

Hydrogen Demand / Off-take in Germany and Collaboration Potential with German Industry

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Hydrogen Association (DWV) e.V.

Sep 11, 2020, Johannesburg



Industry association of the German hydrogen economy

DWV is committed to developing the green hydrogen economy. Our companies and citizens should receive an integrated, sustainable, climate-neutral, ecological, economical, socially acceptable and secure energy system

Initiation of
measures to
introduce the
hydrogen economy

Moderator between
politics, economy,
associations, science
and the public

Development of
concrete, regulatory
proposals

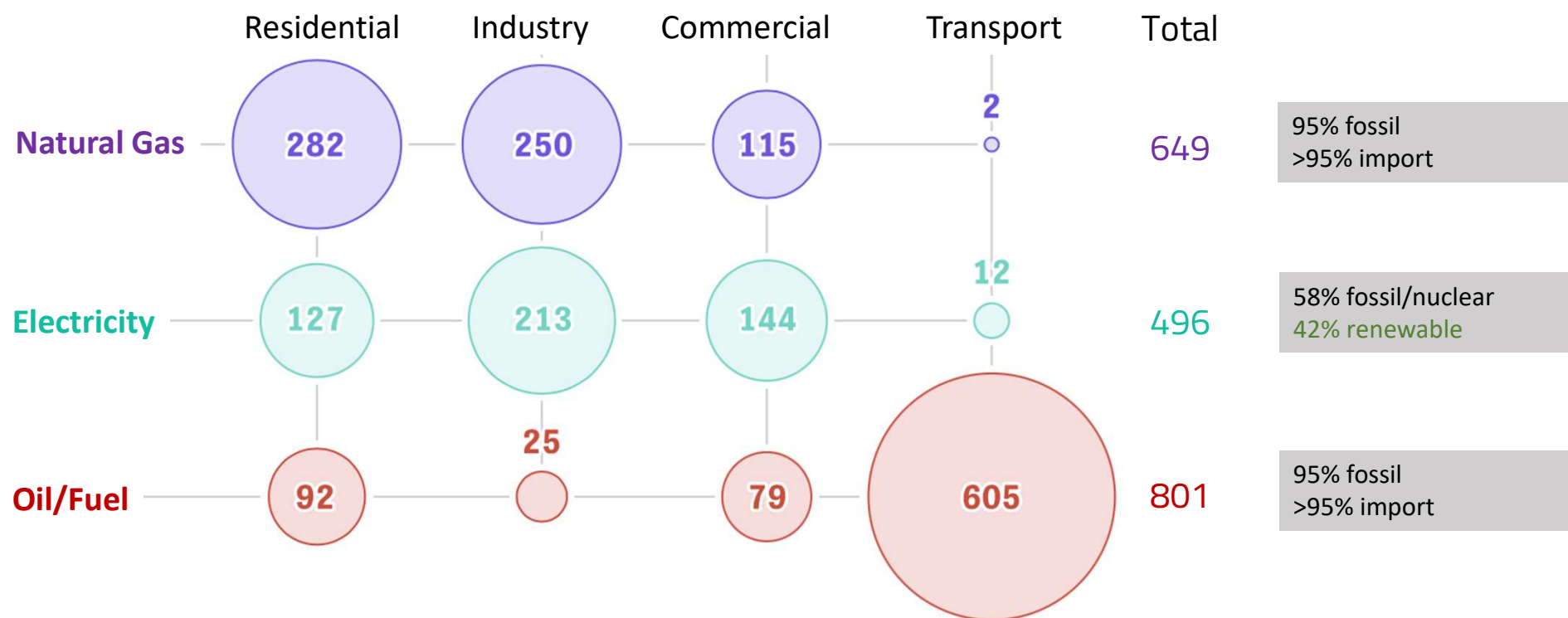
DWV-German Hydrogen and Fuel Cell Association



9/9/2023

German Hydrogen Association

German Energy Demand (TWh, 2021)



