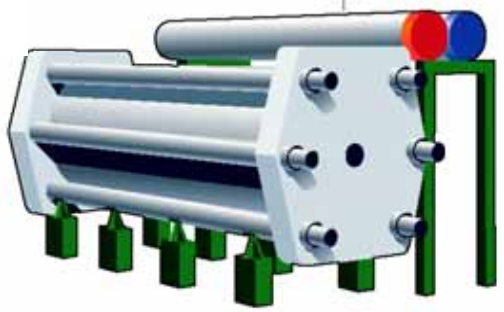
Electricity





3 Turbines

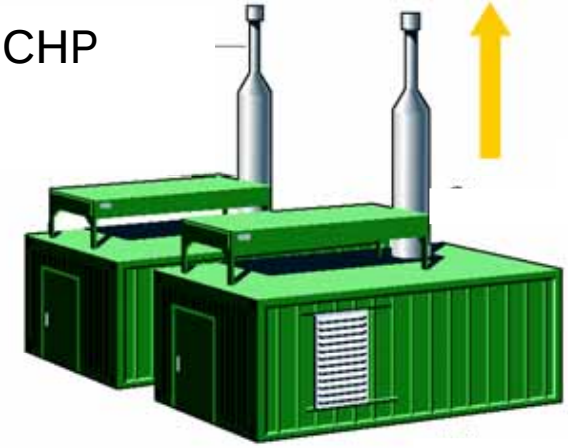
Electrolysis



Hydrogen

Storage

CHP

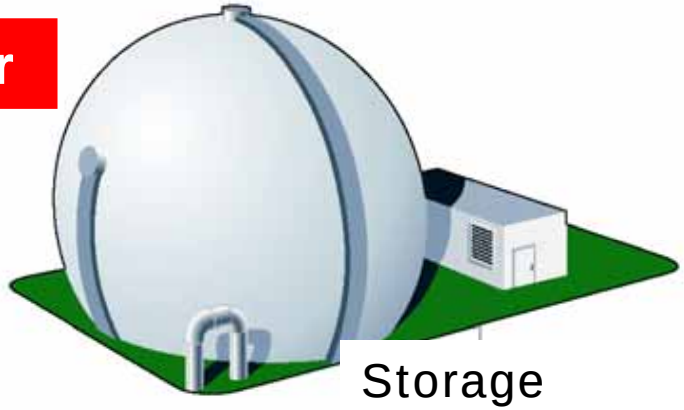


Variable mixing

Mixing valve

Heat – Cooking - Power

Biogas



Storage

Fuel

HYBRID-ENERGY-PLANT: Project details

Technical Specifications:

- Green Energy:
  - 500 kW from the ENERTRAG-WEC Grid
- Hydrogen Generation incl.:
  - Alkaline Electrolyser (500kW): 120Nm³/h @nominal load
  - Compression to 30 bar
- Biomass plant:
  - 625kW
- Ground storage:
  - Hydrogen: 1.350kg @30bar
  - Biogas
- CHP:
  - 350kW (el.)
  - 155kW (thermal)
  - Fuel: max. 70% Hydrogen, 30% Biogas

Main Objectives – First Steps:

