

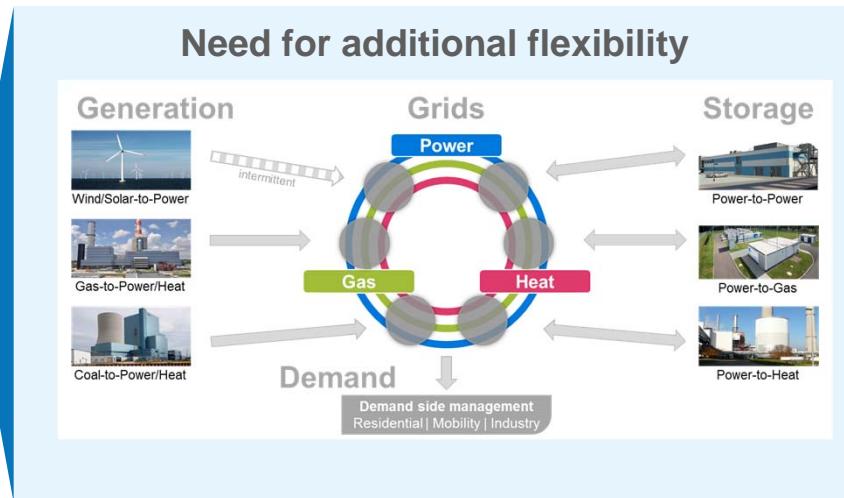
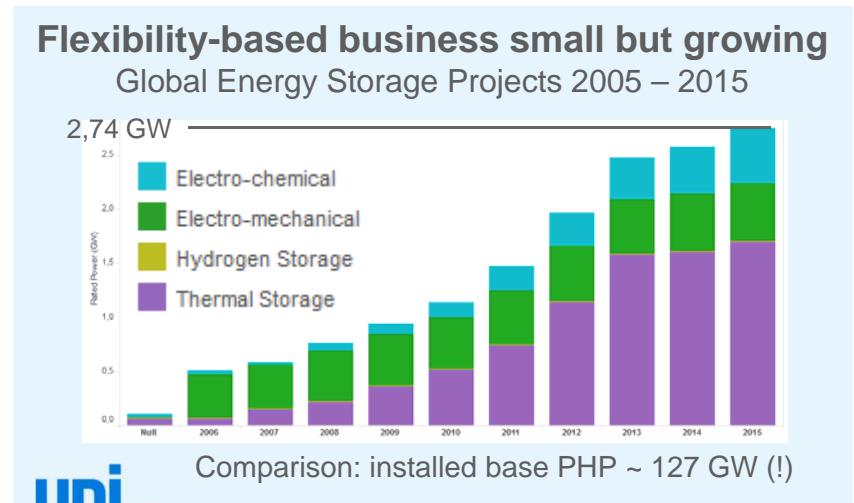
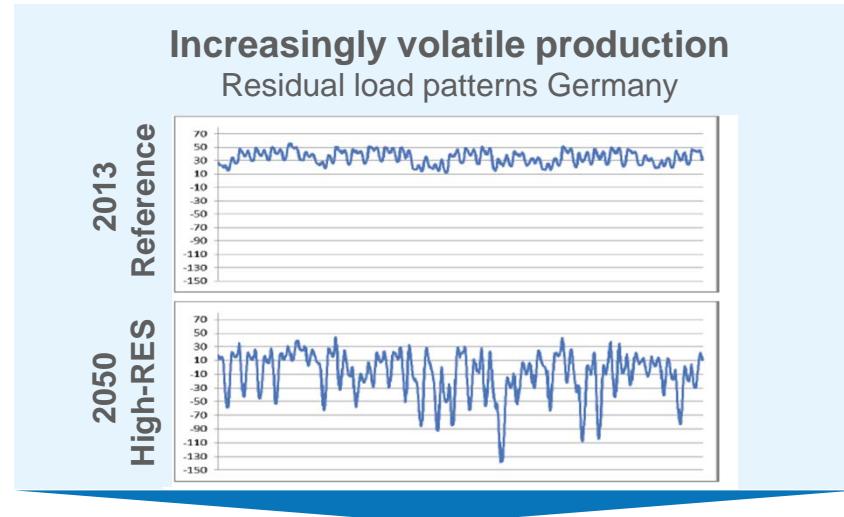
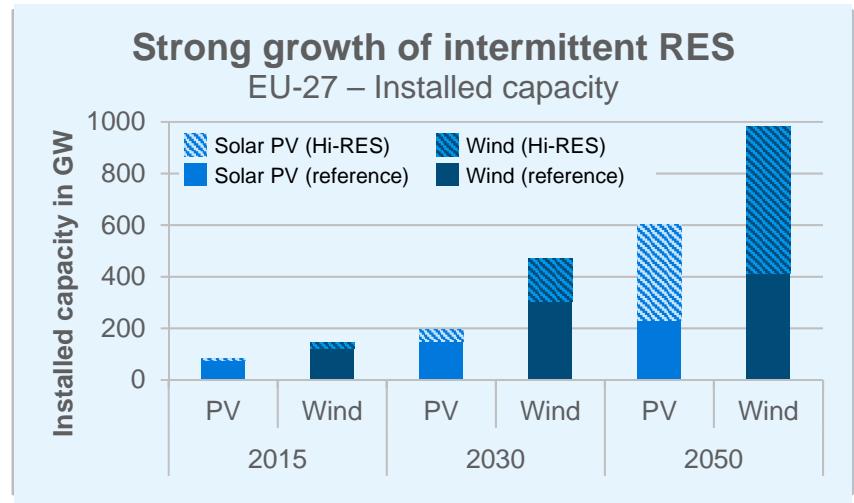
uni per

