H2FUTURE

Experience in certifying renewable Hydrogen via CertifHy

Green Hydrogen for Industry – Regulatory Workshop
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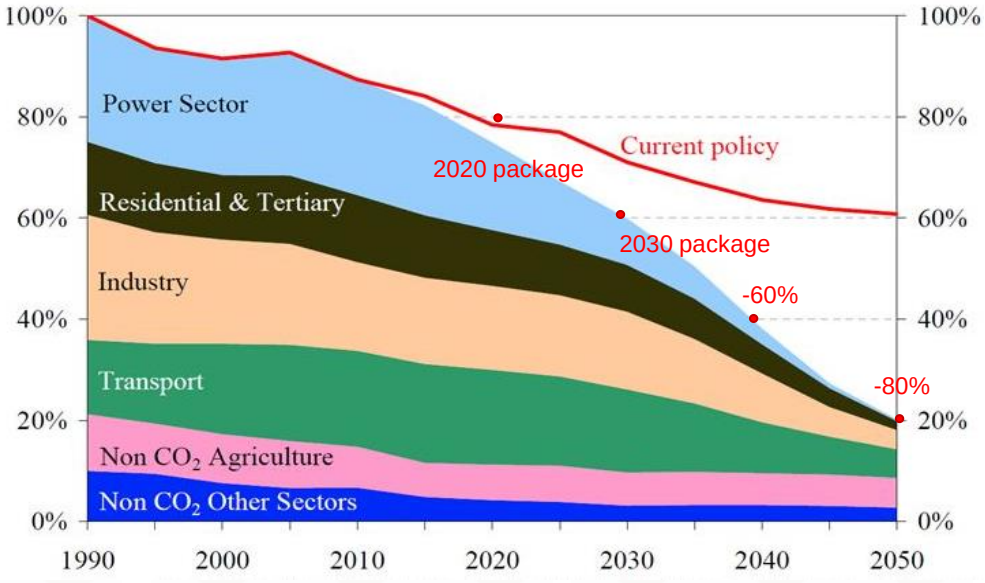
EU 2050 Low Carbon Economy Roadmap
Status of the steel industry