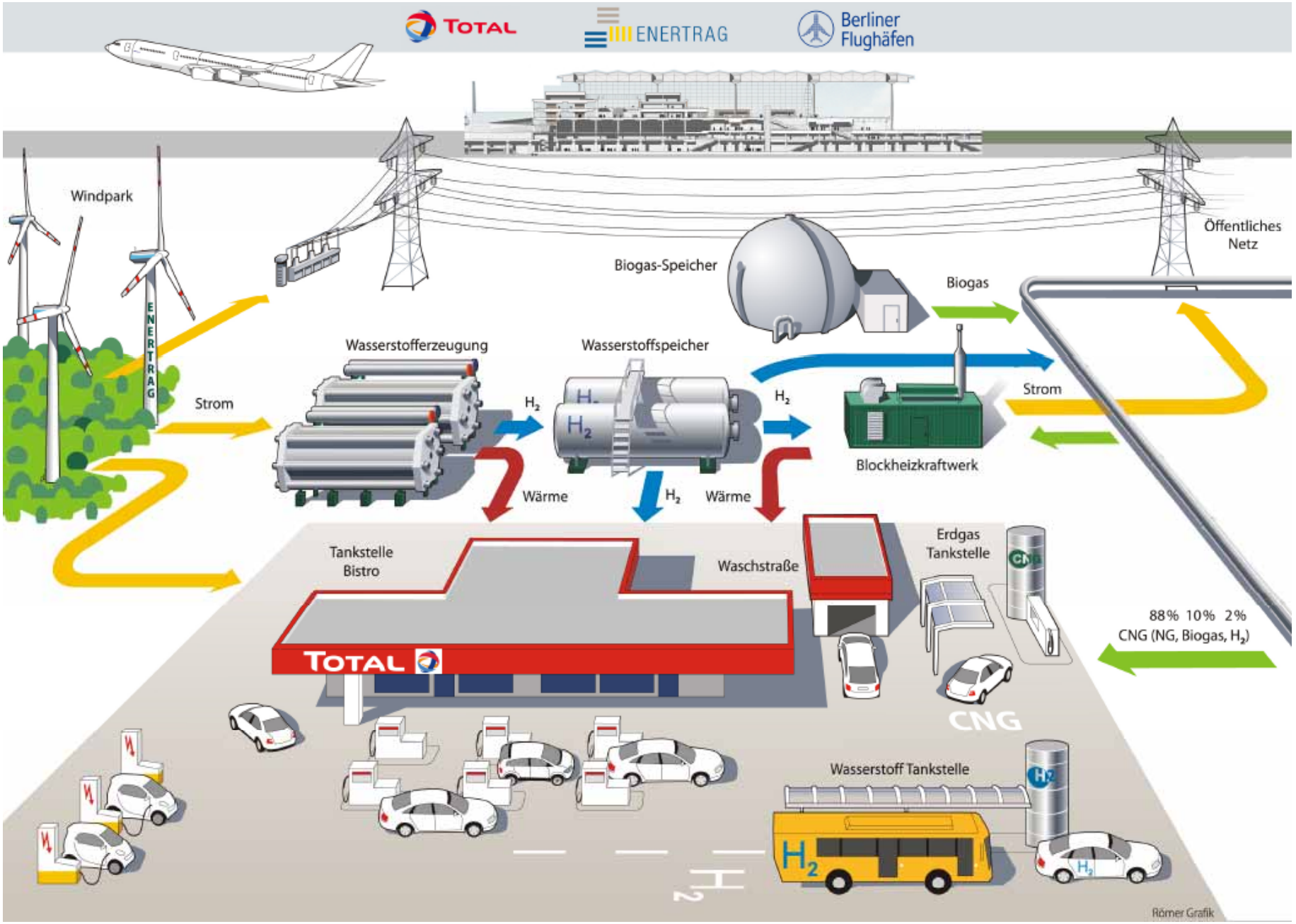
- Development of a Control and Power Conditioning Unit (Software and Hardware)
- System integration according to specific local conditions
  - Optimization of a standard electrolyser
  - Improvement of system efficiency, reliability and availability
  - Balance of component-sizing
- Development and optimization of a H_2/Biomass-CHP
- Operational:
  - Forecast error compensation
  - Grid Stabilization
  - Peak-Shaving
  - Insured Supply (Availability during calm periods)
- Economy

HYBRID-ENERGY-PLANT allows...

... a full-integrated energy supply by renewable energy with grid-connected large scale hydrogen production.

- new economic chances for Brandenburg
- producing the most cost-effective hydrogen based on renewable energy
- base-load power generation and optimized grid-integration of wind energy
- development of control interface systems for storage and grid management

BBI Airport


TOTAL
ENERTRAG
Berliner Flughäfen
Windpark
ENERTRAG
Biogas-Speicher
Biogas
Öffentliches Netz
Wasserstofferzeugung
Wasserstoffspeicher
Strom
H_2
Strom
Blockheizkraftwerk
Wärme
H_2
Wärme
Tankstelle Bistro
Waschstraße
Erdgas Tankstelle
TOTAL
88% 10% 2%
CNG (NG, Biogas, H_2)
CNG
Wasserstoff Tankstelle
H_2
Römer Grafik

Without storage, a supply in the energy industry can not be guaranteed!

2050 in Germany requires approximately 40 to 50 TWhel.

Available storage capacity in Germany:

- **Water pump storage: ca. 0,07 TWhel**
- **E-Mobility: 45 Mio. cars ca. 0,45 TWhel**
- **Gasgrid: 110 TWhel / Extension up to 2030 to 220 TWhel**