Windgas
an important contribution to the
„Energiewende“

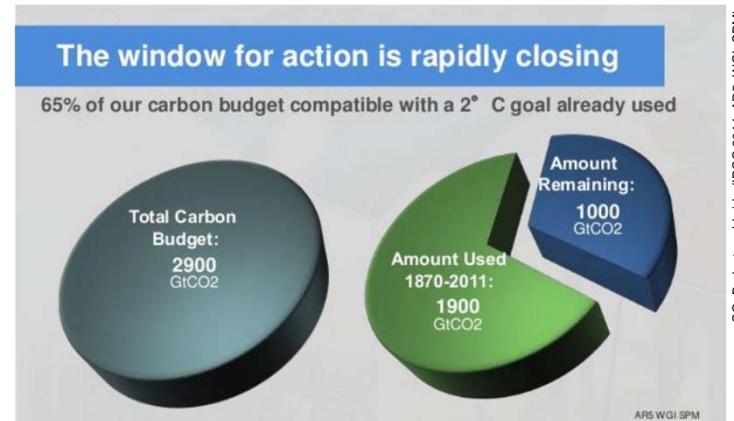
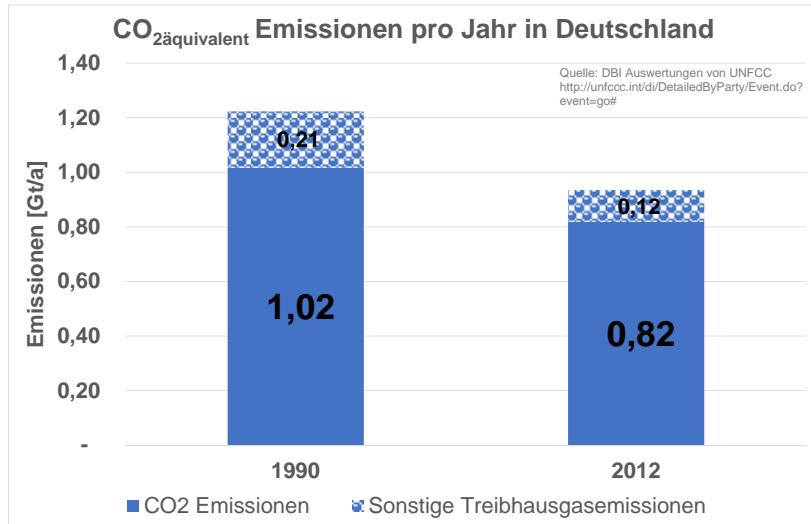
Helge Föcker, Uniper Energy Storage
Berlin, 29. Juni 2018



