Energy, everywhere.

Repurposing of Gas Grids

February 11th, 2021

GAS CONNECT AUSTRIA

20,000 LEAGUES UNDER THE SEA

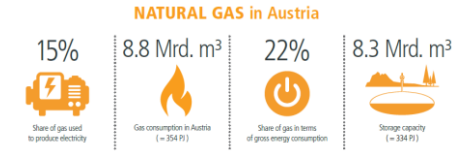
"I believe that water will one day be employed as fuel, that hydrogen and oxygen which constitute it, used singly or together, will furnish an inexhaustible source of heat and light, of an intensity of which coal is not capable."

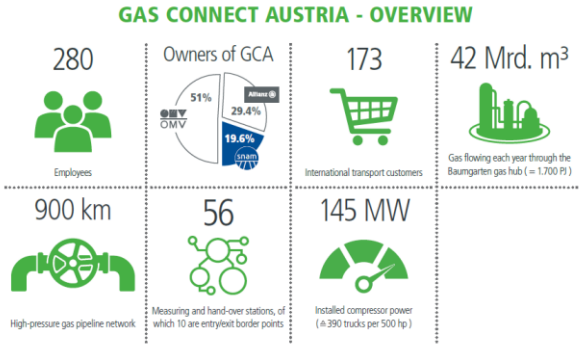
Jules Verne | The Mysterious Island (1874)

GAS CONNECT AUSTRIA

Who is Gas Connect Austria?

- More than **50 years of experience** in gas transport with approx. 280 employees
- Marketing of cross-border entry/exit points
- Sold transport capacity 2020: **143.6 bcm**
- Member of numerous international bodies: ENTSOG, GIE, Hydrogen Europe, European Clean Hydrogen Alliance, European Hydrogen Backbone etc.





GAS CONNECT AUSTRIA

Functions & responsibilities

Cross-border gas transportation

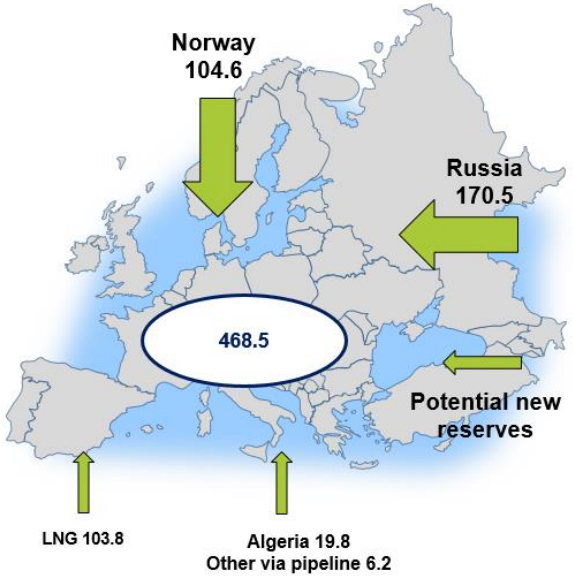
Nationwide gas transportation

Pipeline system operation and maintenance

Network optimisation and development

Subsidiaries & Shareholdings

Gas flow control



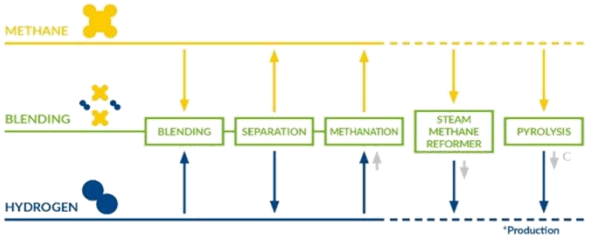
Source: IHS Markit, European Gas Short-Term Demand Outlook; February 2020