Source: EU https://ec.europa.eu/clima/policies/strategies/2050_en

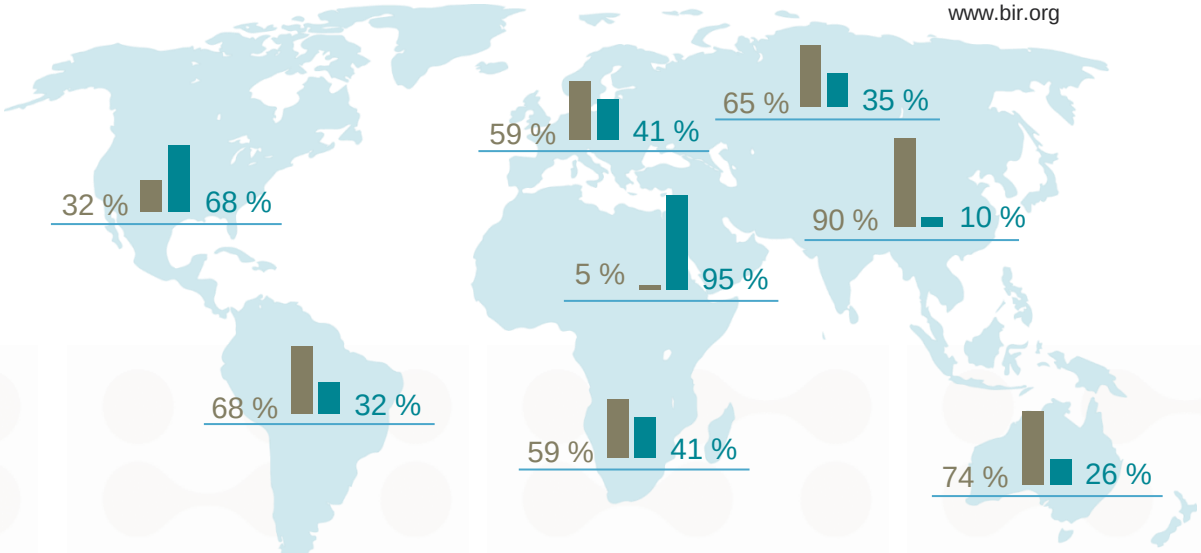
EU low-carbon economy roadmap

- By 2050, the EU should cut greenhouse gas emissions to 80% below 1990 levels
- All sectors need to contribute – **Energy intensive industries** could cut emissions by **more than 80% by 2050**

EU **steel industry committed to** substantial **reduction of** CO_2 **emissions**

- **However: potential of existing** production **routes** (mainly BF/BOF) **limited**
- **Development and implementation** of new breakthrough technologies together with supportive energy infrastructure required

Iron and Steel Making Processes
Global Steel Production

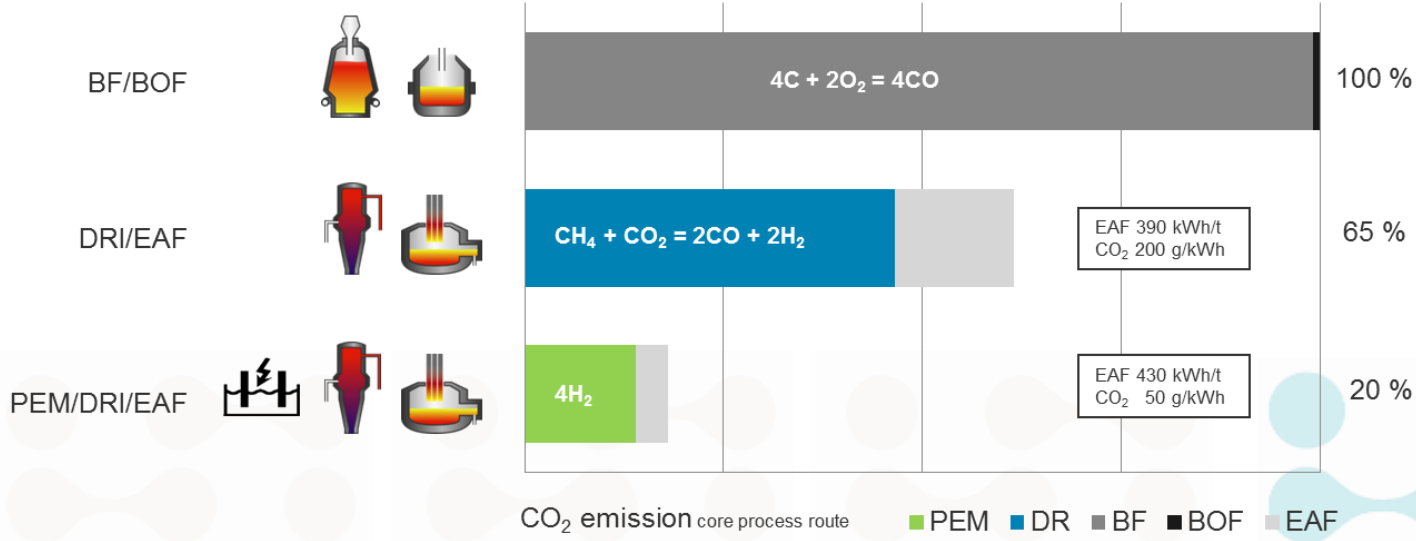


Production share 2019:
72 % BF/BOF route
28 % EAF route (5 % DRI)

Iron and steel industry accounts for approx. 7 % of global anthropogenic and 31 % of industrial CO_2 emissions