Trend (1): Growth of Renewable Energy Sources boosts Demand for Flexibility Options



Trend (2): CO₂ Neutrality to be reached till 2050



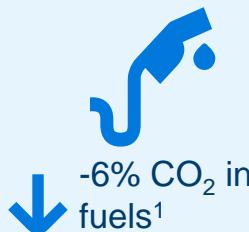
- CO₂ Budget for Germany ([WWF](#) & [WBGU](#) beginning 2015)
 - [1,5 °C target] 2,34-2,67 Gt_{CO₂}
 - [1,7 °C target] 5,23 Gt_{CO₂}
 - [2 °C target] 9,9 Gt_{CO₂}

Assumption: GER has approx. 1.1% of the world wide CO₂-budget

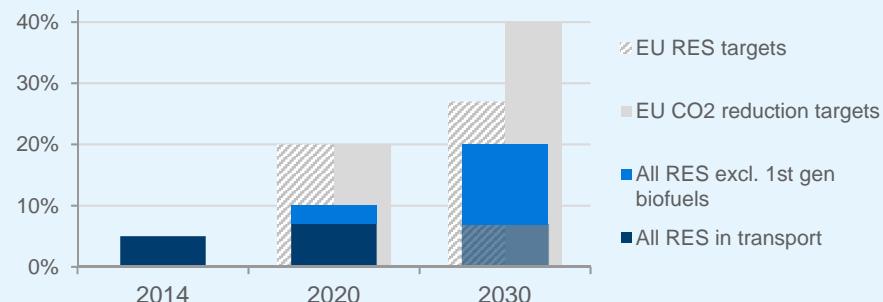
- Paris Agreement - COP21 Limitation of Global warming less than 2°C
- Reduction of Greenhouse Gas CO₂, CH₄, nitrous oxide etc.

Trend (3): Decarbonisation in all industry sectors required incl. transport

EU 2020 Targets



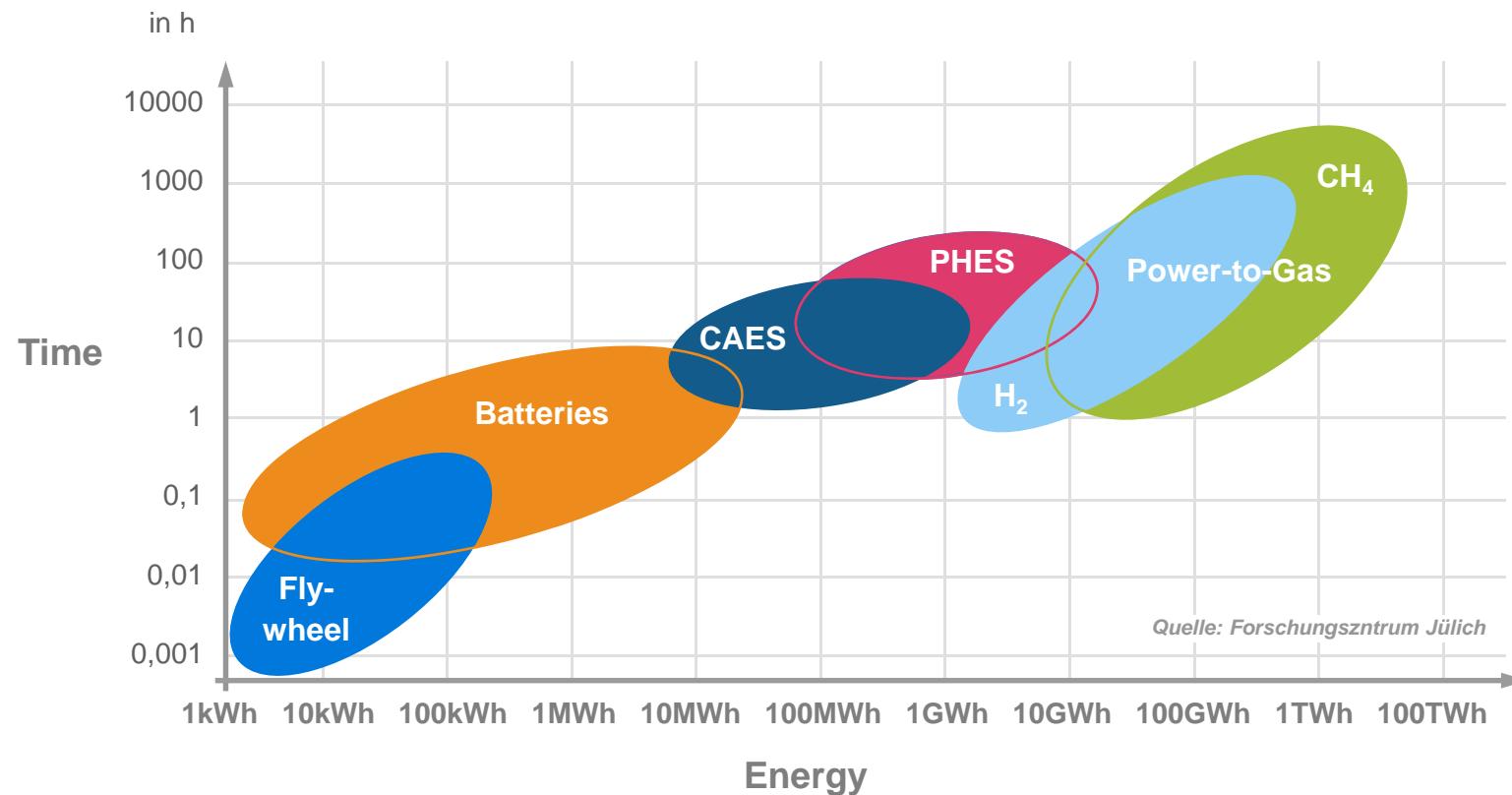
Targets for renewable energy in transport (EU)



