

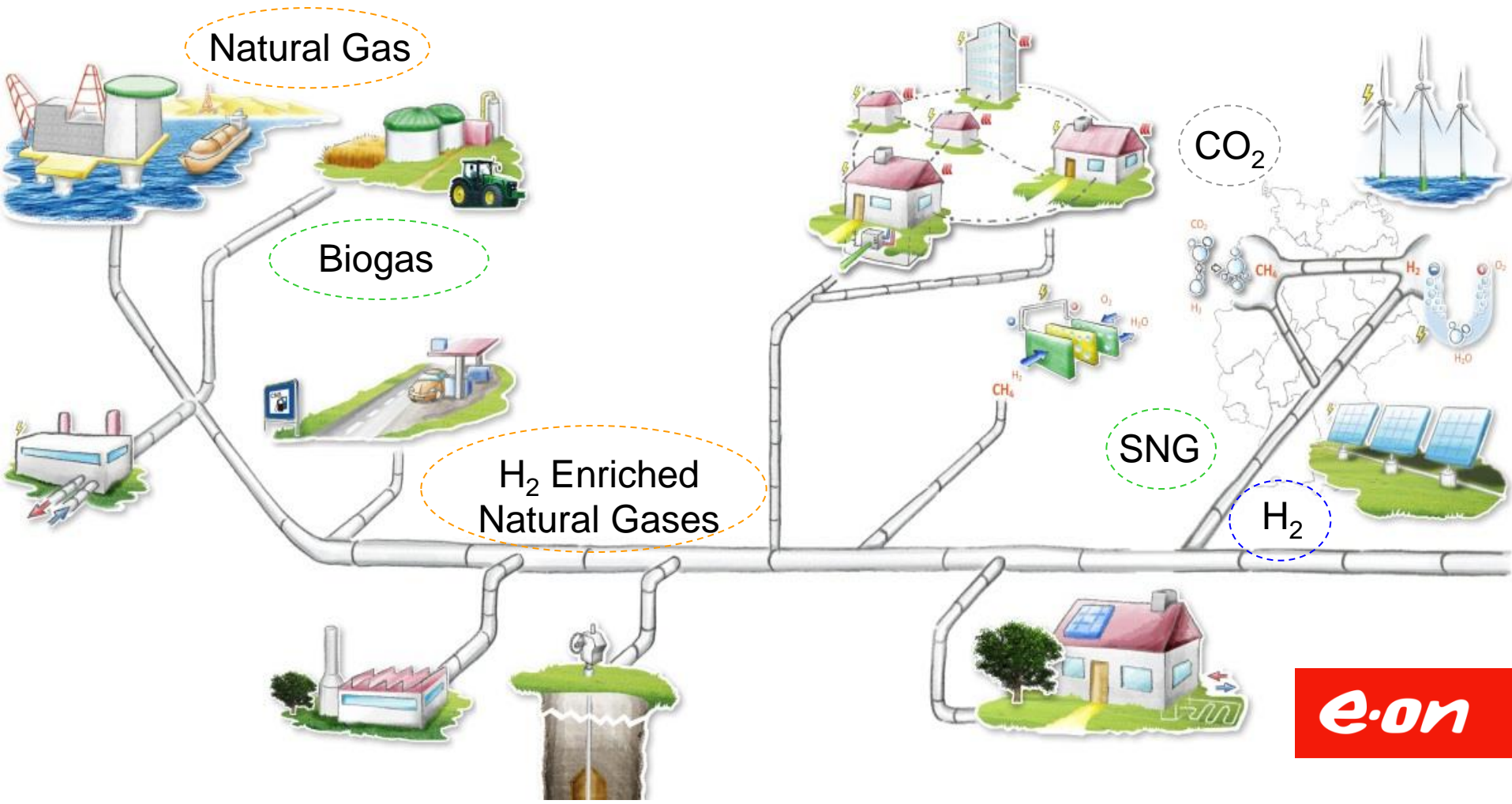


Metering of Gas Flows in Power to Gas Plants

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E.ON Technologies GmbH, *pigsar™
IGRC 2014, Copenhagen, Sept. 17-19, 2014

