

Elements of a Hydrogen Infrastructure

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H2 und BZ in einem zukünftigen nachhaltigen Energiesystem

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Overview

- Mobile Hydrogen Refuelling Equipment
- Stationary Hydrogen Refuelling Equipment
- Public Filling Stations
- Filling Station Infrastructure
- Questions

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Mobile LH₂ Filling Station, GM Monaco



Mobile 700 bar CGH₂ Filling Station, 2002



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350 bar CGH₂ Private Filling Station, DaimlerChrysler



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CUTE

Amsterdam
Barcelona
Porto
Perth



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The amount of energy that was consumed
by German road traffic in the year 2000

App. 2.313 PJoule

More precise...

2.313.684.186.580.000.000 Joule

...in hydrogen

214.517.085.499 Nm³ H₂

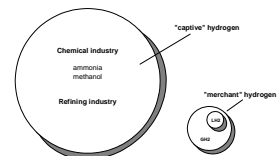
relation

**10x total annual hydrogen
production in Germany (2000)**



H₂ costs at present depend on

- Feedstock (i.e. NG) / Electricity costs
- CGH₂ or LH₂
- Plant capacity, purchased quantity
- H₂ Specs (Pressure, Purity)
- Logistics



Implementation criteria of Hydrogen Infrastructure

- **competitive**

The **costs of the energy carrier hydrogen** must be comparable to the costs of conventional fuels.

The **costs of a hydrogen infrastructure** must be comparable to the invest costs of conventional infrastructure.

- **compact & capable of being integrated**

Hydrogen fillings station must be **capable of being integrated into existing common filling stations.**

That means a hydrogen filling station **must be compact** and must be operable **without additional professional personnel.**

- **universal**

A hydrogen filling station must be universal. That means the hydrogen filling station must be able to deliver **compressed hydrogen (CGH₂)** *and* **liquefied hydrogen (LH₂)**.

- **flexible**

A hydrogen filling station must be **flexibly reactive** with respect to **long-term trends** as well as to **daily fluctuations** of the hydrogen consumption.

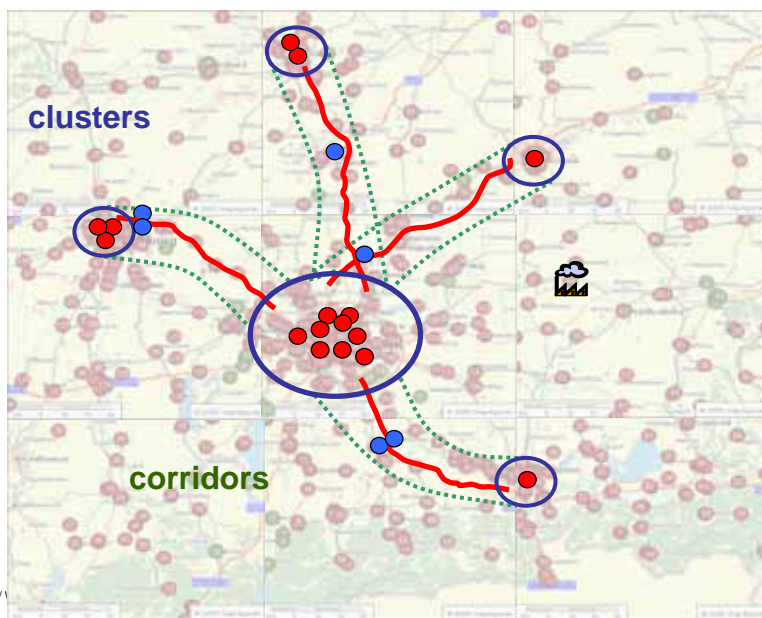
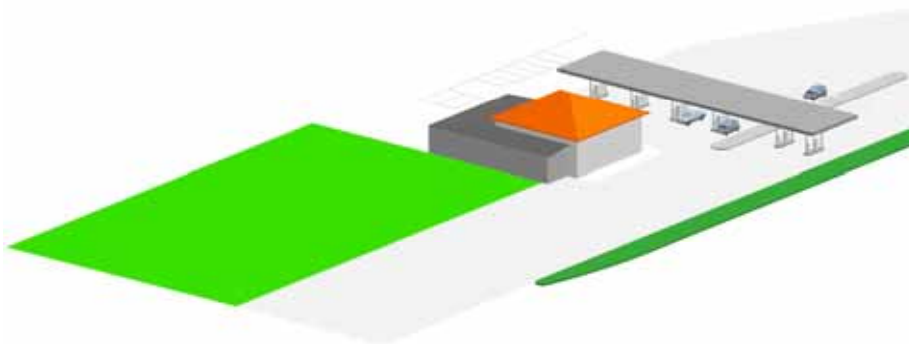
- **compatible**