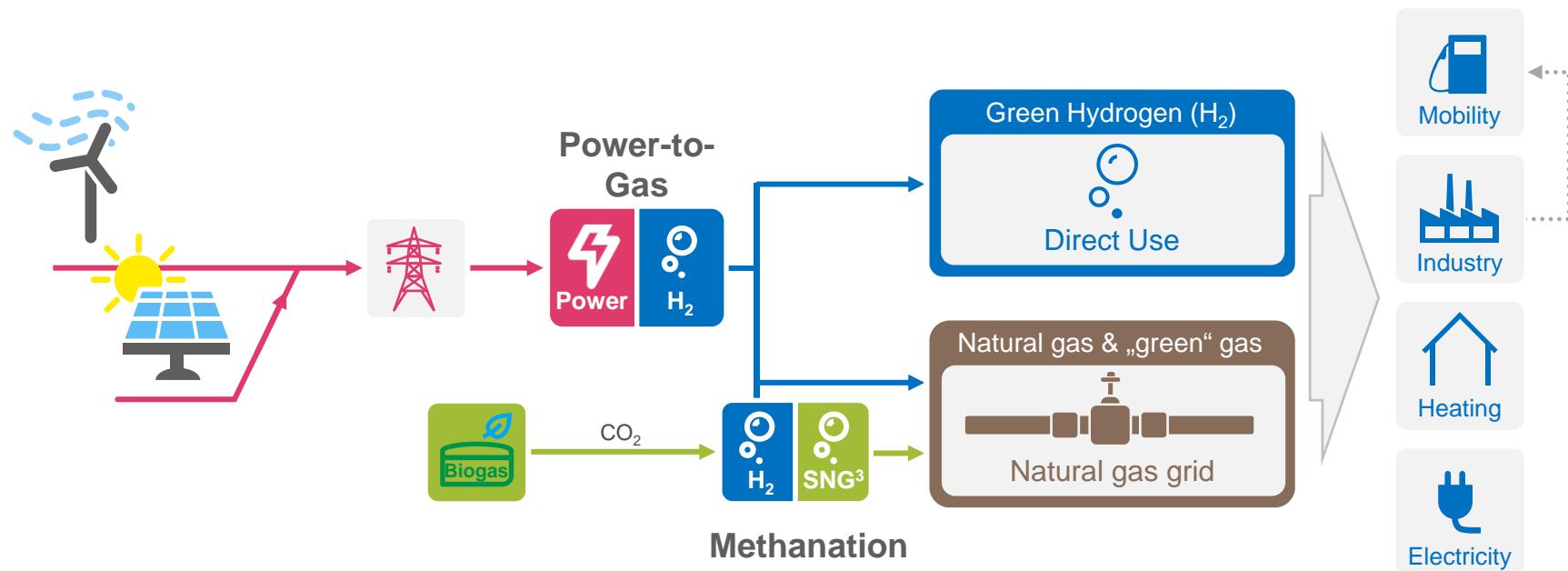
Outlook – Future Regulation?

