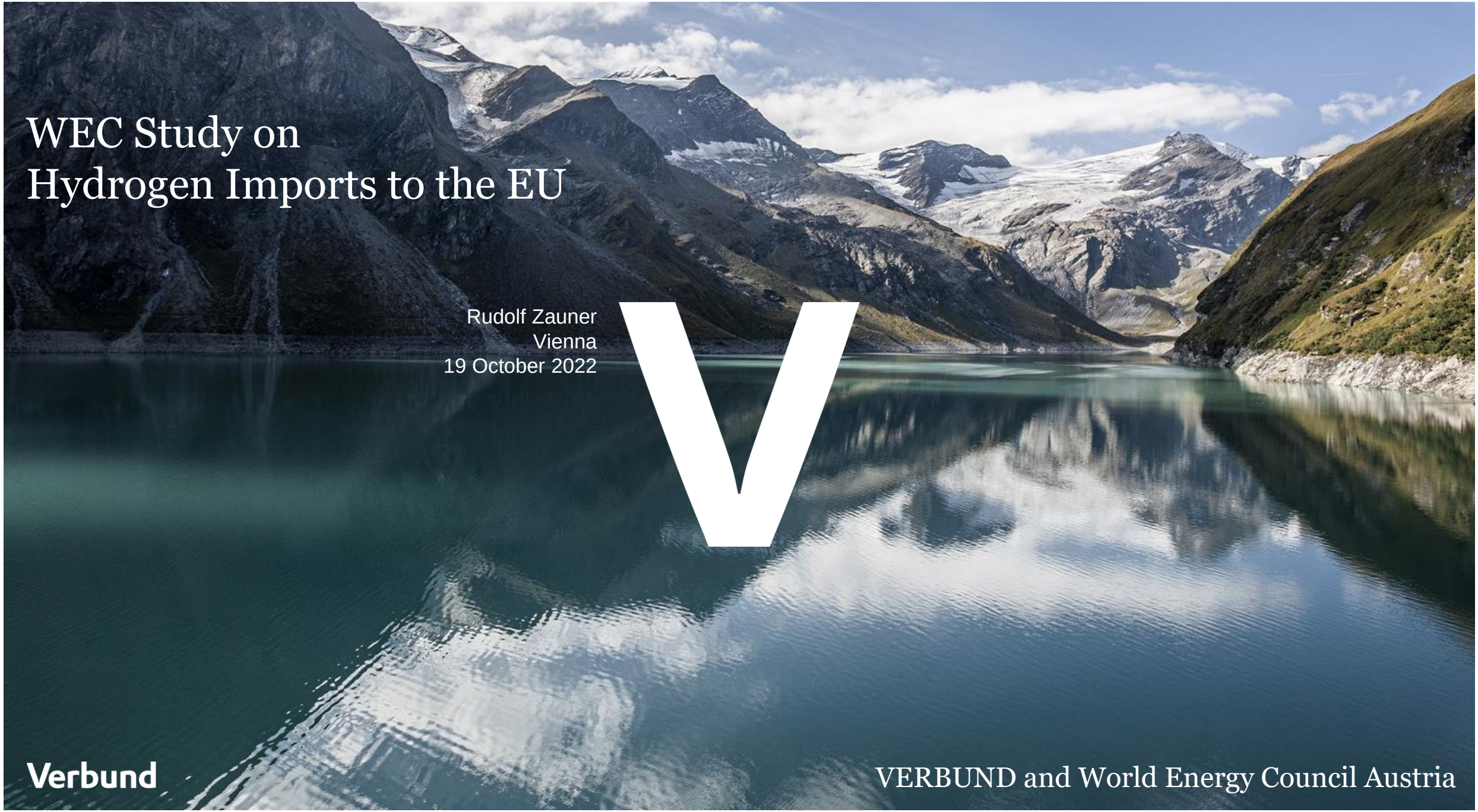


WEC Study on Hydrogen Imports to the EU

Rudolf Zauner
Vienna
19 October 2022

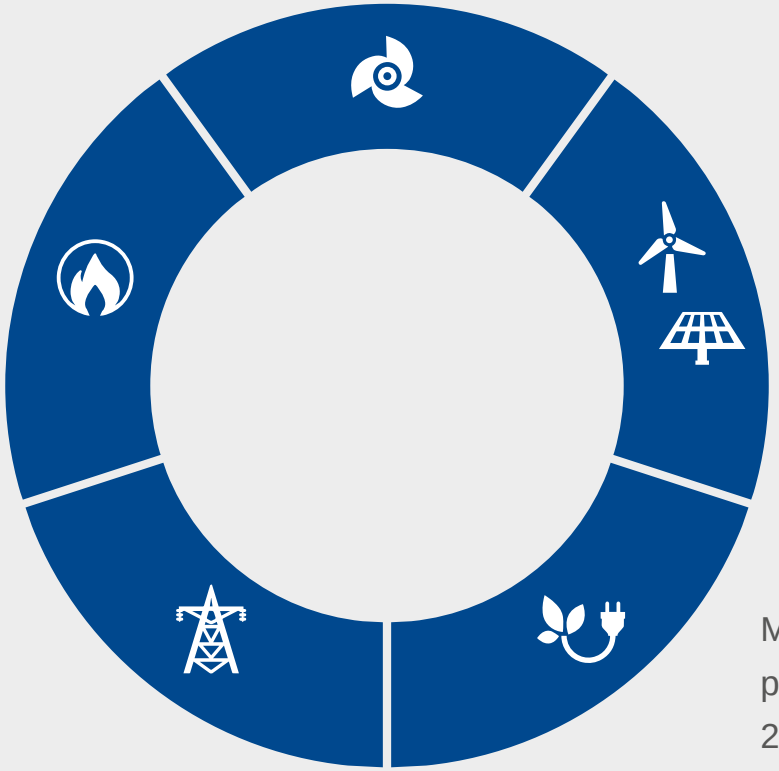
Verbund

VERBUND and World Energy Council Austria

VERBUND at a glance

129 VERBUND hydropower plants with over 8,300 MW capacity.

The GCA high-pressure natural gas grid is around **900** kilometres long.



Up to **1/4** of total generation to come from solar and wind by 2030.

APG's (Austrian Power Grid AG) national electricity grid has around **3,400** kilometres of transmission lines.

More than **500,000** private customers trusted VERBUND in 2021.

With our power into a green future

Expansion of Renewables in Europe

Significant expansion of wind and photovoltaic systems in Europe

Positioning as European hydrogen player

Green hydrogen key to the energy transition and decarbonisation

Strengthening of the integrated domestic market

Strengthening of our position as integrated provider and leading hydropower generator,
reliable gas and electricity grid operator,
and decarbonisation partner in Austria and Germany

Decarbonisation of industry and mobility

Green hydrogen as feedstock for hard-to-abate sectors

Verbund

FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

H2FUTURE – green hydrogen for the steel industry

- **6 MW electrolyser**
- Green hydrogen for s… **production** and **grid**
- Currently **largest PE… lyser in steel indust…**

Source: voestalpine

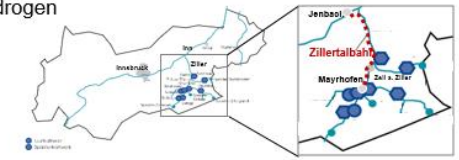
Verbund

Hydrogen-Operated Narrow Gauge Railway

Source: ZVB

- World's first hydrogen-operated narrow gauge railway in Zillertal valley (www.zillertal.at)
- 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 sector coupling using green hydrogen

"Trains operating on crystal-clear water from the Zillertal valley"