Source: AG Energiebilanzen e.V. / Zeit

Industrial decarbonization



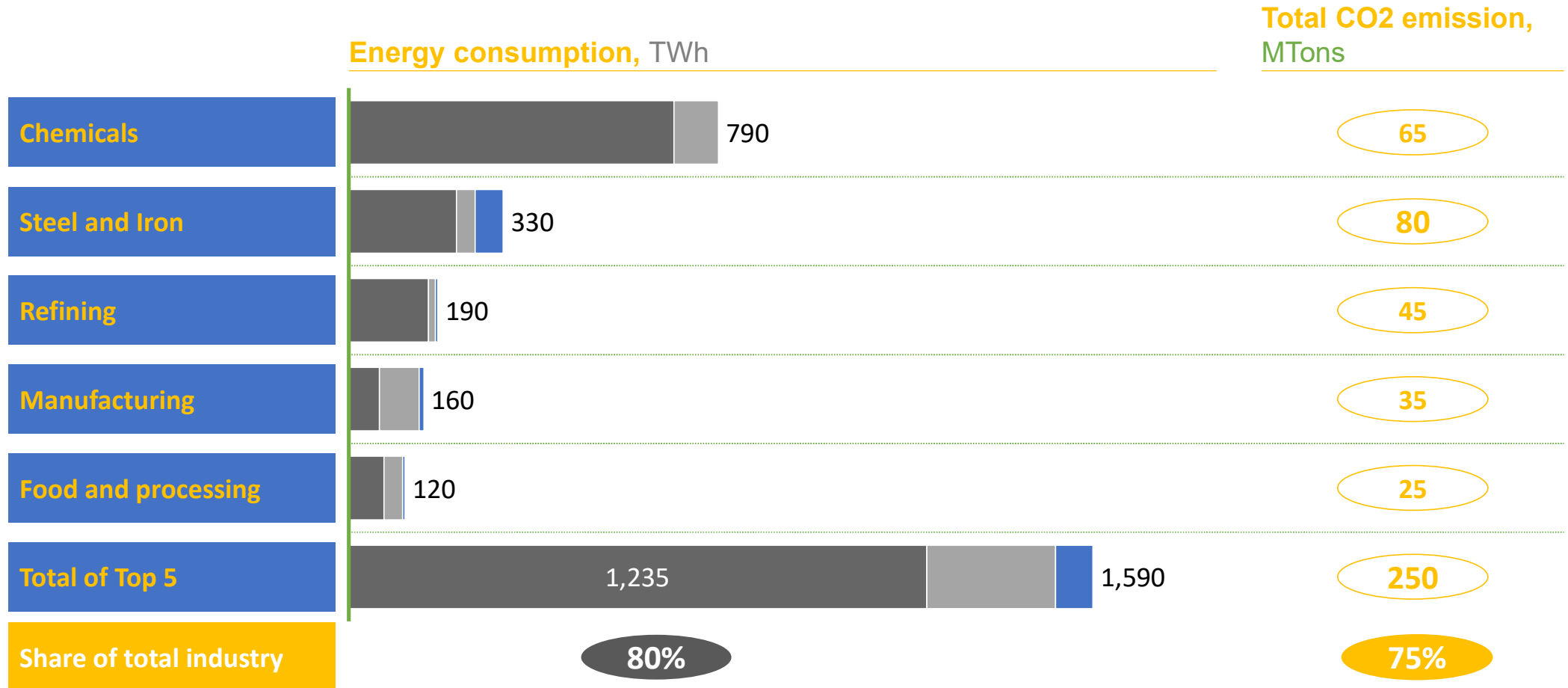
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German Hydrogen Association



Top 5 industries consume 80% of the fossil fuel (1,235 TWh) and emits 75% of the CO2

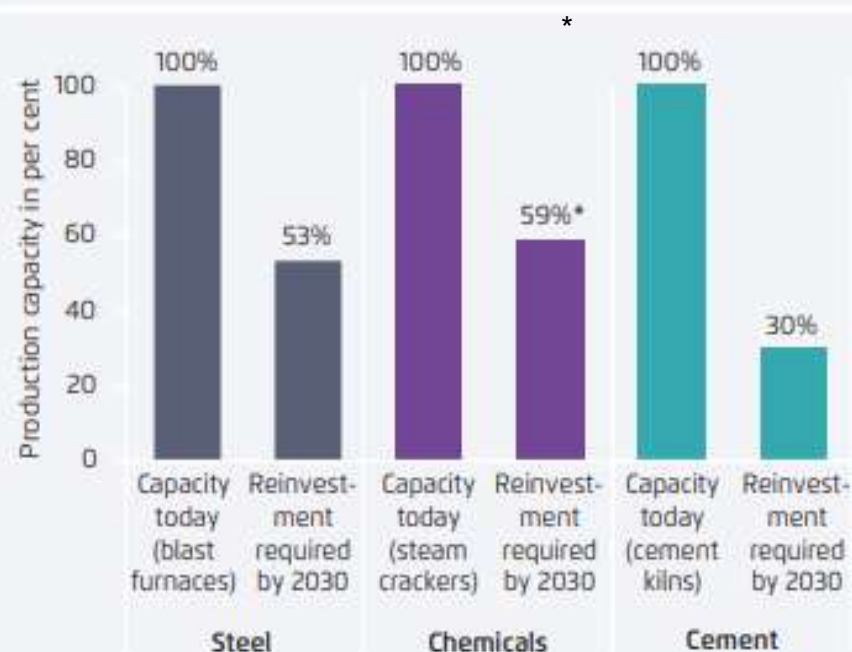
■ Fossil fuel ■ Electricity ■ Other



SOURCE: Voorstel voor hoofdlijnen voor het Klimaatakkoord/McKinsey

Industrial investment needs - Push for decarbonisation efforts across German industries needed

REINVESTMENT REQUIREMENT OF PRIMARY PRODUCTION CAPACITIES IN GERMANY BY 2030



- Chemical and Steel Industry and Steel with high investment needs short- to mid-term.
- Investment cycles for furnaces 30-40 years – new assets will reach far into a potentially carbon-neutral future. Likely to trigger a strong push for high sustainability requirements
- Investment cycles for chemical assets approx. 15 years – less danger of "stranded assets" due to increasing sustainability requirements

