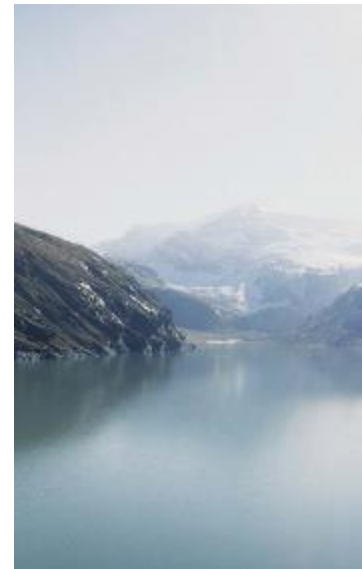


Green Hydrogen @ VERBUND

Overview of Activities & Projects

The Future of Energy, Siemens City Vienna, 27.06.2019



VERBUND at a Glance

~ 96% production from renewable sources

128 hydro power plants – 8,500 MW

Austria's leading electricity company

1,800 GWh of pumped storage

**Austria-wide charging infrastructure
for electric vehicles**

Environmental measures –
€280 million to be invested by 2027

**No. 1 in climate change mitigation
among European power supply companies**

First green bond in German-speaking Europe

Environmental management – ranked in the top 10 out
of 160 energy companies analysed by oekom research

**Market leader in marketing of flexibility and
green electricity in Austria and Germany**

**Quoted on the Vienna Stock Exchange with
excellent compliance culture**



Austria's Climate and Energy Strategy

Austria's climate and energy strategy **#mission 2030**

- **100% renewable electricity by 2030**

EU long-term strategy: **Deep decarbonisation by 2050**



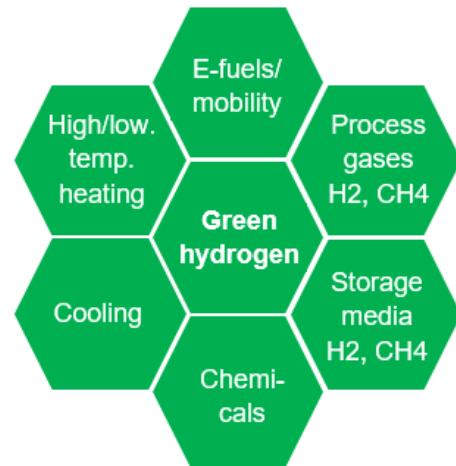
Green hydrogen can be used as a

- process gas
- energy carrier
- storage medium



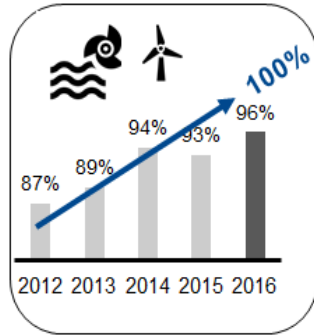
Green hydrogen can

- contribute to the decarbonisation objectives of the EU and its Member States: “Deep decarbonisation” by 2050
- increase the flexibility in the energy system
- provide additional storage options for increasingly renewable and volatile electricity systems (seasonal shifting of energy)



VERBUND: At the Forefront of Green Energy

Green Electricity

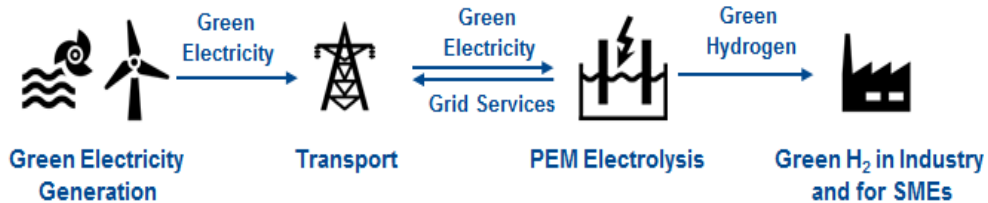


- **21 pumped storage plants** (3,260 MW)
- **693 million m³ storage volume** (1,800 GWh)