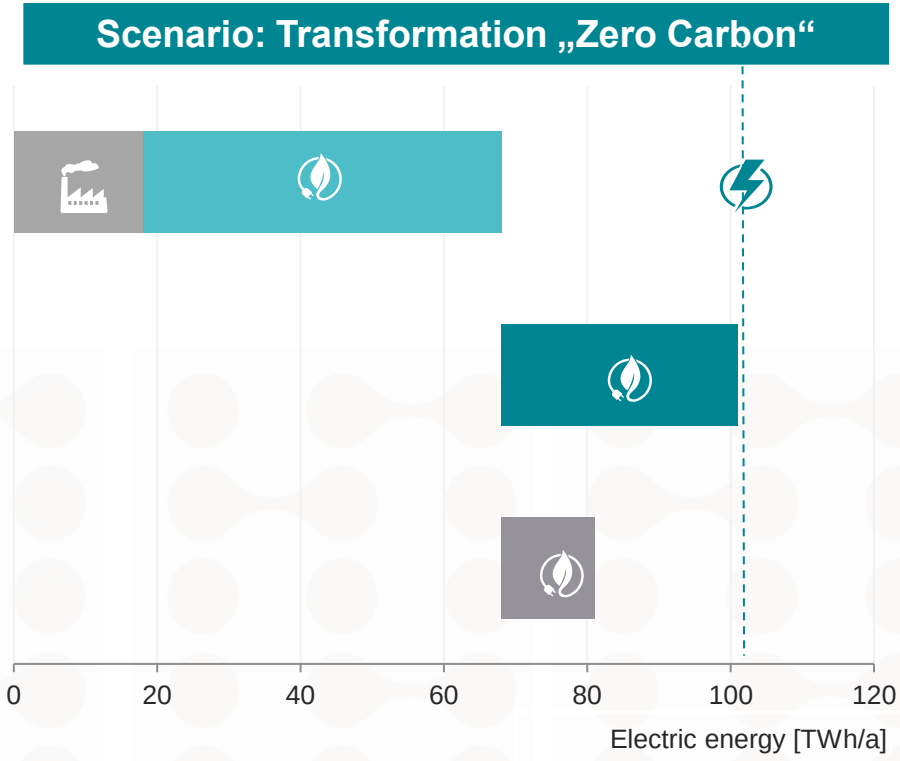
Global steel production: 1.9 billion tons in 2019 (EU 160 million tons)
Two production routes:
Primary steelmaking from iron oxides (BF/BOF route)
Secondary steelmaking from scrap (EAF route)

Iron and Steel Making Processes
Carbon, Natural gas and H2



Iron and steel industry accounts for approx. 7 % of global anthropogenic and 31 % of industrial CO_2 emissions origin and availability of electric energy is essential for renewable H_2 production and use in the DRI/EAF route.

Transformation Scenario
Energy System Austria



fossil renewable total

Existing situation

Electricity production in Austria : 68 TWh/a

voestalpine Linz und Donawitz are almost self-sufficient

Future situation in this scenario

Additional demand on renewable energy: ~ 33 TWh/a

available 8760h/a from external grid

~ 50 % of Austria‘s production

Competition with other sectors - traffic

Changeover of the passenger car fleet to electric drive in Austria requires additional ~13 TWh/a

H2Future - R&D objectives
PEM Electrolysis Technology

Systematic upscaling requires answers of following questions and topics

- Operation of PEM electrolyser
  a. operating range
  b. Efficiency: Influence of dynamic operation, continuous and overload operation
  c. Degradation of PEM due to ageing and poisoning
- Durability considering the mode of operation
  a. Maintenance intensity
  b. Tightness
  c. Corrosion
- Quality of product and input reactant streams
  a. Requirements deionized water
  b. Quality of H_2 and O_2 dependent on operation mode
- Influence of operation time

