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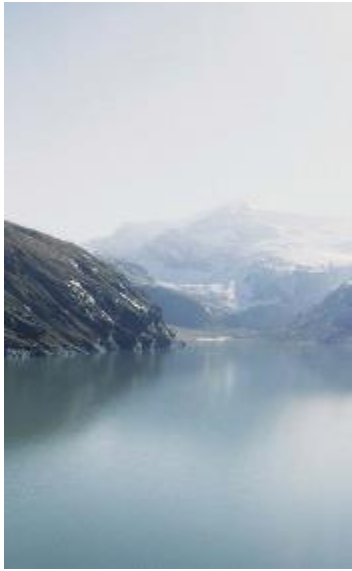
Sectoral integration with transport and industry – Key role for renewable hydrogen

Practical experience and challenges



Fink, Madrid 06.06.2019

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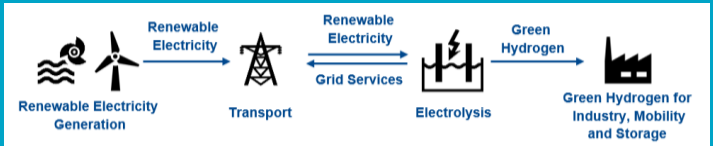
Green Hydrogen@VERBUND: Where do we stand today?

VERBUND is perfectly positioned for green H2

- 95% green electricity → 100%
- 1,800 GWh of pumped storage capacity
- Hydropower for 24/7 renewable energy



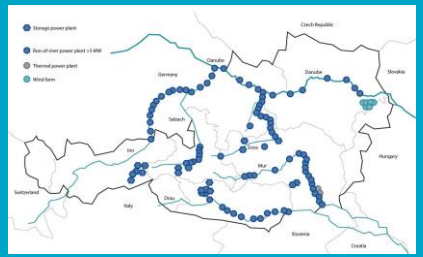
VERBUND focuses on the generation of green hydrogen via electrolysis.

Current focus on **"sectoral integration"**
- in the industrial sector (steel, potentially refineries and other sectors) and
- in the mobility sector (railway, bus, heavy duty)

The injection into the gas grid is currently not a strategic focus of VERBUND, but might become one in the future -> **"sectoral coupling"** (surplus volatile renewable energy).

Future perspective of using **green hydrogen for long-term/seasonal energy storage.**

Early business cases with existing hydroelectric power (24/7 renewable electricity)



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H2FUTURE
Green Hydrogen

FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING

H2FUTURE – Hydrogen for the Steel Industry

Installation and Operation of an Electrolysis System at the Steel Production Site in Linz, Austria


Source: voestalpine

Key Data:
- 6 MW PEM electrolyser
- Start of pilot plant operation in 2019
- Pilot tests and demonstration phase
- Project volume: 17.8 MEUR
  (12 MEUR funding)

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voestalpine
ONE STEP AHEAD.
SIEMENS
K1 MET
metallurgical competence center
APG
AUSTRIAN POWER GRID
TNO innovation for life

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H2FUTURE
Green Hydrogen

FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING

H2FUTURE – Hydrogen for the Steel Industry

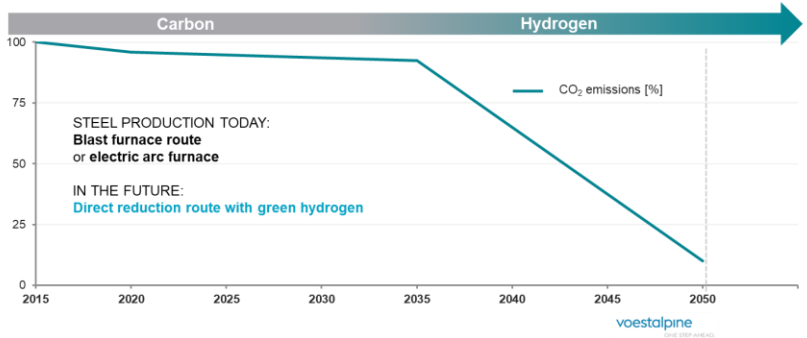
Installation and Operation of an Electrolysis System at the Steel Production Site in Linz, Austria

Current Status

- Approx. 1.7 tonnes of CO2 emissions per tonne of steel.
- Steel industry contributes 30% of global industrial CO2 emissions.
- Replacing carbon with green hydrogen as the reducing agent is the only realistic way to substantially reduce CO2 emissions.

Challenges

- Total replacement of carbon results in a significant increase in production costs.
- Huge demand for green electricity 24/7 in the steel industry.



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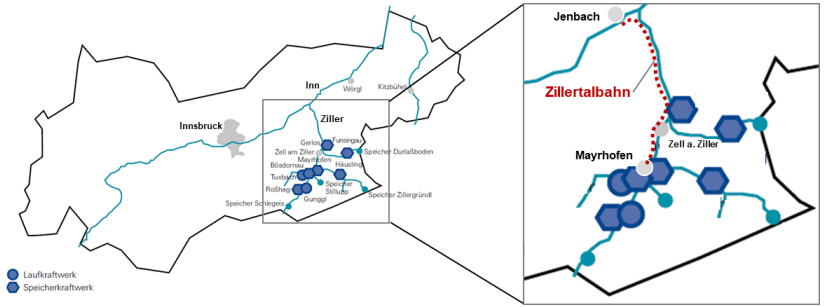
H2Zillertal – „green mobility“