Storage in natural gas system

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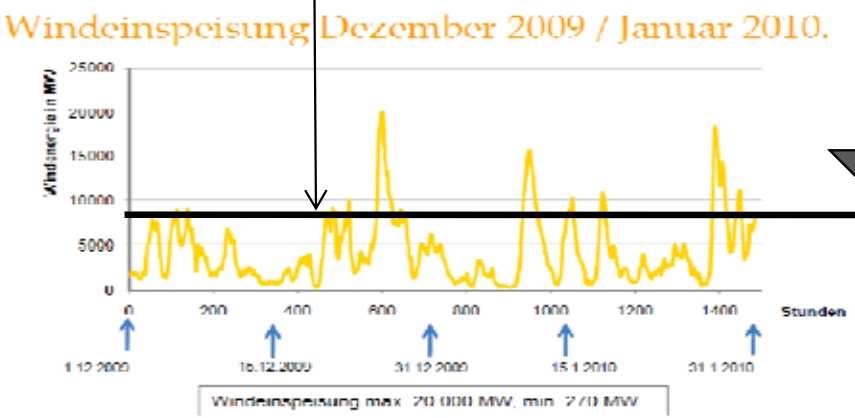
Powergrid

Gasgrid

Reduction Windturbines



Quelle: DENA – Vortrag auf dem EVU Gipfel 2010 in Heiligendamm

Not used energy will be lost

Windpower Will be used

Biogas-plant

Biomethan 1 (CH_4)

Renewable CO_2

Biomethan 2 (CH_4)