Green Hydrogen as carbon free energy/feedstock

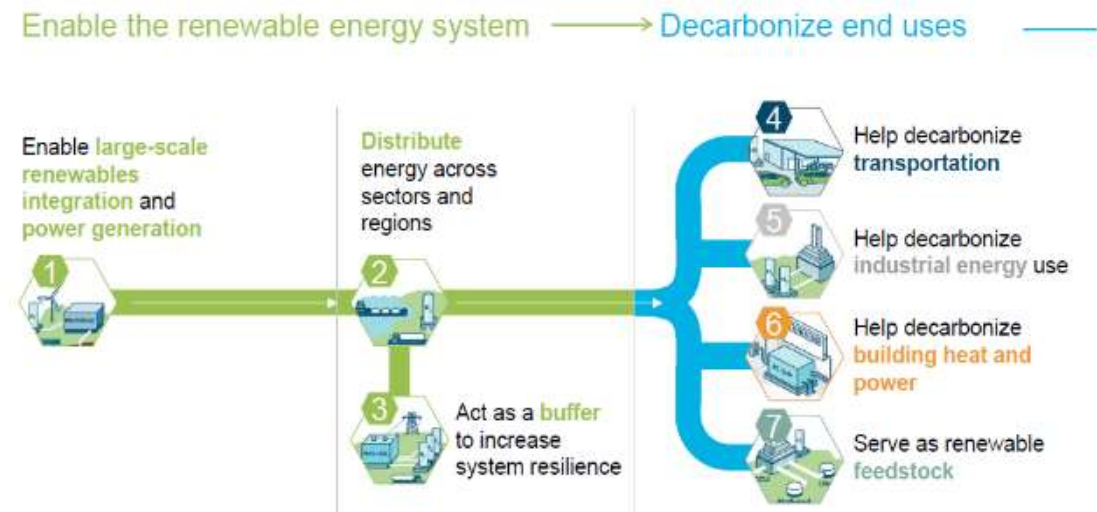


Source: agro&chemistry



Why is green hydrogen important

- Enables decarbonization in hard to abate sectors like industry, transport, (heat)
- Increases energy supply resilience
- Independency from fossil resources
- However: Increasing volatile renewable production implies increasing demands for flexibility



Source : Hydrogen Europe

Promising Applications for clean hydrogen

TRANSPORTATION



Green hydrogen as fuel for

- ✓ **Heavy duty trucks**
- ✓ **Fuel cell busses**
- ✓ **Fuel cell trains**
- ✓ **FCEV Passenger vehicles**

REFINERIES



- ✓ **Substitution of biofuel additives (e.g. RME) in conventional fuel production by green hydrogen (REDII)**
- ✓ **Synthetic fuels (e.g. SAF)**

INDUSTRIES



Substitution of industrial process gases by green hydrogen

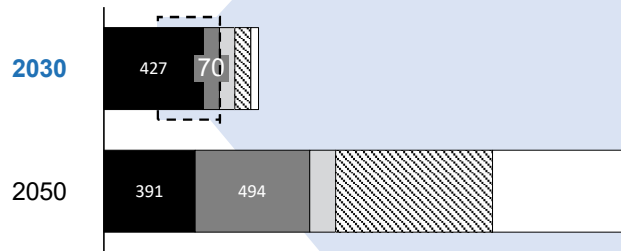
- ✓ **Steel production**
- ✓ **Ammonia production**
- ✓ **Green Methanol**

Demand clusters (> 2 TWh) by 2030

Where will the main demand for decarbonized hydrogen emerge and where will it come from – heavy industries

European H₂ demand 2030 & 2050 in a 2°C climate scenario (TWh)

(Source: Fuel Cells and Hydrogen 2 Joint Undertaking)