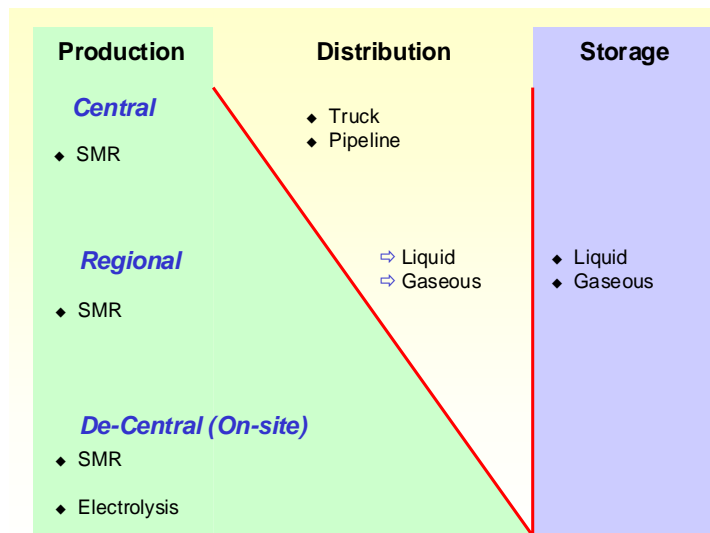
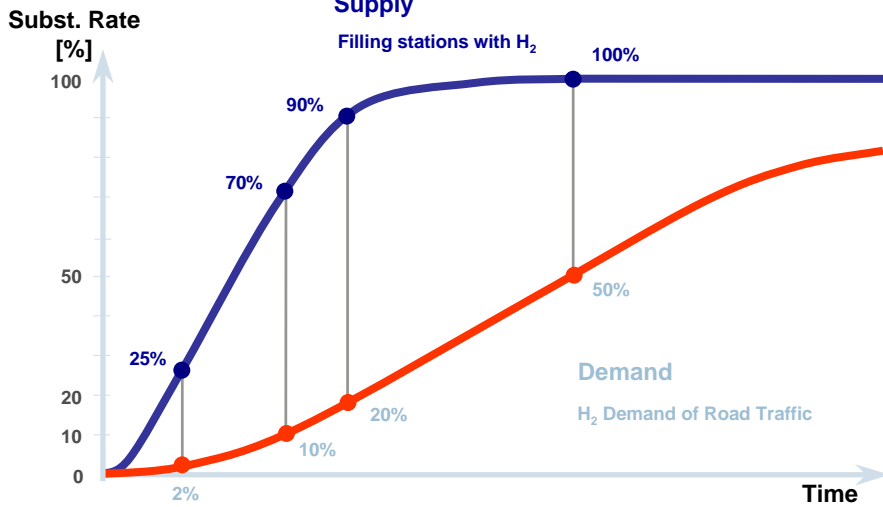
The logistical concept for hydrogen filling stations **must fit to the concept of the mineral oil companies.**

- **forward-looking**

The initial overall concept must ensure a direct and cost saving **transfer from fossil to regenerative generated hydrogen.**