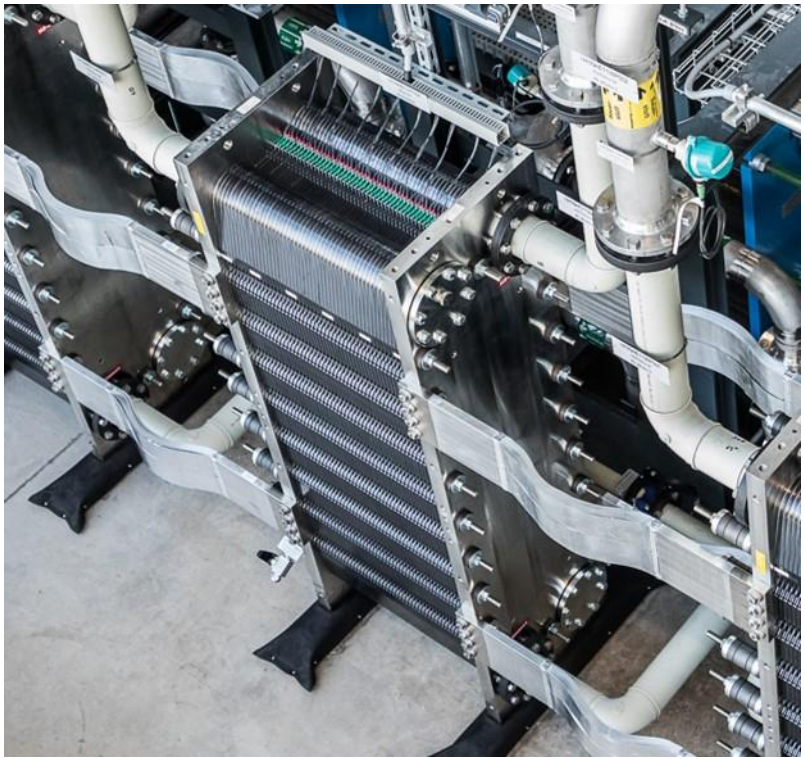
6 MW PEM Electrolyser

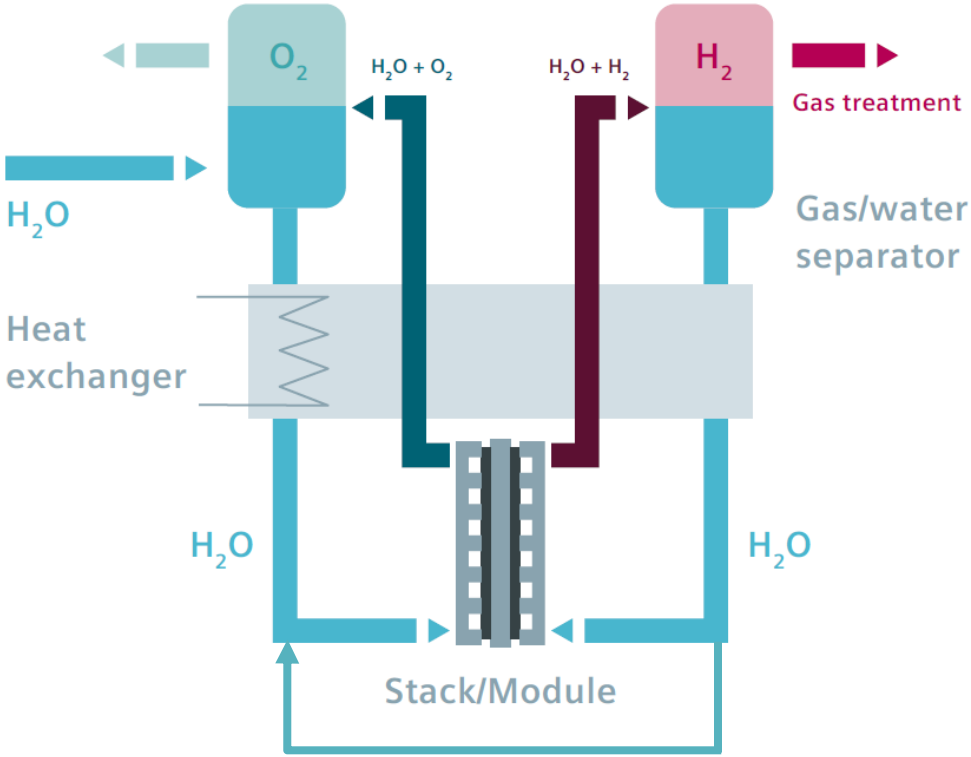
Key data

Rated power	6 MW
Hydrogen	1200 $m^3_{(STP)}$/h
Oxygen	600 $m^3_{(STP)}$/h
Modules	12
Cells	600 (12 x 50)
Current	5000 A
Voltage up to	2 V/cell
Pressure	max. 150 mbar
Purity	up to 99,8 %