- **Trading** in 12 countries (24/7), electricity / gas → 100 TWh per year

Green Hydrogen





H2FUTURE

H2FUTURE – Hydrogen for the Steel Industry



FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING

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 **fulfill the CO₂ reduction targets by 2050.**

Challenges

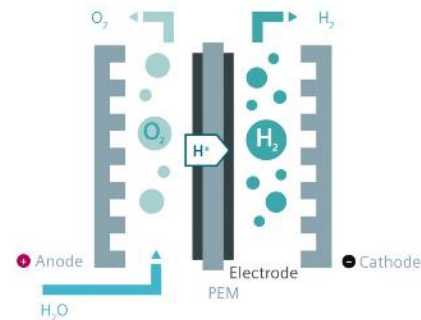
Total **replacement of carbon** results in a significant increase in production costs by up to 80%.

Huge demand for **green electricity 24/7** in the steel industry.

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



FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING



1 cell



50 cells

Key Data

- 6 MW PEM electrolyser
- Start of pilot plant operation in 2019
- Two years of pilot tests and demonstration

Long-Term Goal: Replacing Coal and Coke with Green Hydrogen

- **Design and installation of a 6 MW Siemens PEM electrolyser system** at the voestalpine steel plant in Linz, Austria
- **Industrial integration of renewable hydrogen production** in the steelmaking process
- **Two-year demonstration** of the electrolyser system, including grid services
- Long-term goal of **replacing coal and coke** with green hydrogen