Quantifying of Flows and Qualities in Gas Grids

- Transmission & distribution of natural gases and renewables gases
- Metering of process parameters for control of gas infrastructures
- Custody transfer and fiscal metering



E.ON's Power to Gas Pilot Plant Falkenhagen

Specifications

- Rated load: 2 MWeI
- H₂ generation: 360 m³/h
- Injection into regional natural gas network
- Commissioning June 10th, 2013



Objectives

- Demonstration of process chain
- Optimisation of operations (wind power fluctuations and injection)
- Utilisation of wind power for H₂ production
- Gain deeper insights into technology, cost & authority approval from the experience



In cooperation with



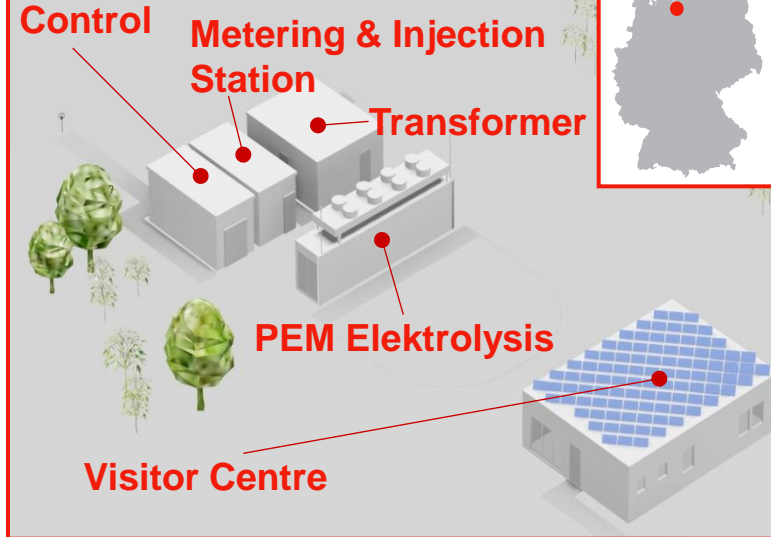
E.ON's Power to Gas Plant Hamburg-Reitbrook



Specifications

- Rated Load: 1 MW_{el} (PEM Stack)
- H₂ generation: 265 m³/h
- Injection into regional natural gas grid
- Commissioning 1st quarter 2015
- Project period: 3 years
- Project costs: 13,5 Mio. €
- Subsidies by German Fed. Governm.

Instrumentation & Control



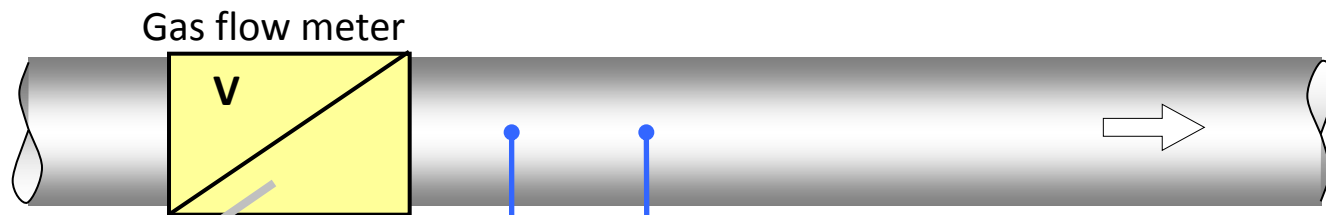
Objectives

- Engineering & operation of next generation electrolysis technology
- Plant integration into E.ON's gas infrastructure, field test and trial
- Developing a business model

Cooperation Partners



Valuation of Injected H₂ Energy Flow (Fiscal Metering)