Verbund

LAFARGE OMV Verbund BOREALIS

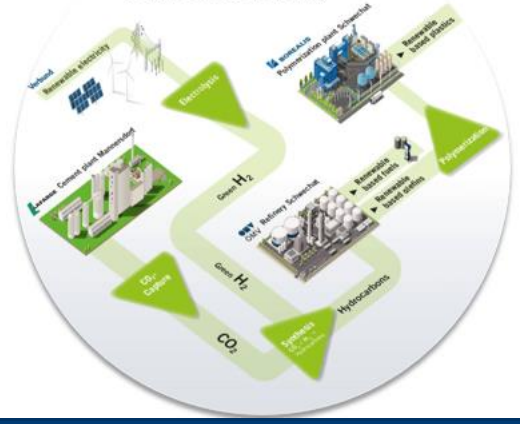
Green hydrogen for the decarbonisation of CO_2 intensive industries

Circular economy
- Carbon2Product Austria (C2PAT)

Cross-sectroial collaboration
- Lafarge, OMV, Borealis, VERBUND

CO_2 capture and usage
- Major industrial plant planned to be completed by 2030
- On the long run capturing of almost 100% of the emissions at the Mannersdorf cement plant (700,000 tonnes of CO_2)
- Production of hydrocarbons and plastics from the recycled CO_2

Cross sectoral value chain
to drive climate neutrality



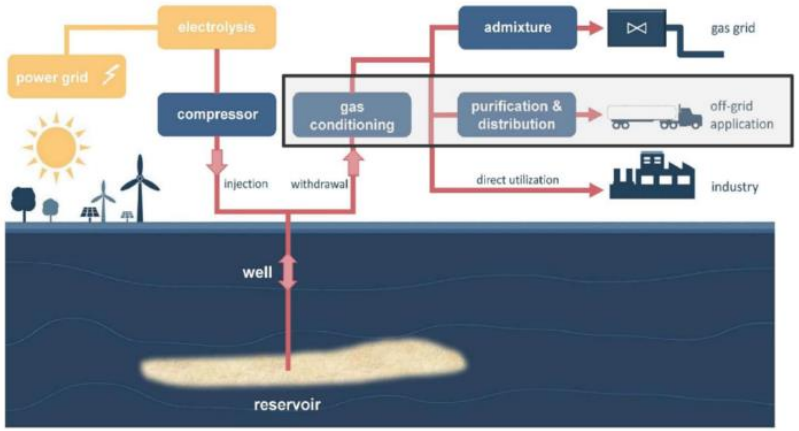
Flexibility and seasonal storage of volatile renewables

Green hydrogen as energy carrier and storage medium for the energy system of the future

Verbund

UNDERGROUND SUN.STORAGE 2030

Underground Sun Storage 2030: Hydrogen for Seasonal Storage



EVN · TU WIEN · axiom · ENERGIE AG · HyCentA · BOKU · ENERGIE INSTITUT · K1 MET · voestalpine · WIVA P&G

Key facts

- Develop **large vo** exploite
- Producti MW PE
- After **no** hydroge into the other ap

High-temperature electrolysis in combination with a CCGT

- Installation and operation of a 150 kW pilot plant for SOEC and 20 kW SOFC at a VERBUND gas power plant site
- Lower TRL than PEM
- Longterm vision: renewable flexibilities replace fossil flexibilities

Estimated demand for hydrogen in Austria in 2050

Annual hydrogen demand, electricity demand, electrolyser capacity 2050

* Assumptions:
Industry 8,760 h/a
Transport 3,000 h/a
50 kWh/kg

Decarbonised hydrogen imports into the European Union: challenges and opportunities