- Renewable Energy Directive II (under discussion) will promote higher targets for renewables
- Biomass-based biofuels will be reduced and ‚advanced biofuels‘ will be increased
- (Renewable) electricity-based fuels expected to be considered

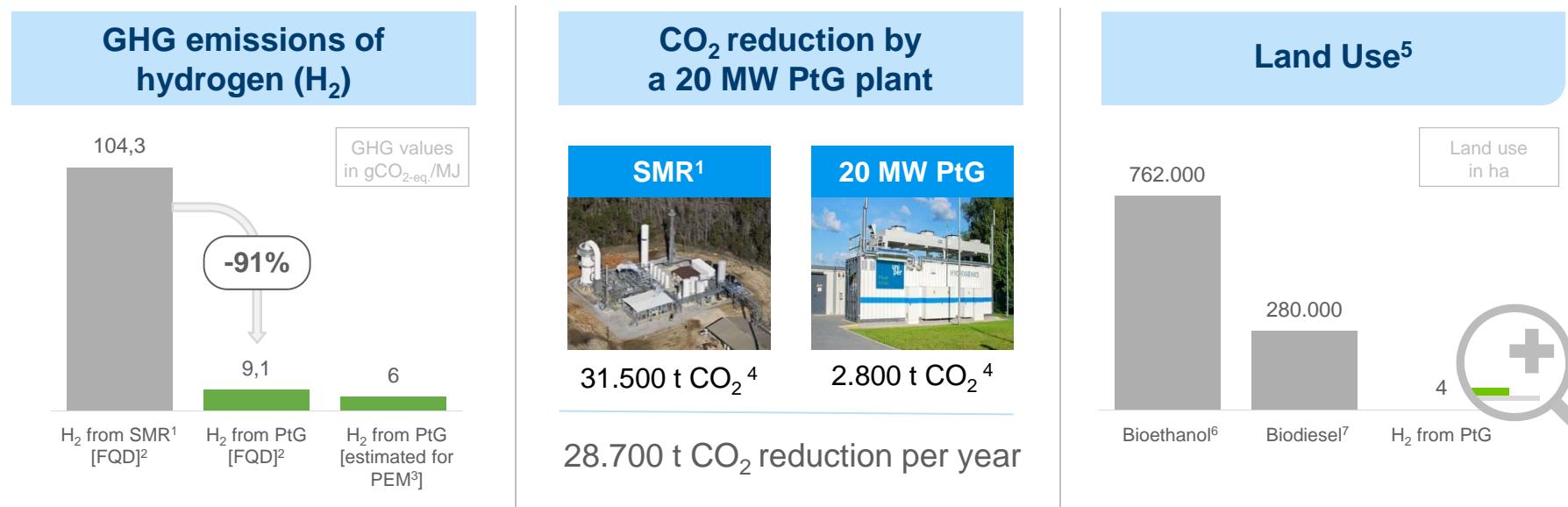
Comparison of various storage technologies: storage of chemical energy has the largest potential



Power-to-Gas supports the integration of renewable energy and connects markets



Green Hydrogen from Power-to-Gas (PtG) can directly lead to significant emission reductions



7

¹ Steam Methane Reforming of Natural Gas - Conventional production process for hydrogen, ² Default value of the life cycle GHG intensity according to Annex I of Council Directive COM (2014) 617 [Fuel Quality Directive - FQD], ³ Proton Exchange Membrane, ⁴ Total emission for the production of 3,43 Mio. Nm³ H₂/a calculated with FQD standard values. 20 MW PtG plant with 80% availability, ⁵ Required surface for the production of 0.5 % of final energy consumption of German road transport (= 3.09 x 10⁶ MWh), ⁶ Average land use: Sugar beets 40 GJ/ha = 11.1 MWh/ha, wheat 8.8 GJ / ha = 2.44 MWh / ha, corn 15 GJ / ha = 4.17 MWh / ha, ⁷ Feedstock rape: 1000 kg/ha with 40 MJ/kg = 40 GJ/ha = 11.1 MWh/ha