Gas meter



PTZ correction & data logger

Gas law deviation factor
(compressibility acc. to AGA8-DC92)

$$K = \frac{Z_{H_2}}{Z_n} = f(T, p)$$

Volume conversion
of uncorrected volume to
volume at standard
conditions (PTZ correction)

$$V_n = V_b \cdot \frac{1}{K} \cdot \frac{T_n \cdot p_b}{T_b \cdot p_n}$$

Energy quantity

$$E = V_n \cdot H_{SH_2}$$

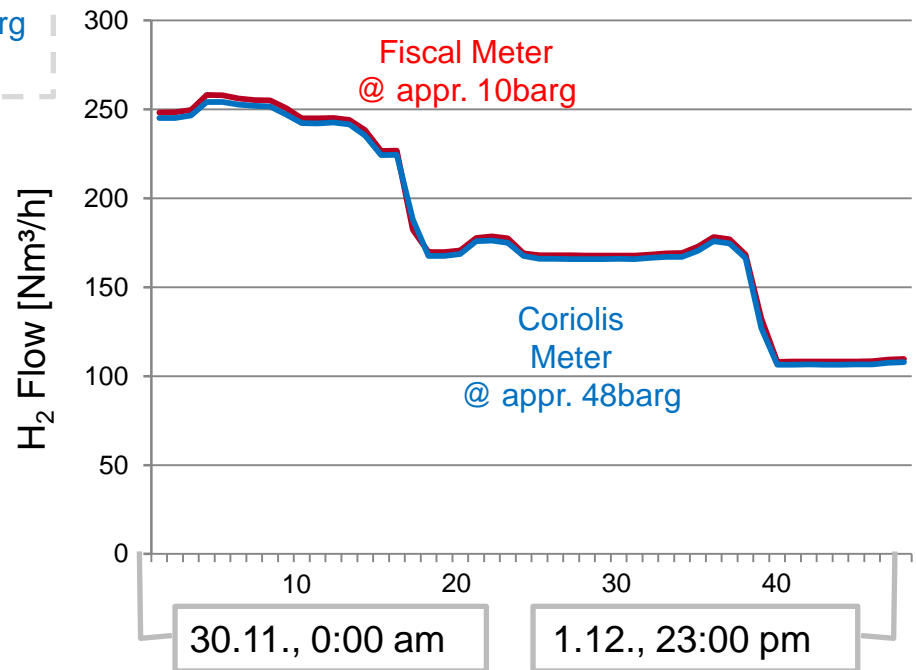
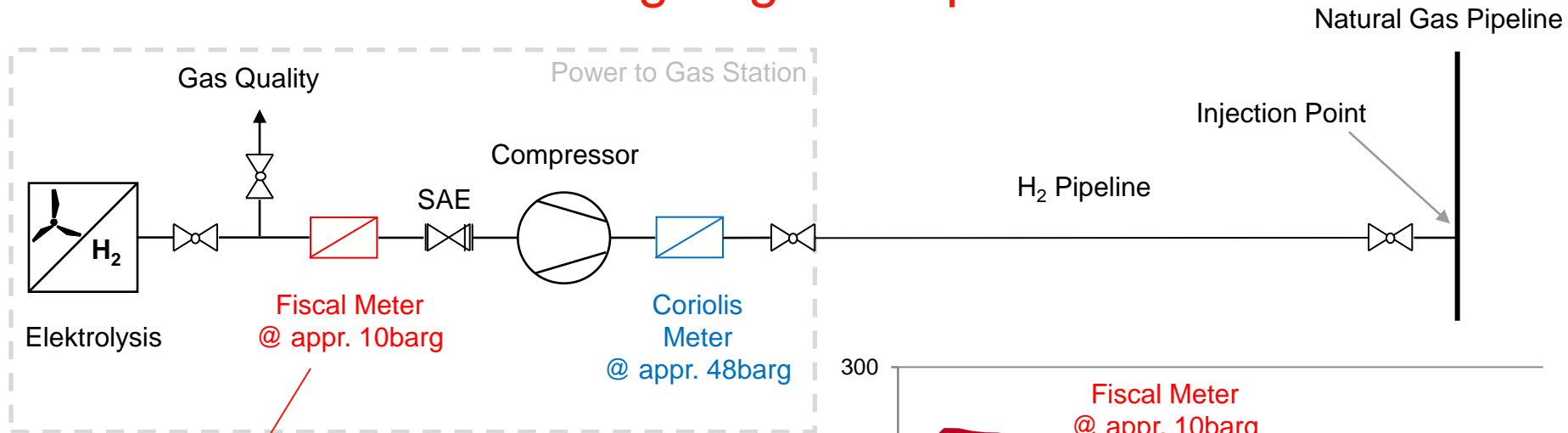
ISO 6976
H₂ calorific value H_{SH2}