(Marco Baroni, November 2021)

with contribution by VERBUND

30+ Experts peer reviewers and speakers

25+ Companies and organizations involved

from **12** countries

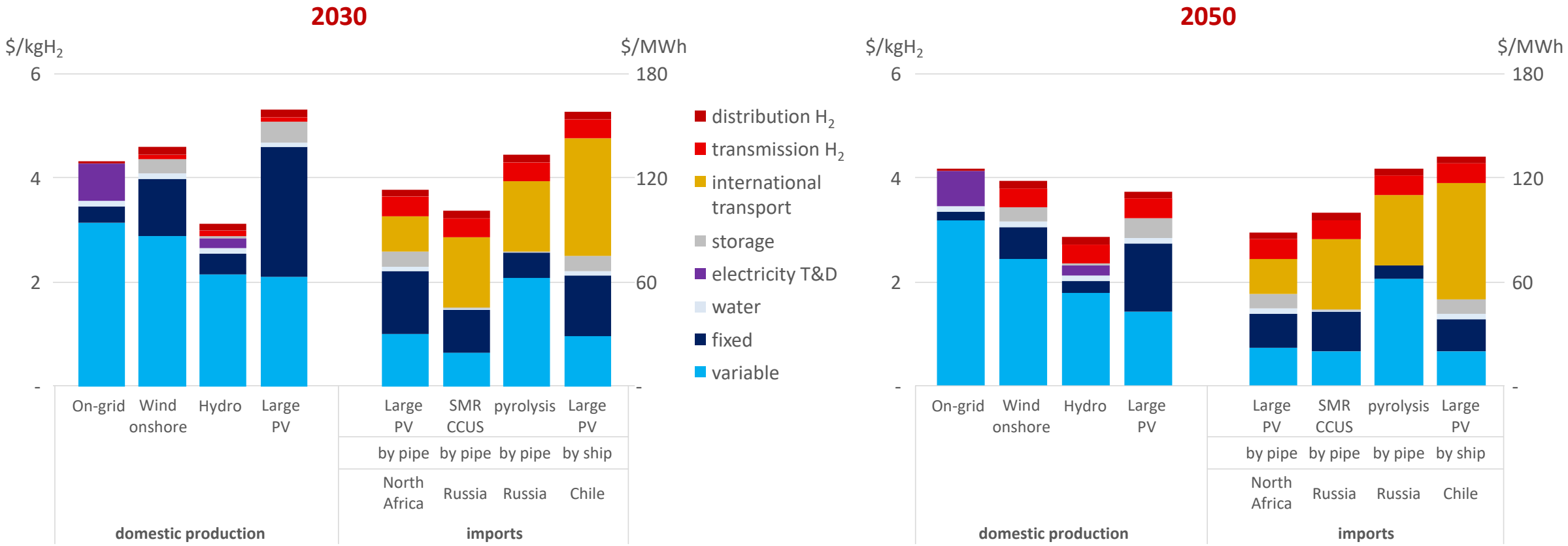
Steering Committee of **9** members

The scope and structure of the study

- Three broad questions:
  - *Why import decarbonised hydrogen to the EU?*
  - *How to make imports possible?*
  - *What would be the conditions for mutual success?*
- An opportunity to cross views between potential importers and exporters
  - *Uncertainties on domestic demand and supply of hydrogen in the European Union*
  - *Review of current production and transportation costs, and possible future evolutions*
  - *Implications on energy and technology security and interactions with the power sector*
- Technology neutrality while respecting stringent emission targets
  - *Decarbonised vs emitting hydrogen production*