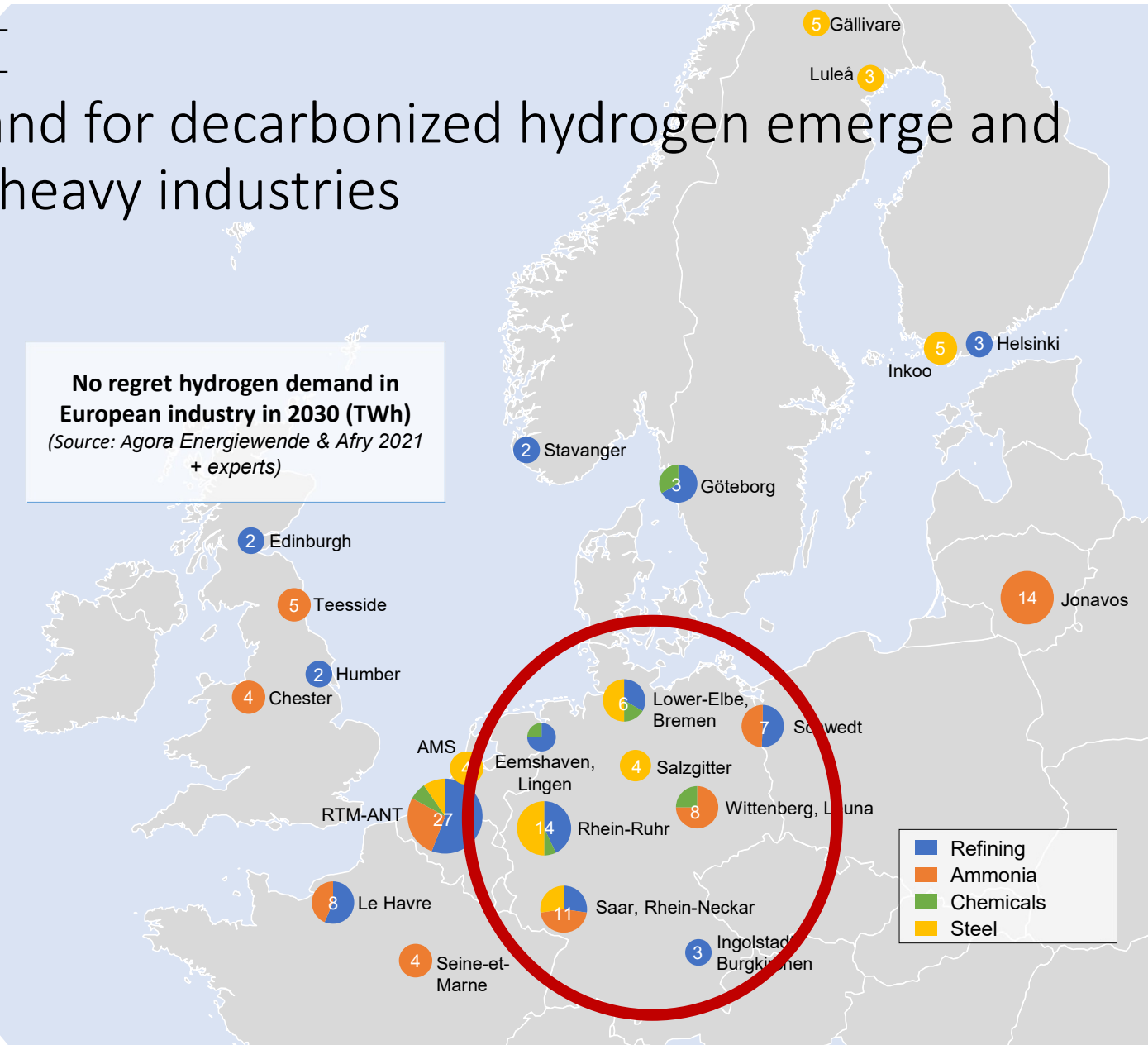


Legend:
 ■ Existing Feedstock
 ■ Industry
 ■ Power generation
 ■ Transport
 □ Heating and power for buildings

Sources: Graph: Hydrogen Roadmap Europe: A sustainable pathway for the European Energy Transition. Image: Agora Energiewende / Afry: No-regret hydrogen: Charting early steps for H₂ infrastructure in Europe, experts

No regret hydrogen demand in European industry in 2030 (TWh)

(Source: Agora Energiewende & Afry 2021 + experts)



German National Hydrogen Strategy

Scenario 2030:

- Demand green hydrogen: 95 - 130 TWh
- Includes hydrogen and derivatives (ammonia, methanol, Sustainable Aviation Fuels)
- National production: 10GW electrolyser capacity
- Share national/import: 30%/70%
- Import from European countries and international
- Import strategy under development



Expectation on Green Hydrogen Demand in Germany

	2030	2045
Expected demand climate neutral gases	94-162 TWh	304-652 TWh
Thereof green hydrogen, mainly import ¹	47-171 TWh	451-648 TWh
Corresponding electrolyser capacity ²	10-38 GW	100-144 GW

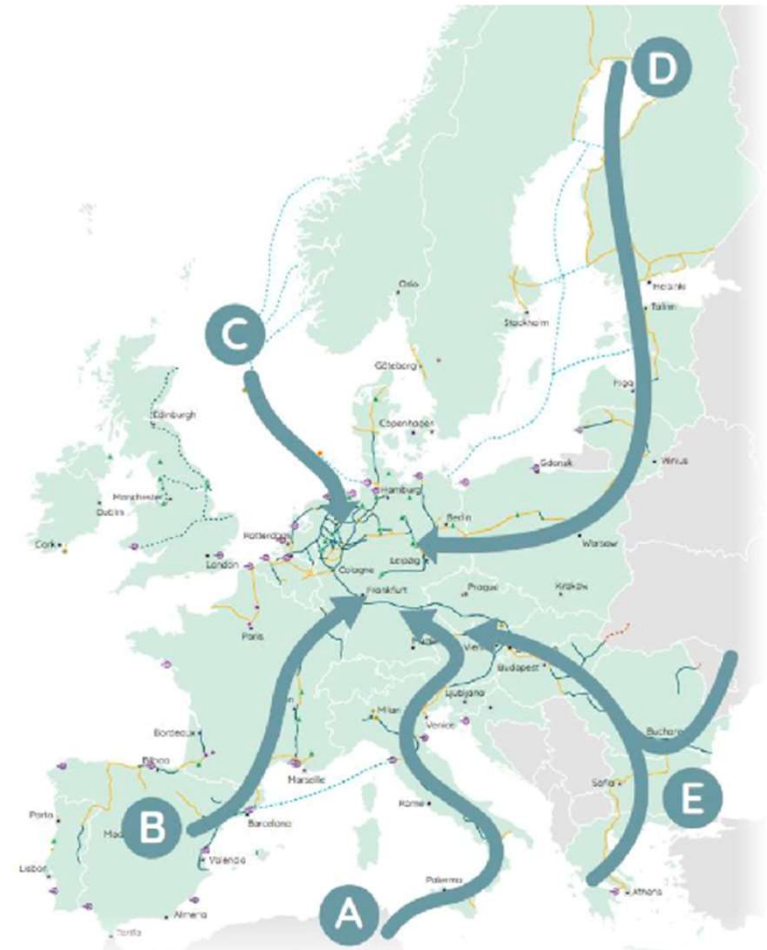
1: other sources: Biomethane, blue and turquoise hydrogen