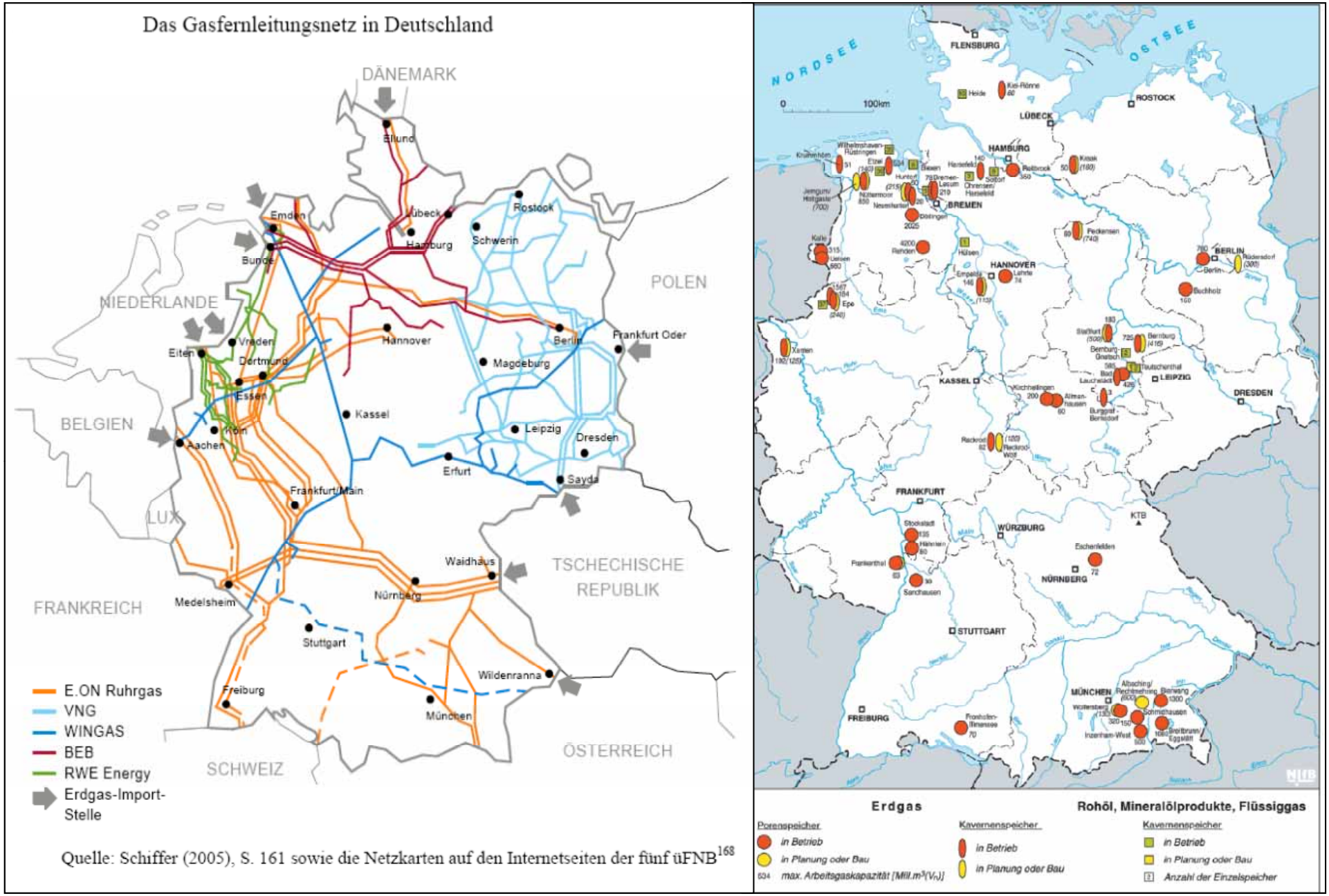
EE-H_2

Elektrolyseur

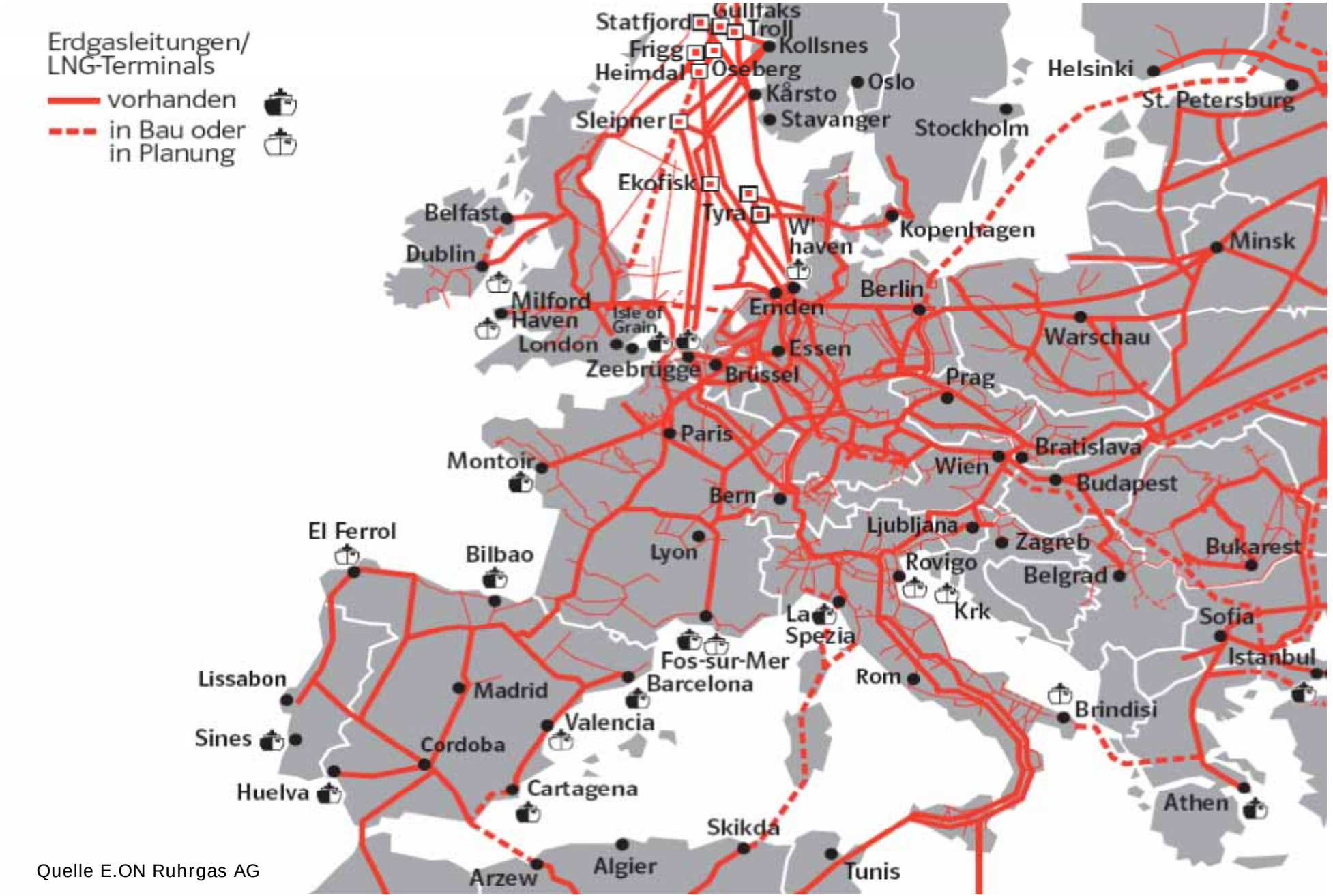
EE-Hydrogen(H_2)

Gridcapacity can used

Gas Injection



European Gassystem



Quelle E.ON Ruhrgas AG

Cooparation between Germany and France

ENERTRAG – TOTAL

Hydrogen of Filling Station in Berlin

Cooperation in Hybrid-Power-Plant

Winner of German-France Business Award

ENERTRAG – GreenGT

Exclusive Supplier of “Green Hydrogen”

Season 2013 – Le Mans

ENERTRAG – Air Liquide

Partner for hydrogen delivery

System Supplier of storage system

ENERTRAG

Hydrogen and Fuel Cells as Strong Partners of Renewable Energy Systems