Silyzer 300 PEM module

…the heart of each Silyzer PEM array





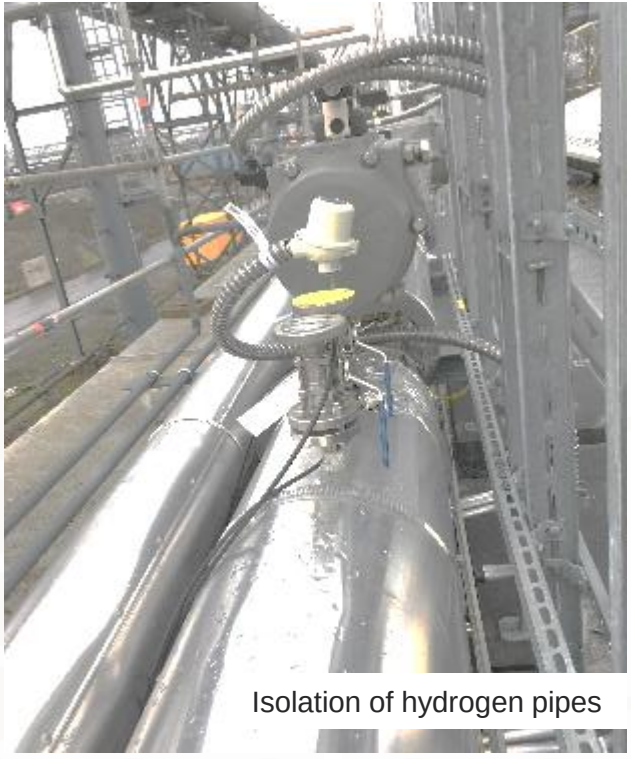
voestalpine Linz – Site view
Steel Division

H2Future - Location selection
“BG 89 Wasserstoffanlage Nord”

- voestalpine is in charge of providing the infrastructure
- Location next to power station ensures availability of
  - Electricity
  - Cooling water
  - Deionized water
  - Nitrogen
  - Pressurized air
  - Connection to COG-network

Connection to Existing Infrastructure

Isolation of cooling water pipes

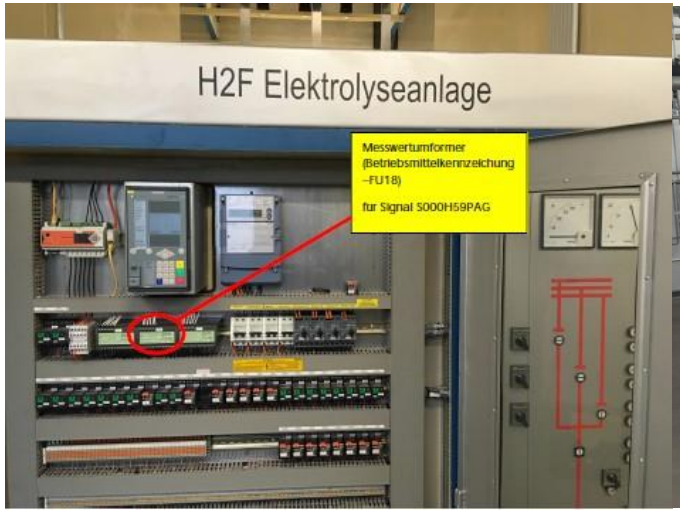


Isolation of hydrogen pipes

Nitrogen connections

Auxiliary equipment

Gas analysis, control cabinet, electric metering



Pipe connection & blow-off lance

Blow-off lances for hydrogen (left) and oxygen (right)