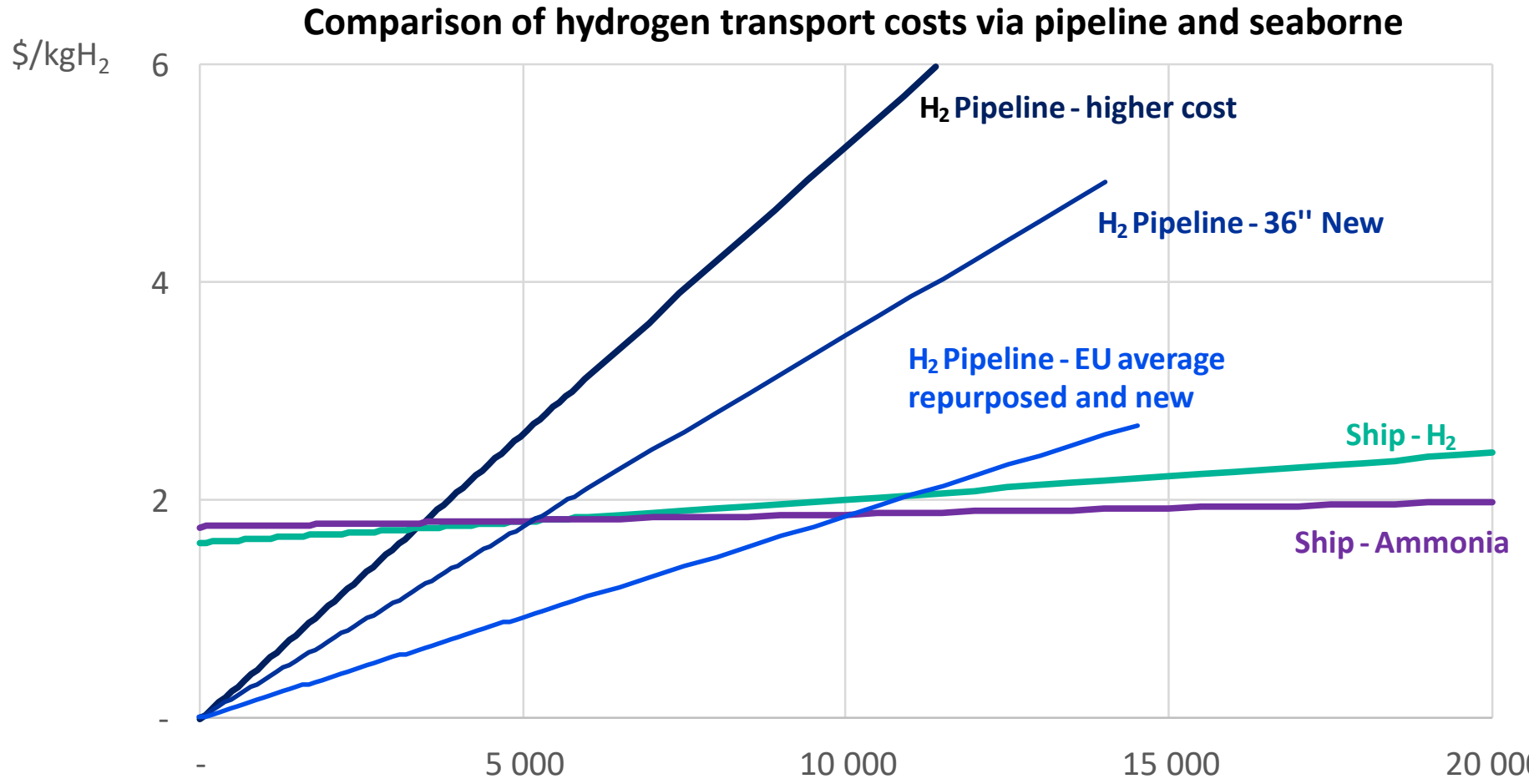
Drivers of hydrogen imports – Costs

Indicative delivered hydrogen costs to a typical industrial customer in Austria from selected countries and technologies, 2030 and 2050



Transportation costs are set to play a key role in the competitiveness of hydrogen produced in countries outside the European Union, as they often offset their different production costs