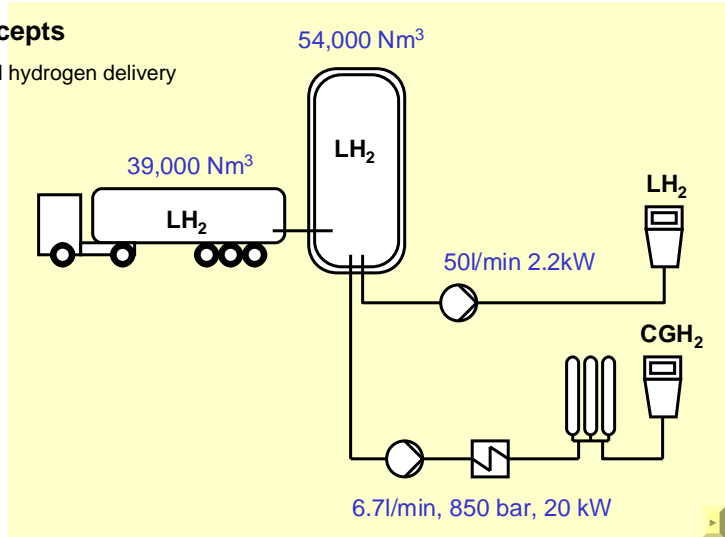
Floor Plan of a present Motorway Filling Station



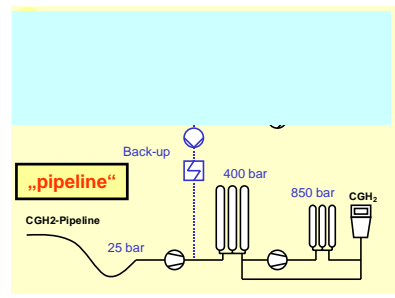
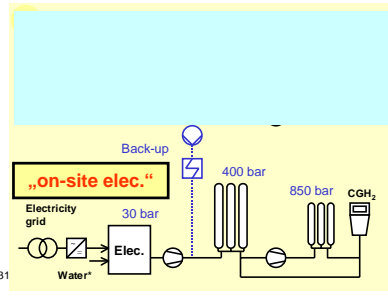
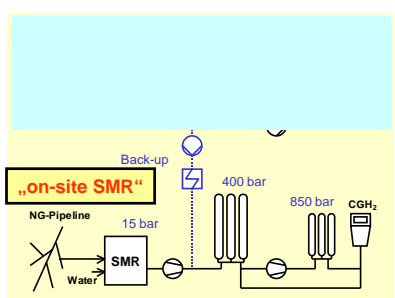
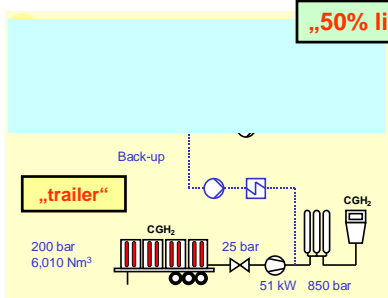