2: assumption 4500 full load hours operation of electrolyser

Source: BDEW, DVGW, Zukunft Gas: WEGE ZU EINEM RESILIENTEN UND KLIMANEUTRALEN ENERGIESYSTEM

Import of Green Hydrogen by Pipeline

- Huge existing natural gas pipeline grid (transmission & distribution) and storage system
- Moderate cost for conversion to Hydrogen in existing pipelines
- New pipelines need to be built
- Transport capacity 5-10 times more than transmission power line



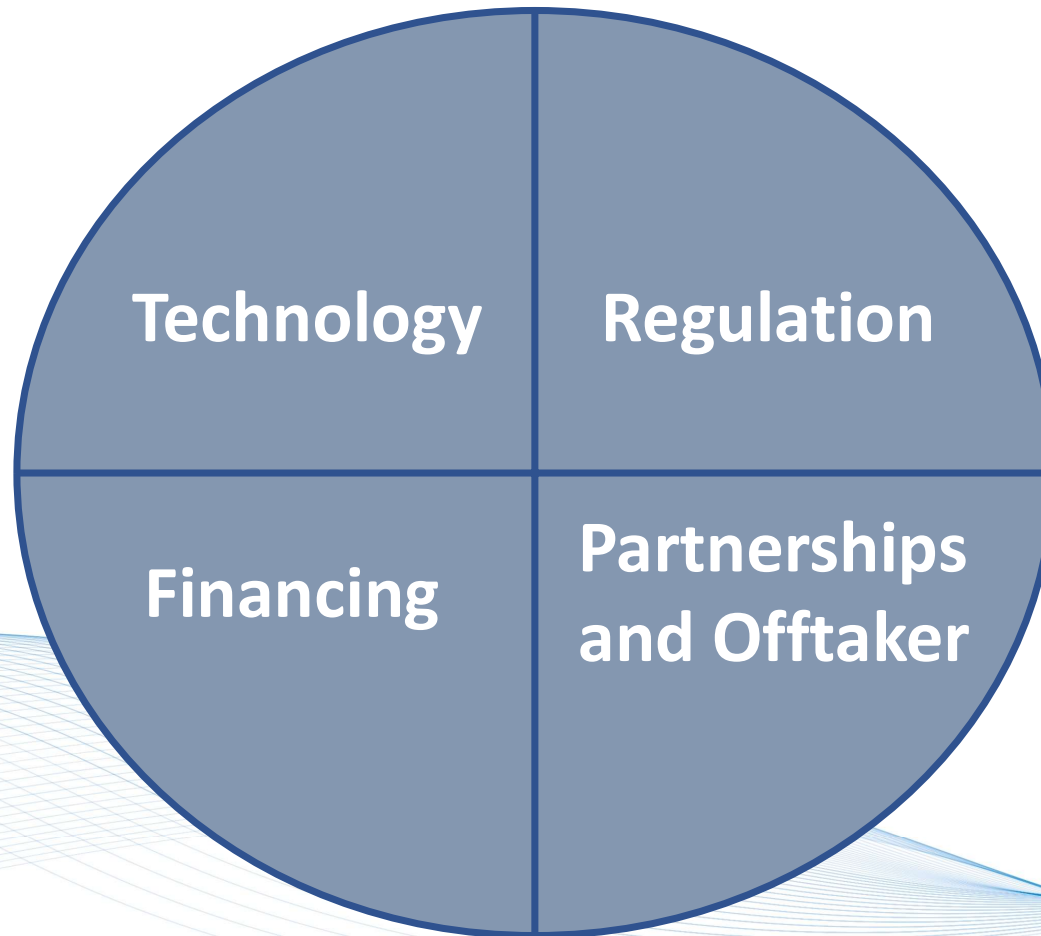
Quelle: European Hydrogen Backbone

Import of Green Hydrogen Derivates with Vessels

- Applicable for liquid hydrogen derivatives
 - Ammonia
 - Methanol
 - Sustainable Aviation Fuels
- Option for long distance transportation and liquid fuels
- Existing and established infrastructure (ports, vessels)