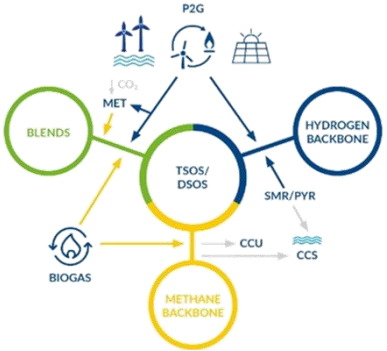
GAS CONNECT AUSTRIA

Role & activities of GCA in international bodies

ENTSOG

1. Tolling model for P2G systems
2. Re-Stream Study
   - Fact-based study on the reuse of existing oil and gas infrastructure for CO_2 and H_2 transport in Europe
   - key characteristics include: Pipeline material & condition, maximum allowable operating pressure, diameter etc.
3. Prime movers' group on Gas Quality & H_2-Handling





GAS CONNECT AUSTRIA

Role & activities of GCA in international bodies

European H_2-Backbone

After the EU published its H_2-strategy, 11 European TSOs presented a plan for their own dedicated pan-European H_2 grid (→ 0,17€/kg/1000 km).

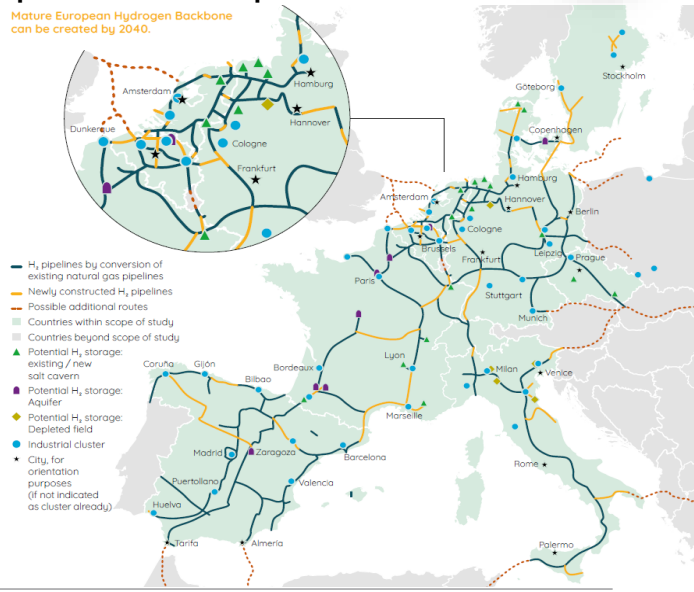
The plan is to create a parallel regulated gas networks: a dedicated hydrogen & a dedicated (bio)methane grid

2030: H_2 grid in clusters (6,800 km)

2035: connected H_2 grid (23,000 km)

2040: pan-Europe H_2 network (75% repurposing of existing pipelines → CAPEX: 64 bn. €)

→ Work is currently underway on a follow-up study
→ update of the last one



GAS CONNECT AUSTRIA

Role & activities of GCA in international bodies

Hydrogen activities in Germany

Cooperation and assessment of the consequences of a German hydrogen network for the border transmission.

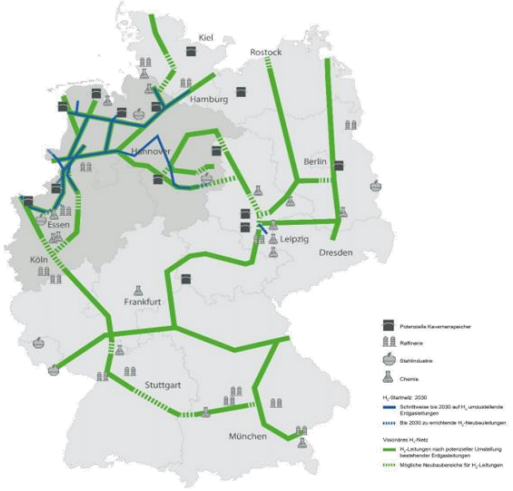
Vision for an H_2 starter network 2030:

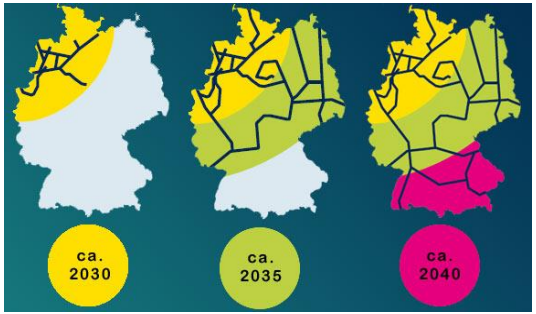
→ 1,200 km H_2 line from:

- 100 km new H_2 pipelines
- 1100 km of rededicated CH_4 pipelines

→ Investments of €660 million by the end of 2030

→ resulting in a moderate increase in transmission system tariffs of less than 1% in 2031.





GAS CONNECT AUSTRIA

Role & activities of GCA in national bodies

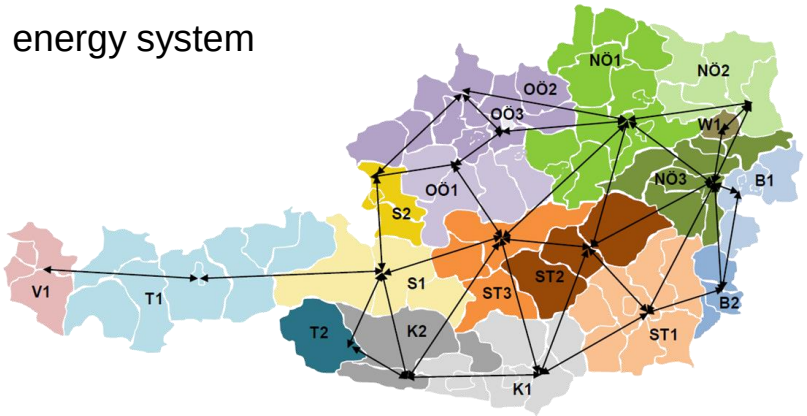
ONE 100 („Österreichs nachhaltiges Energiesystem“)

Austria's sustainable infrastructure for gas & electricity in a climate-neutral Austria 2040

Scope:
Energy system in 2040 → if 100% GHG reduction & climate neutrality → Modelled infrastructure

Method:
Simultaneous optimisation of the sector-coupled overall energy system
→ for all energy sources & value chain
→ taking into account natural potentials

Output:
Per region: capacity per energy source for
- Production
- Conversion
- storage
- Consumption



GAS CONNECT AUSTRIA

Role & activities of GCA in national bodies

AGGM: H_2 Readiness

Objective horizon of the study is short to medium term consideration:

- **Minimising the risk for H_2 feeders** through gas flow control (concepts for stable H_2 content)
- **Identification** of optimal H_2 feed-in locations
- **H_2 compatibility** of existing infrastructure
- **Investment requirements** for the realisation of the respective H_2 share
- **Time horizon** for the realisation of the respective H_2 share

Role & activities of GCA in national bodies

Hydrogen activities in Austria

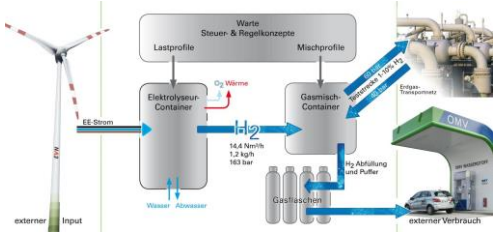
1. **Hydrogen Strategy for Austria** of the BMK (draft):
   - 200 MW electrolysis capacity by 2025
   - 2 GW electrolysis capacity by 2030

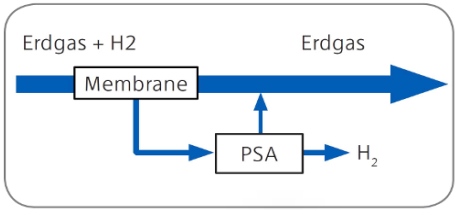
   } → gas consumption to be carbon-neutral by 2040
   → feeding 5 TWh of green gas into the gas grid by 2030
2. **Austrian Association for the Gas & Water Industry:** Compendium H_2 in gas distribution networks (not completed)
3. **Austrian Association for the Gas & Water Industry - G 31:** Increasing the H_2 share in the gas grid (under discussion)
4. **Association of Gas & Heat Supply Companies**: Position development, lobbying & regulation
5. **TYNDP** scenarios show hydrogen production for Austria
6. **Austrian hydrogen cluster** of the BMDW (under development)
7. **Hydrogen** anchored in the **Renewable Energy Act** (draft)