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Challenges in view of green Hydrogen production

- Advantages of site integrated plant vs. proof of utility consumption
  - Different electricity sources for H2 production and auxiliary systems
  - Measurement of side streams (e.g. cooling water)
  - Consideration of small consumers (e.g. emergency generators)
- 2 Outlets for hydrogen (position indicator with continuous signal necessary)
  - Blow-off pipe
  - Connecting pipe
- Required H2 quality for certificate
  - Quality fit for final hydrogen consumers (various quality requirements)
    - Future industrial main consumers (e.g. steel industry) do not need high quality hydrogen
  - Comparability of different electrolyzer processes
- Sophisticated process data storage system necessary
  - Easy to be verified by auditors

H2FUTURE – green hydrogen certification

Summary

- Clean and safe Hydrogen production via water electrolysis by PEM technology
  - No chemicals needed
  - “Impurities” in hydrogen are only water vapor and traces of oxygen
  - Low pressure system with small amount of hydrogen in the plant
  - Dependent on electricity source
- Complex circumstances due to site integration
  - Advantages due to availability of utilities (deionized water, cooling water, nitrogen,…)
  - Challenges as to documentation of plant parameters
- Challenges in setting the criteria for green hydrogen
  - Various electrolysis processes (comparability)
  - Different quality requirements of end consumers (considering also future consumers)
- Challenges regarding competitiveness towards fossil processes (SMR)
  - Criteria as to eligibility of green hydrogen (e.g. electricity mix, additionality,…)

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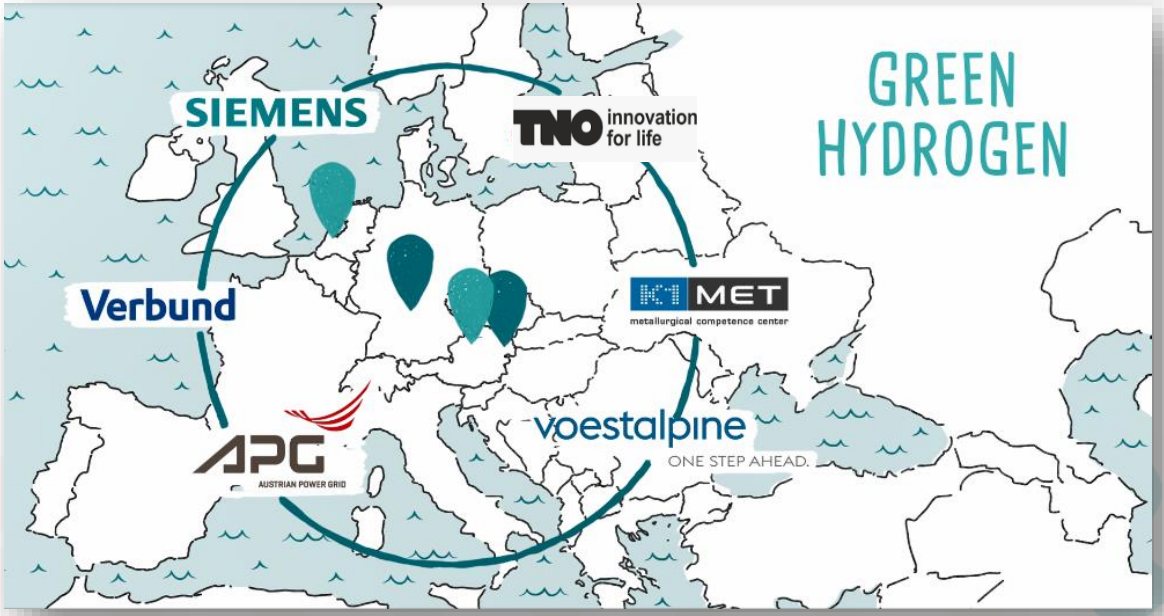
FUEL CELLS AND HYDROGEN JOINT UNDERTAKING



http://www.h2future-project.eu

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