Project budget: €18 million

Total funding: €12 million from FCH JU

Project duration: 4.5 years

Verbund

voestalpine
ONE STEP AHEAD

SIEMENS

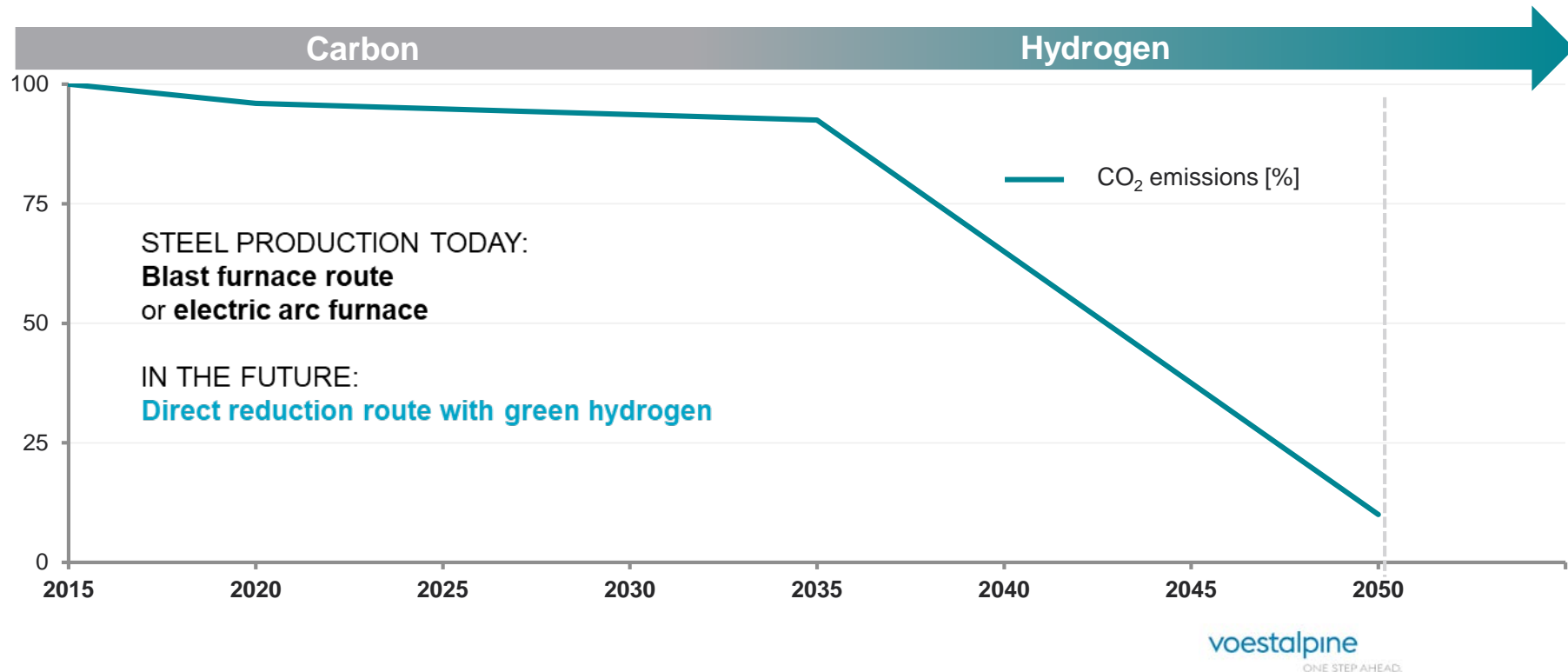
met MET
metallurgical competence center

APG
AUTOMATON POWER GRID

TNO innovation
for life



Scenario for Transformation: Decarbonisation of Steel Maker voestalpine Using Green Hydrogen



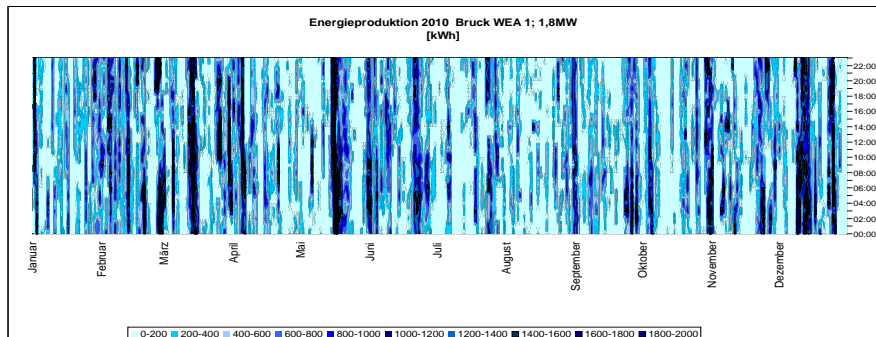


H2FUTURE

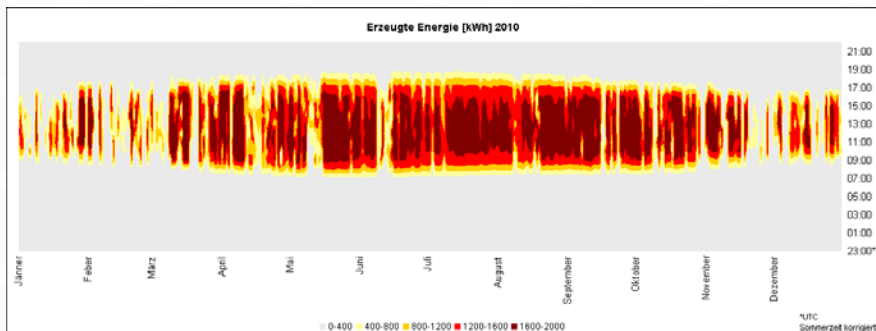
Provision of Ancillary and Grid Services



FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING



Wind



Solar

Prequalification of the PEM
electrolyser for ancillary services



© APG



H2FUTURE

EU Flagship Project



FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING



© BMNT Robert Strasser



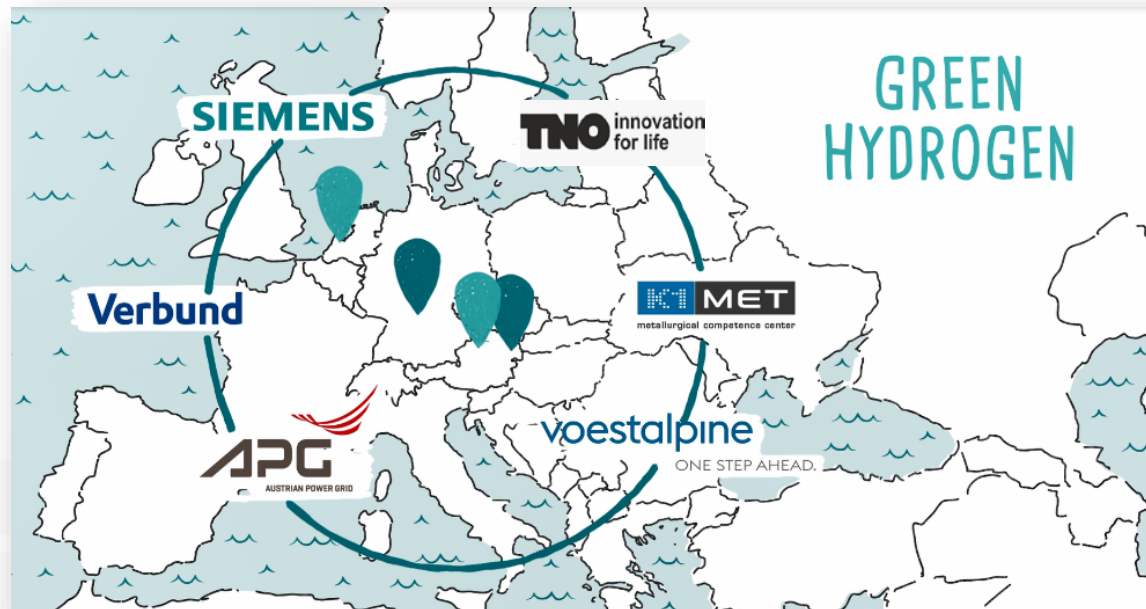
- **Green hydrogen for steel making process** (currently not cost competitive with carbon based steel production) → market pull?
- **Grid services** with electrolyser and revenues from **electricity intraday and spot markets**



H2FUTURE



FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING



<http://www.h2future-project.eu>

Projects in the Industry, Transport and Energy Sectors

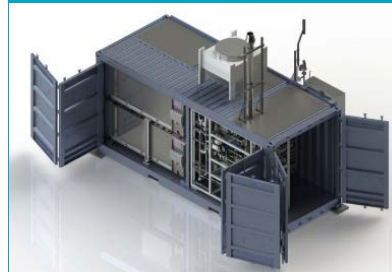


H2FUTURE - Green hydrogen for the **steel industry** and for providing **grid services** – full integration of 6 MW PEM electrolysis on an industrial site. 1,200 m³/h hydrogen
Commissioning in 2019

VERBUND provides green hydrogen for the **rail operator** directly from one of its **hydroelectric power stations**: “Zillertalbahnhof powered by crystal clear water from the Zillertal valley”
Commissioning with winter timetable 2022



Green hydrogen for **mobility and refinery applications** – engineering study UpHy (Vorzeigeregion WIVA P&G, coordinator: OMV)



Operation of a 150 kW **high-temperature electrolyser and fuel cell (SOEC/SOFC) reversible system** on CCGT site of VERBUND
Commissioning in 2019

Opportunities and Challenges for Green Hydrogen

Opportunities

- Reduce Europe's **energy dependence**
- Increase **security of supply**
- Create **local value and jobs**
- Secure Europe's **technological leadership** in hydrogen production technologies
- Solve the **seasonal storage** dilemma
- Use as a building block for **e-fuels or green methane** → use of **existing infrastructure**

Challenges

- **Economic viability**
- Fast deployment and availability of **renewables**
- **International cooperation** essential
- **Infrastructure** and transport
- Development of coherent **regulatory framework**

Hydrogen can play a crucial role in the energy transition

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