Concepts

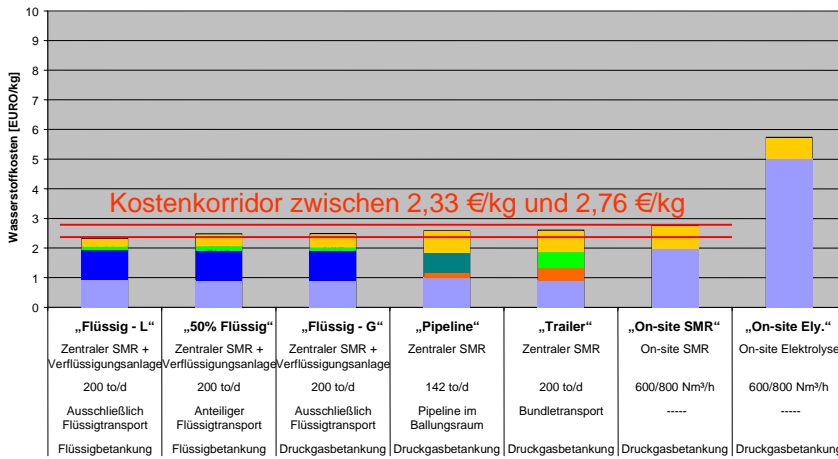
Liquid hydrogen delivery



„50% liquid“

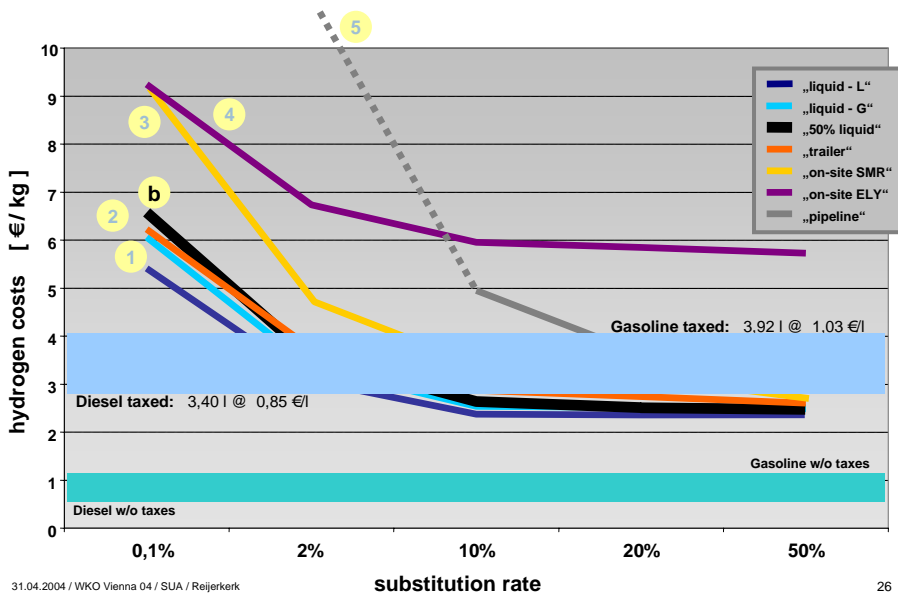


Bereitstellungskosten für Wasserstoff in der Sättigungsphase
 (50% Quote, 12.000 Tankstellen, 42.000 Zapfsäulen, 100% Zapfsäulenauslastungsgrad)

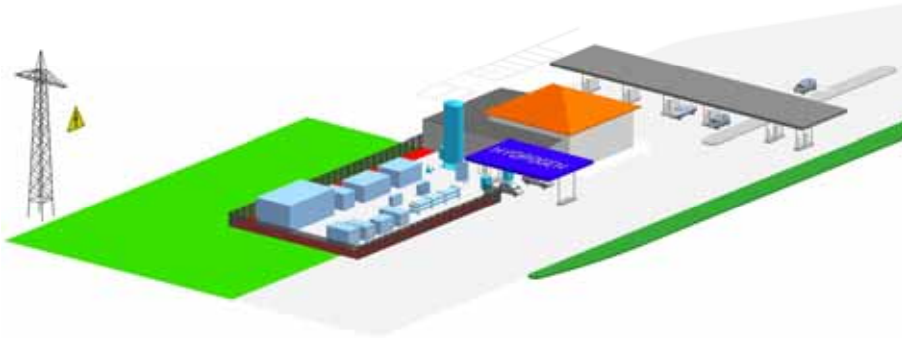


Kostenkomponente: **Herstellung** **Verflüssigung** **Kompression f.d.** **Transport**
 31.04.2004 / WKO Vienna 04 / SUA / Reijerkerk **Straßentransport** **Pipelinetransport** **Betankung** 25