Standard conditions: T_n = 0°C; p_n = 1,01325 bar

Image source: RMG



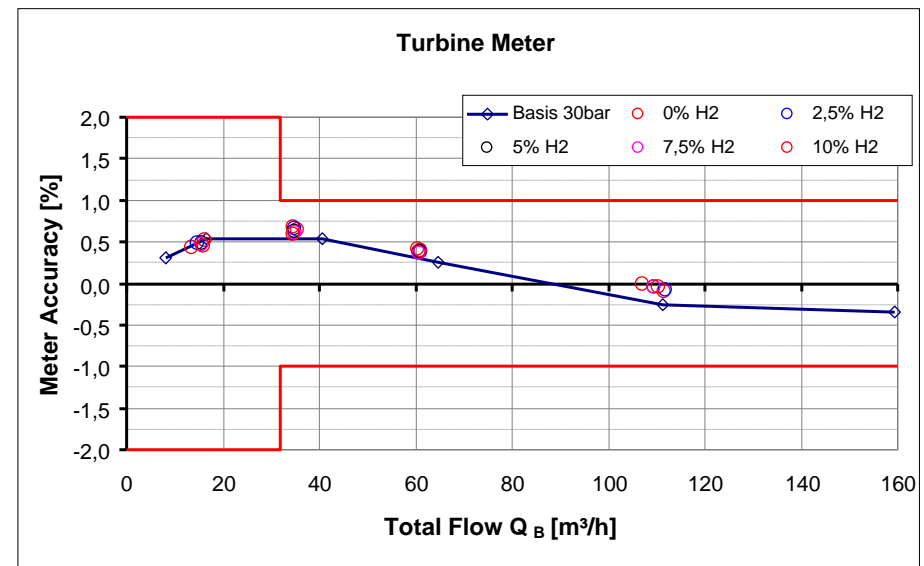
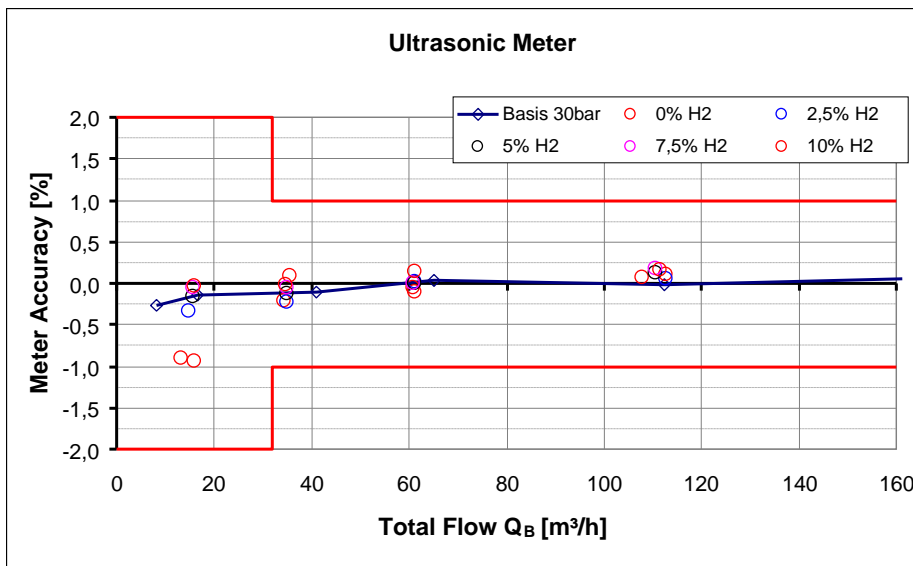
Station Section Monitoring: e.g.: Compressor Unit



- Deployment of commercially available MID meters
- Specification of metering station compliant to network access agreement