7

WindGas Falkenhagen

Key Parameters

- Power: **2 MW_{el}**
- Hydrogen Production **360 Nm³/h**
- Technology: **Alkaline electrolysis**
- **Fed into the gas grid** of ONTRAS Gastransport

Goals

- **Demonstration of the process chain**
- Optimization of operational concept (fluctuating wind power/gas feed)
- Gain experience in technology, costs, permitting, trading

Partner:

SWISSGAS +G



WindGas Falkenhagen

Installation of Methanation plant

Key Parameters

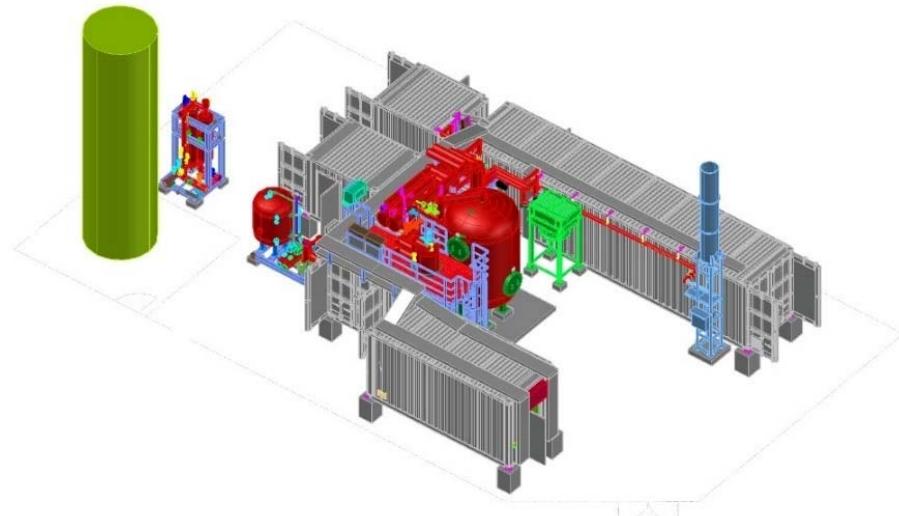
- Input: Renewable hydrogen **210 m³/h**
Biogenic CO₂: **52,5 m³/h** (external supply)
- SNG¹ production: **57 m³/h** (catalytic)
- **Injection of SNG into natural gas grid** (ONTRAS)
- Start of operation: March 2018

Goals

- **Testing new methanation technologies**
- Gain experience in technology, operation and permitting
- Assessment of economic and business aspects and analyze the large-scale storage and market-uptake potential of the technology