GAS CONNECT AUSTRIA

Activities of GCA

- → GCA has been working on the conversion of renewable energy into H_2 for storage & injection into the gas infrastructure incl. deblending of high purity H_2 since 2014 via projects such as **Wind2Hy** and **HylyPure**.
- → These 2 coordinated projects formed the cornerstone for the further proceeding of the **GCA DBI study** on the H_2 conversion of the GCA grid:
  - → Phase 1: **Metastudy** incl. component assessment for 10%, 25% & 100% H_2 - completed Dec 2019.
  - → Phase 2: **Implementation plan** for higher H_2 shares (10% H_2 by 2024 and 25% H_2 by approx. 2030) - completed 2020.





GAS CONNECT AUSTRIA

Activities of GCA

→ For each reinvestment, the hydrogen-fitness is checked on the basis of our study and only future-fit components are installed.
  - mainly the **connecting elements** & **compressors** have to be replaced due to the different working pressures & the chemical properties of H_2

→ **GCA's long-term goal**: to reserve future freed-up capacity no longer needed for natural gas for H_2 and to establish Baumgarten as a European distribution centre for H_2.

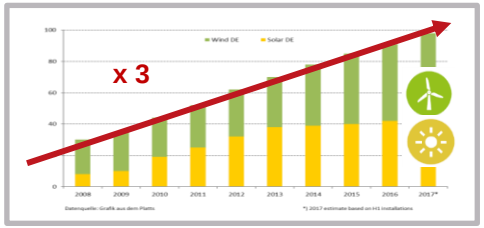
→ Desired, if regulators allow: **GCA as interface** (sector coupler & integrator) between the energy carriers.

Gas infrastructure per se is neither climate-damaging nor fossil, it is part of the solution!

Why is rapid action necessary?

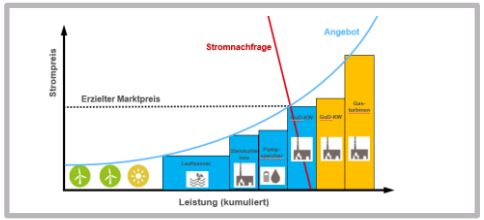
European system transformation happens largely uncoordinated ...

- **Decarbonization requires extensive expansion of renewables**
  (mostly controlled by the government)



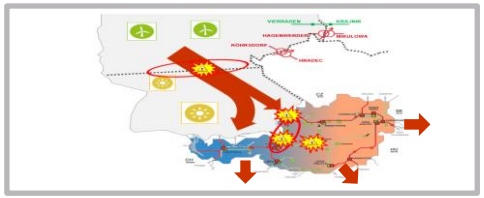
Continued in large parts of Europe

- **Which market design for a single European market?**
  (energy only vs. capacity market, CEP etc.)



In progress

→ **Increasing network bottlenecks in Europe** (need for flexibility options to geographically balance generation and consumption)