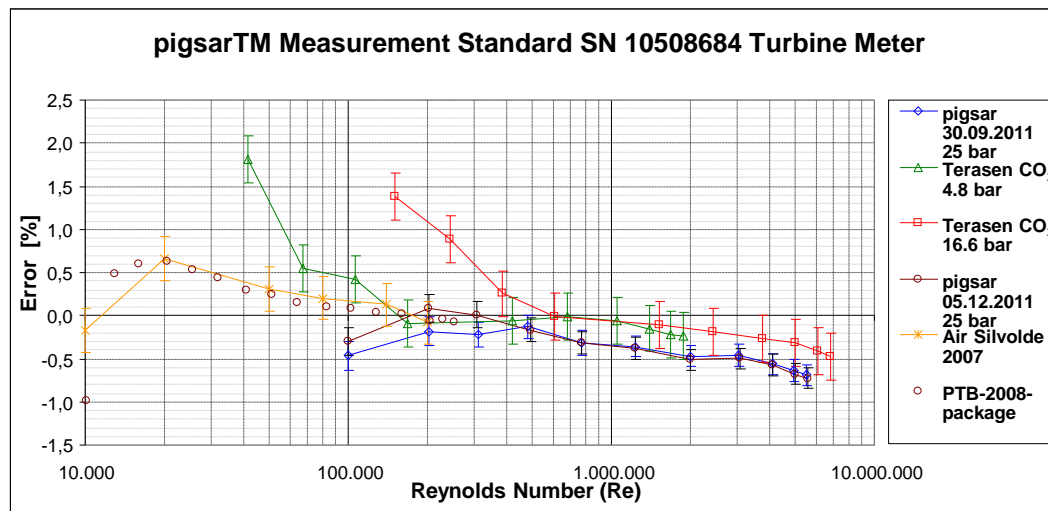
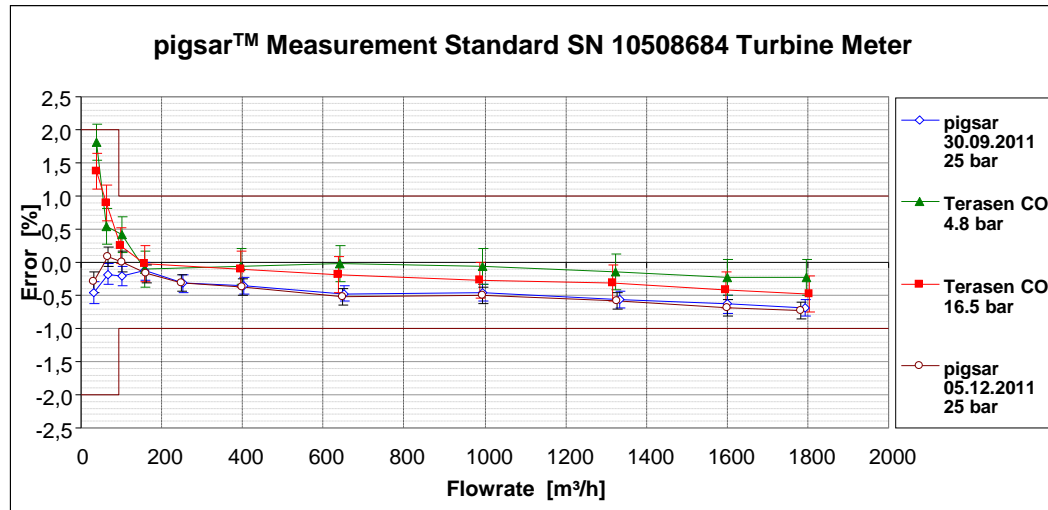
Point of Contact Metering of H₂ Enriched Natural Gases

- Insignificant impact on meter accuracy up to 10% H₂ content
- Process gas chromatographs to determine H₂ content of natural gases commercially available



Metering of CO₂, Natural Gas & Air with a Turbine Meter

- Commercially available natural gas turbine meters can be deployed for metering of gaseous CO₂, natural gas & air flows at high pressures



Metering of Gas Flows in Power to Gas Plants



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The logo for E.ON, featuring the lowercase letters 'e-on' in white on a red rectangular background.