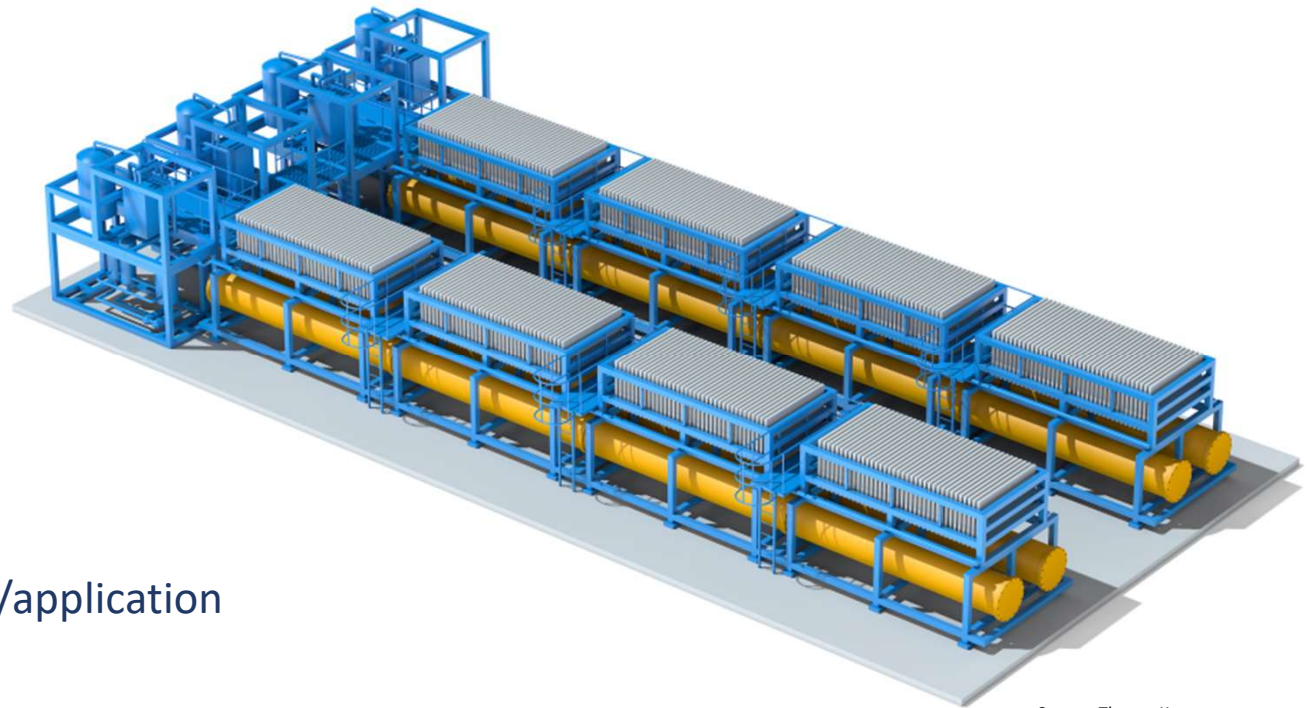
Requirements for a successful market introduction



Technology

Electrolyzer – key technology

- Efficient
- Low Capex and Opex
- Ramp-up of production capacity



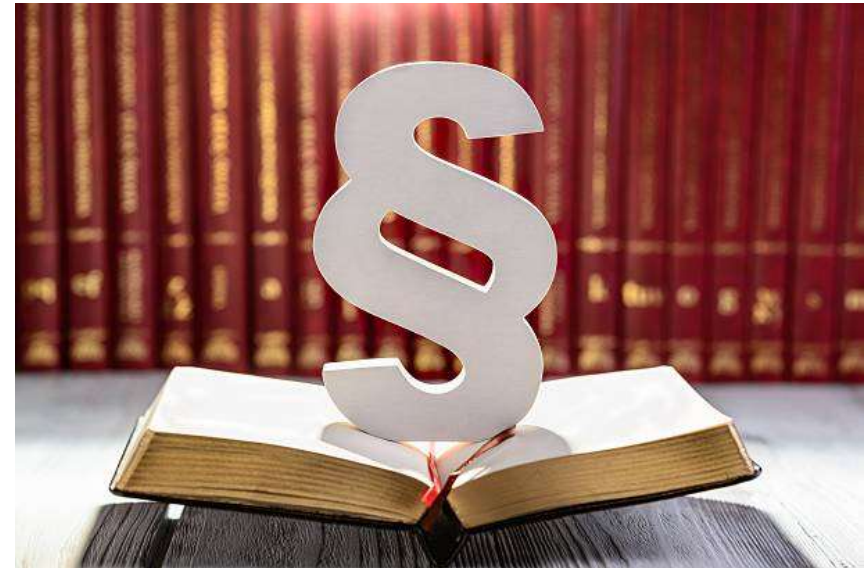
Source: ThyssenKrupp

Various technologies in distribution/application

Regulation

Investment friendly regulation is key

- Imports need to fulfill regulatory requirements for green hydrogen
- Production based on renewable energies (wind, solar)
- For imports from partner countries of development cooperation, Germany will ensure maximum synergies with a local socio-ecological social and economic transformation and energy transition as well as the sustainability goals (SDGs).