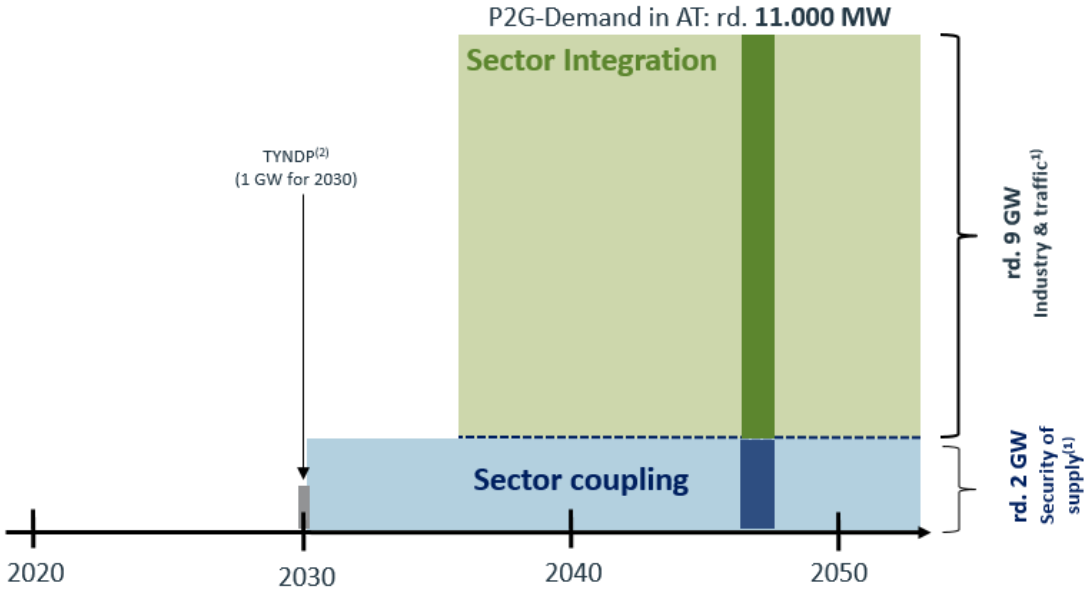


Expansion of power grids urgently required

GAS CONNECT AUSTRIA

Why is rapid action necessary?

Necessary development path of installed P2G-capacity to meet policy requirements:



Quelle:

(1) Endbericht aller Arbeitsgruppen zur österreichischen Wasserstoffstrategie – Empfehlungen der Stakeholder für die Strategieerstellung, 10/2019

(2) TYNDP … Ten Year Network Development Plan der ENTSO-E

GAS CONNECT AUSTRIA

Study: Power2Gas4Austria

- Optimized & cost-efficient use of the electricity & gas grid for long-term electricity storage
- TSOs make P2G plant available to all market players on a non-discriminatory basis and do not own the energy (neither electricity nor gas)
- Concept of a concrete pilot plant - "sector transformer" (design; clarify technical requirements for market test & location → as TSO equipment to ensure SoS)
- Scalable: holistic system approach, can be rolled out to the whole of Austria
- "developing" P2G technology through pilot projects in the regulated sector

This preliminary work for the sandbox project is being carried out in cooperation between APG & GCA

GAS CONNECT AUSTRIA

IPCEI – „H_2EART“

“**H**ydrogen to **E**urope – **A**ustrian **R**egional **T**urntable”

What are we submitting?

1. Conversion of our network for hydrogen transport (blending & backbone).
2. Baumgarten as the future hydrogen hub of Europe
3. Direct lines to major H_2 consumers (e.g. Voest Linz and Donawitz)

Scope:

Backbone infrastructure instead of only backup infrastructure in the future

GAS CONNECT AUSTRIA

What needs to be done?

1. **Blending** - who will organise the switching on of H_2 production in the future if the share in the grid becomes too high? Will there be a statutory ranking (at EU level) on this?
2. **Deblending** - Will there be funding for technology research in this area? Who may be responsible for blending? Financing at the national borders in case of different limits?
3. **Conversion -** How should a conversion or the development of the hydrogen network take place?
4. **Targets -** How are the ambitious targets for hydrogen production, grid efficiency, security of supply and electrolysis capacities to be achieved if gas TSOs are excluded from the market ramp-up at an early stage?

Thank you!

Erich Lugbauer
Chief Technology Officer, CTO

E-Mail: Erich.Lugbauer@gasconnect.at

Peak Vienna
Floridsdorfer Hauptstraße 1
1210 Wien, Vienna, Austria
T +43 1 27500-88000

www.gasconnect.at