Source: ZVB

- World’s first hydrogen-operated narrow gauge railway in Zillertal valley (https://www.youtube.com/watch?v=A9Bo_Dm_akQ)
- Green hydrogen supply from VERBUND’s local hydroelectric power stations
- Extension to green hydrogen-powered coach and bus service (skiing resort) under evaluation
- Early business case for sectoral integration using green hydrogen



Slogan: “Trains operating on crystal clear water from the Zillertal valley”

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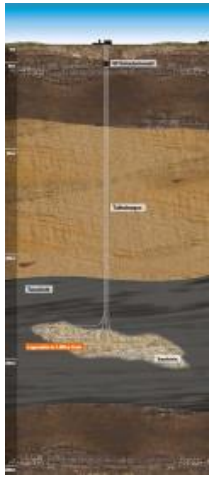
Future perspective – „green energy across sectors“

“Underground Sun Storage” - storability of hydrogen in existing gas storage facilities

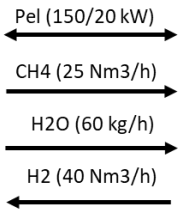
- Potential for inexpensive seasonal storage, huge underground storage capacities currently used for natural gas storage (pore caverns)
- In Austria in 2030: about 10 TWh of renewable electricity need seasonal shift
- Storage cycles with admixtures of up to 10% hydrogen
- Natural conversion H2->CH4 will be further analyzed in follow-up project (Underground Sun Conversion)

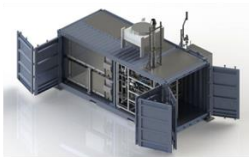
UNDERGROUND SUN.STORAGE



„HotFlex“ - high-temperature electrolysis in combination with a CCGT

- Installation and operation of a pilot plant for SOEC and SOFC at an existing VERBUND gas power plant (commissioning 12/2019)





This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 779481. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme and Hydrogen Europe and N.ERGHY

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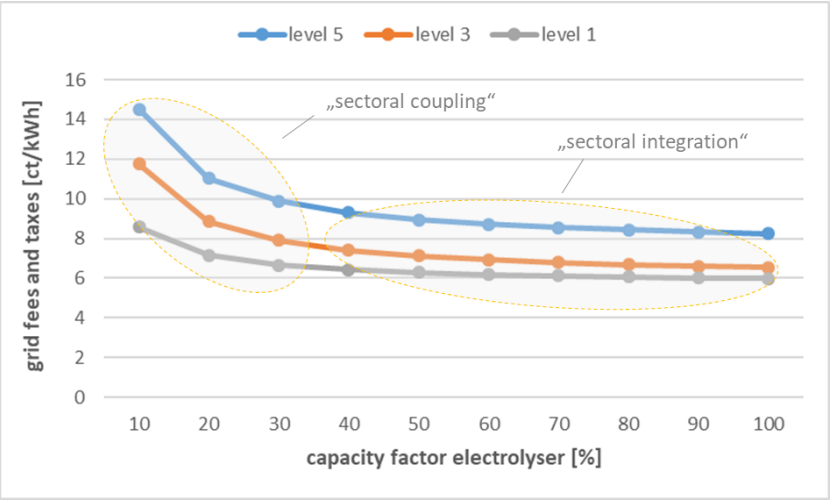
Practical experience and challenges

Techno/Economic

- Energy cost: electricity vs. natural gas price
  (add. carbon leakage for conv. hydrogen)
- Availability/cost of vehicles for mobility sector
- Electrolyser cost
- Limited local renewable hydrogen sources
  (back-up, distribution network)

Regulatory framework / others

- Network and other fees / taxes in the electricity sector
  („energy-end-user“ vs. „energy transformer“)
- Authority approvals



Therefore…

… special framework conditions needed for green hydrogen applications.

… currently limited market potential for green hydrogen.

… regulatory environment complicates the usage of system flexibility for sectoral coupling.

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Encourage Green Hydrogen: Building-blocks for a Regulatory Framework

Truly sustainable technologies

Design the regulatory framework in such a way as to encourage **truly sustainable solutions** such as green hydrogen (carbon avoidance) **rather than end of pipe technologies** such as carbon capture and storage (CCS).

Certification

Green hydrogen certificates can contribute to the creation of additional revenue streams for project owners. **Certificates** should **also** be created **for "off-grid" projects**, which do not feed into the gas grid (in particular in the industrial and mobility sectors).

Scale-up

Scale-up needs to be incentivised, bringing green hydrogen applications out of R&D towards broad implementation. **Funding programmes** and funding of implementation projects need to be continued.

Incentivise storage & conversion technologies

In a fully decarbonised electricity generation scenario, large quantities of renewable electricity might need to be curtailed at peak times. The use of **P2G** and seasonal storage should be **incentivised via the market design**, thus avoiding curtailment.

Unbundling

Conversion technologies (such as P2G) should, as a general principle, be **part of the market** in order to avoid market distortions.

Reform tarification

Create a „coupled" regulatory framework: final consumption **charges only at the point of actual final consumption**, not between sectors (P2G). Currently electricity has to bear significantly higher levies than fossil energy carriers, in particular in heating and transport sectors.

Level playing field for green H2 production

The production of conventional hydrogen is on the carbon leakage list up to 2030 → CO_2 price will not drive decarbonisation → need to **eliminate competitive disadvantage for green hydrogen**, i.e. via certificates or additional support.

Additionality

When creating the „Additionality" framework (REDII), obstacles should be kept at a minimum to allow wider deployment of green hydrogen applications according to Art. 25 to 27 of REDII.

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Contacts

Martin Fink
VERBUND Solutions GmbH
Hydrogen Centre
Mobile: +43 664 828 59 46
martin.fink@verbund.com