Financing

Large scale import projects need a sound business case

Funding is necessary for the market ramp-up:

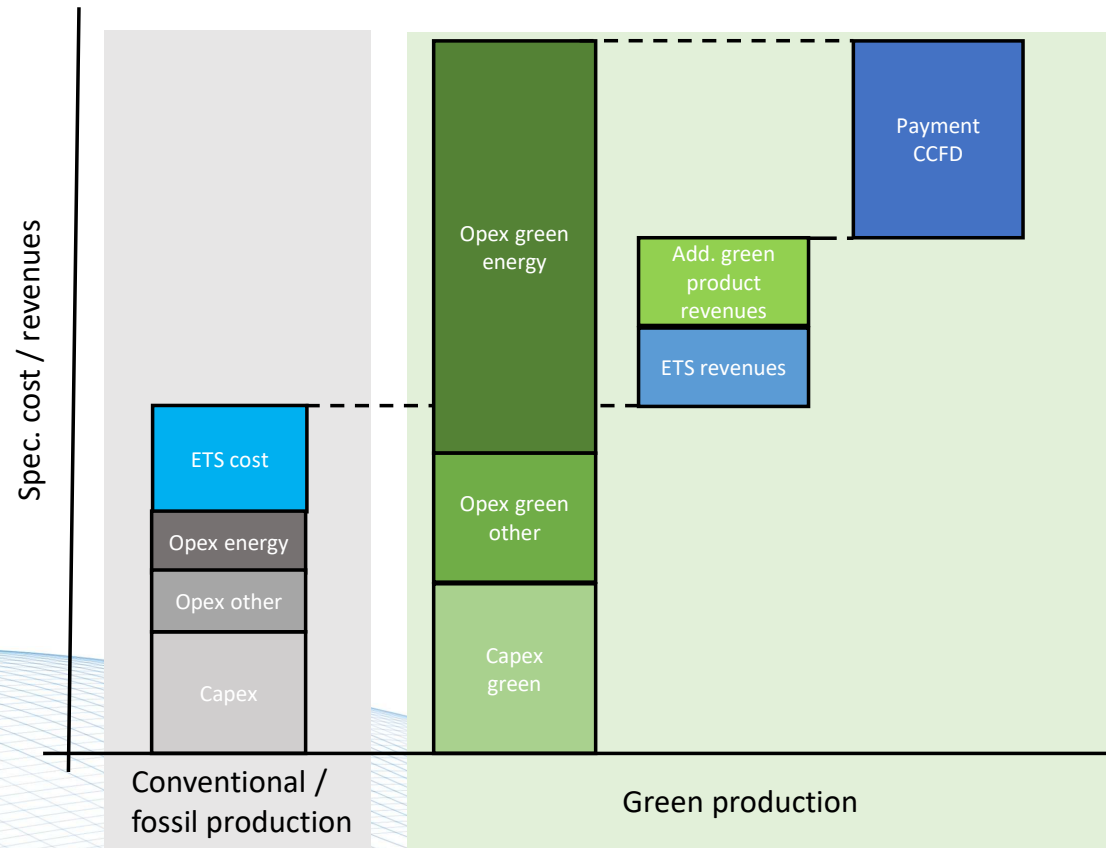
- should be limited for a dedicated period
- should cover opex and capex

Funding instruments

- On European and national level
- Examples: H2Global, H2 Bank



CCFD-Carbon Contracts for Difference



- CCFD covers the cost delta between conventional production (grey) and green production (green)
- the CCFD payment is calculated based on the cost difference between grey and green production minus revenues from green production (ETS and potential additional revenues for green labelled products)



Shaping the global **energy transition.**

H2Global | Idee, Instrument und Intention
March 2023

- ▶ **EUR 900m subsidies program of the German federal government (Federal Ministry of Economic Affairs and Climate Action), in 2022 increased by EUR 3.7b**
- ▶ **Goal: Establishing infrastructure for long-term procurement of green H2 derivatives outside of Europe**
 - ▷ Production
 - ▷ Transport
 - ▷ Storage
- ▶ **Green H2 derivatives: No CO2 emissions in the production process**



H2Global Mechanism

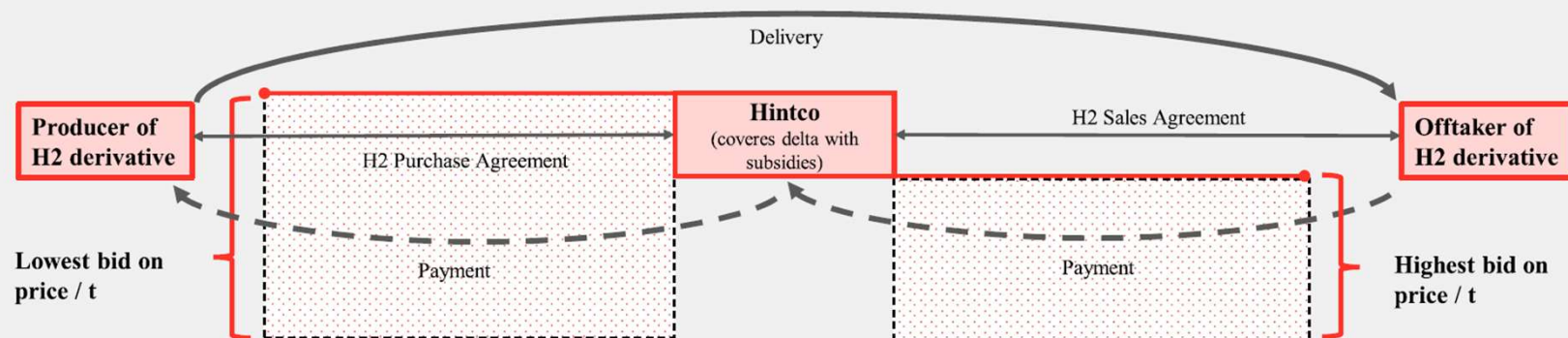
Mechanism: Long-term buy-side / short-term sell-side