Transport costs

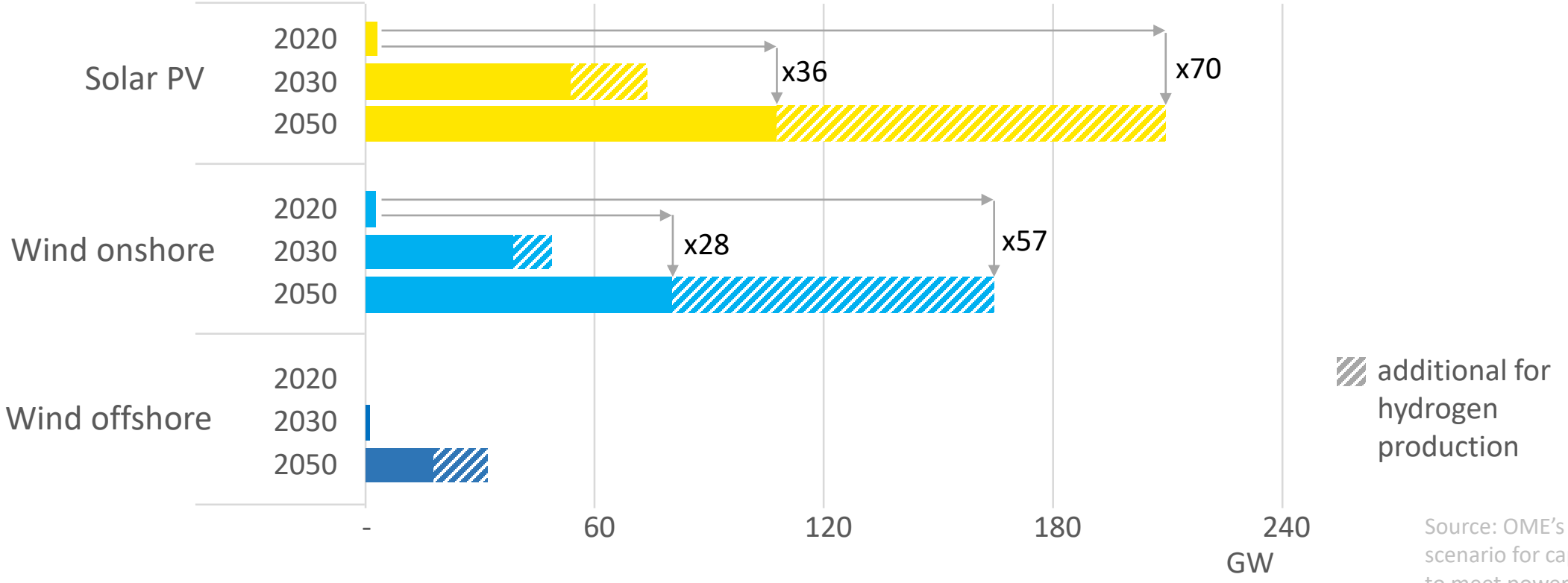


Sources: IEA, 2019; EHB, 2021a; EWI, 2020

Transport costs for pipeline and seaborne trade will be crucial in determining the competitiveness of exporting countries and technologies

Growing ambitions in North Africa

Installed capacity for solar PV and wind power in North Africa, including and excluding additional capacity for hydrogen production, 2020-2050