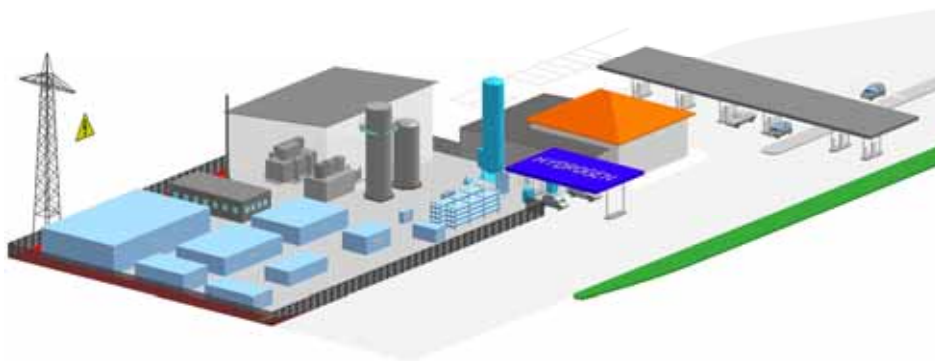
Gesamtkosten, nach Konzepten

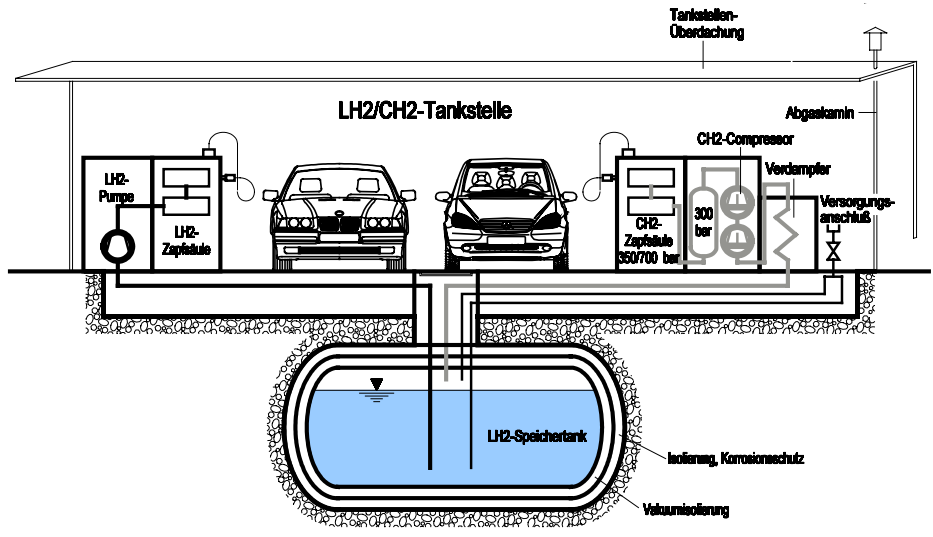


10% Filling Station Capacity and H₂ Electrolyser “on-site”

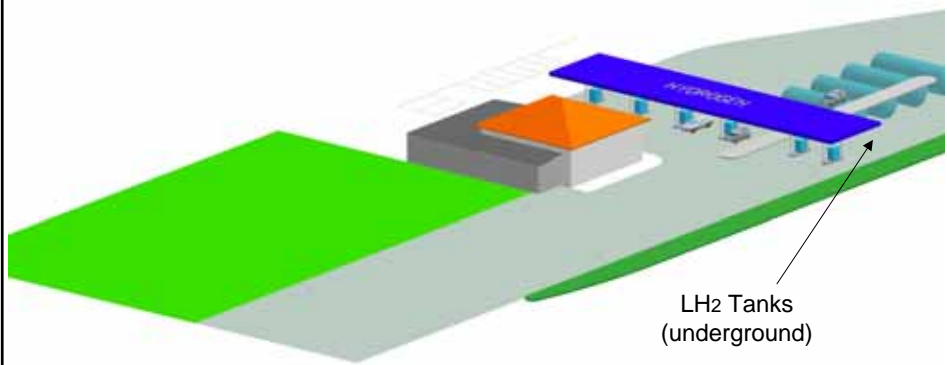


50% Filling Station Capacity Electrolyser and Liquefier





100% Filling Station Capacity LH2 delivery



Questions ?



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