► **Buy-side:**

- Hintco receives funding
- Tenders long-term (10yrs) procurement contracts for H2 derivatives ammonia, methanol and SAF to bidder with lowest price per ton and highest delivery volume

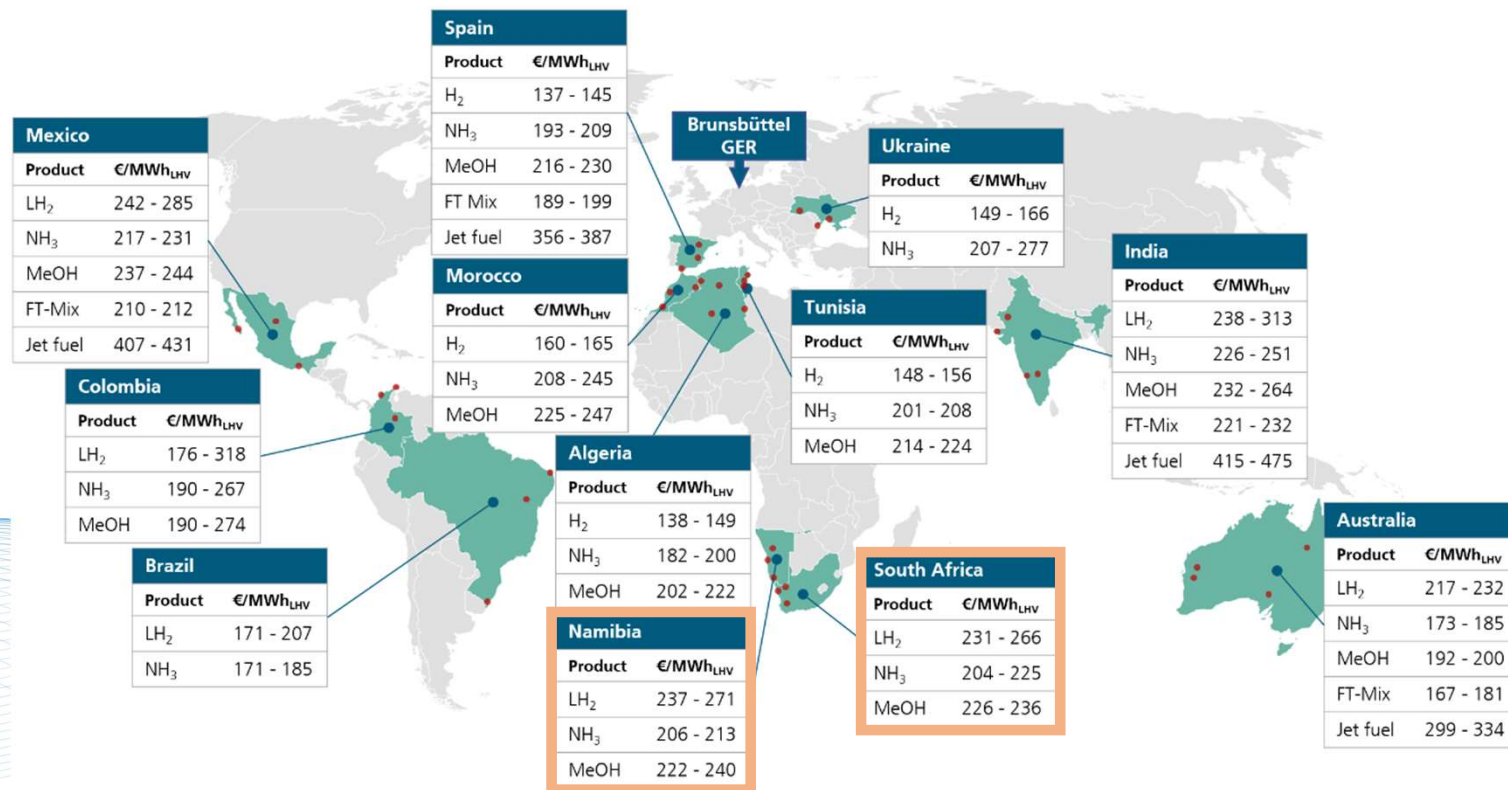
► **Sell-side:**

- Hintco tenders short-term sale contracts for H2 derivatives ammonia, methanol and SAF to bidder with highest price per ton
- Subject of H2Global subsidies: Delta between purchase price and sales price



Source: Chatham House

Possible Countries for H2 Import to Germany – rough cost analysis



Source: Fraunhofer ISE/ H2Global

Partnerships and Offtaker

Partnerships are essential in the ramp-up phase

- Risk mitigation
- Financing
- Offtaker with willingness to pay
- Long term agreements





Federal Ministry
for Economic Affairs
and Climate Action



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