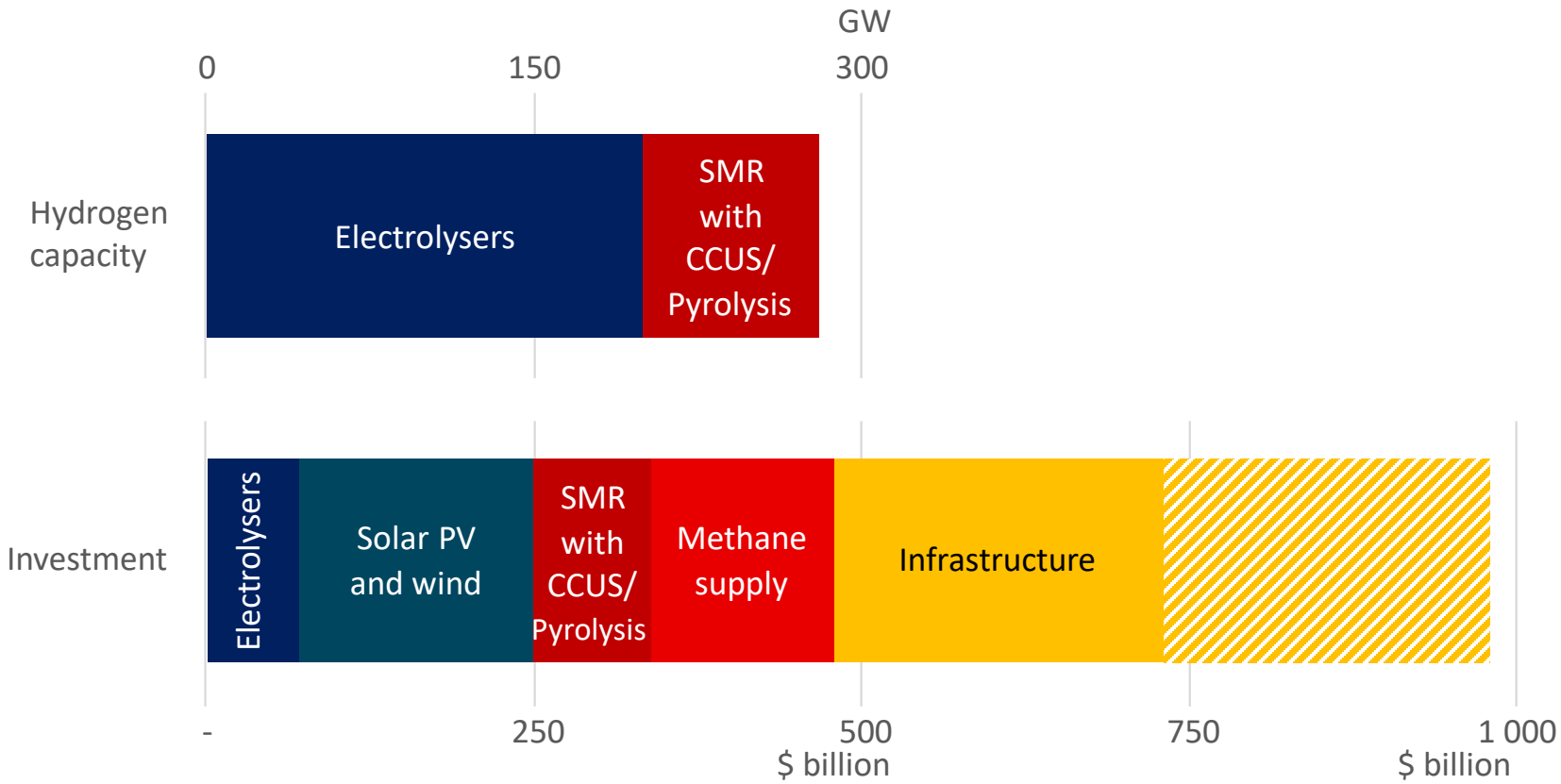


Source: OME's ProMed scenario for capacity used to meet power demand

North African countries are expected to see continuing soaring electricity demand. The ambition of exporting decarbonised hydrogen must be well integrated with the strategies to decarbonise the power sector

How to make imports possible?

Capacity and investment needs outside the European Union for export purposes, 2021-2050



Meeting exports of around 30 million tonnes of hydrogen requires around 300 GW of hydrogen production capacity and $750-1 000 billion of investment. Access to low-cost financing is set to play a key role

Conditions for mutual success

- Coordination of all infrastructure (hydrogen, electricity, gas, heat) both within and outside the EU
- Implementation of a clear regulatory framework to ensure that investment will be forthcoming in a timely manner
  - *International hydrogen and derivatives quality, technical and safety standards*
  - *Well-designed certification of the decarbonised nature of hydrogen*
  - *Stable and coherent set of support measures for both importing and exporting countries*
- Create stable relationships with key trading partners
  - *Ensure acceptability and respect of the principle of additionality for new hydrogen projects*
  - *Foster industrial development*
  - *Establish a high-level roundtable between exporters and importers for the development of a joint hydrogen roadmap*

WORLD ENERGY COUNCIL | EUROPE

H2

EUROPEAN UNION IMPORTS STUDY

Decarbonised hydrogen imports into the European Union: challenges and opportunities

www.weltenergierat.de/wp-content/uploads/2021/10/WEC-Europe_Hydrogen-Import-Study.pdf

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