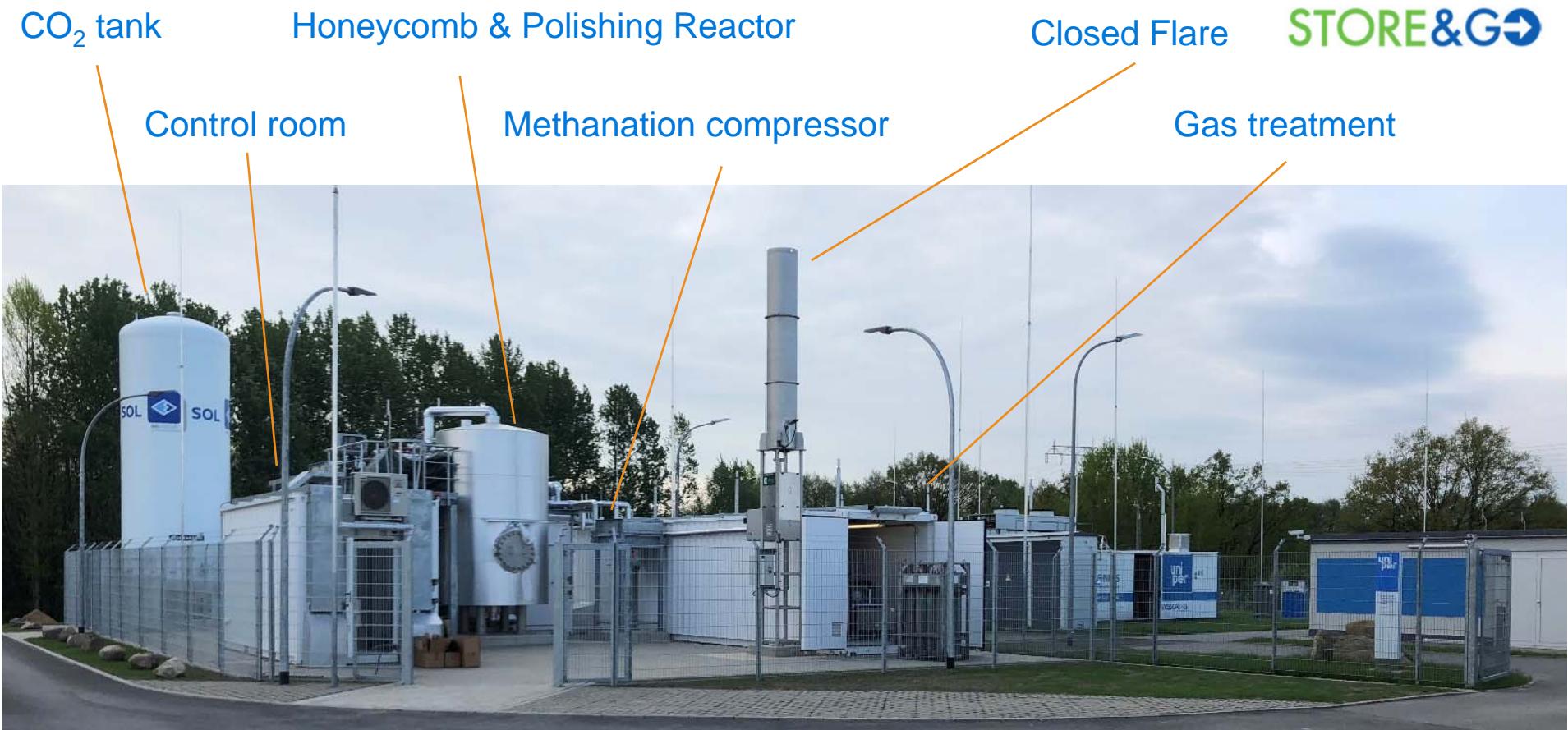
STORE&GO

- Horizon 2020 funding (EU)
- Consortium: 27 partners from 6 European countries
- 3 pilot sites: Falkenhagen (Germany), Solothurn (Switzerland), Troia (Italy)
- Duration: 48 months
- www.storeandgo.info



WindGas Falkenhagen

Installation of Methanation plant



WindGas Hamburg

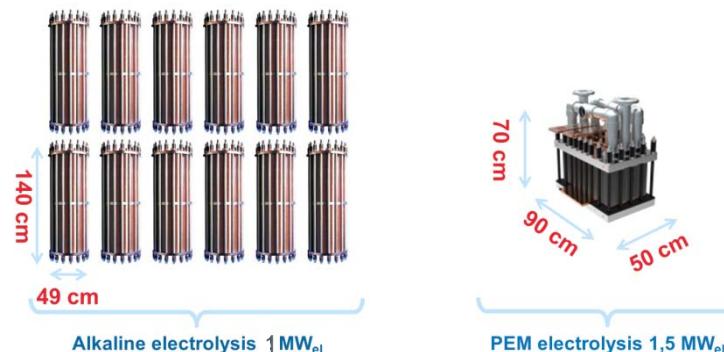
Key Parameters

- **Max. Power: 1,5 MW_{el} (stack)**
- Hydrogen production: 290 m³/h
- Fed into the local distribution gas grid
- Start of operation: 15th Oct 2015
- Public funding from BMVI (ministry of transport)



Goals

- **Utilization of high efficient "Proton Exchange Membrane" electrolysis (PEM)**
- Demonstration within Uniper infrastructure
- Business development



Source: Hydrogenics



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