

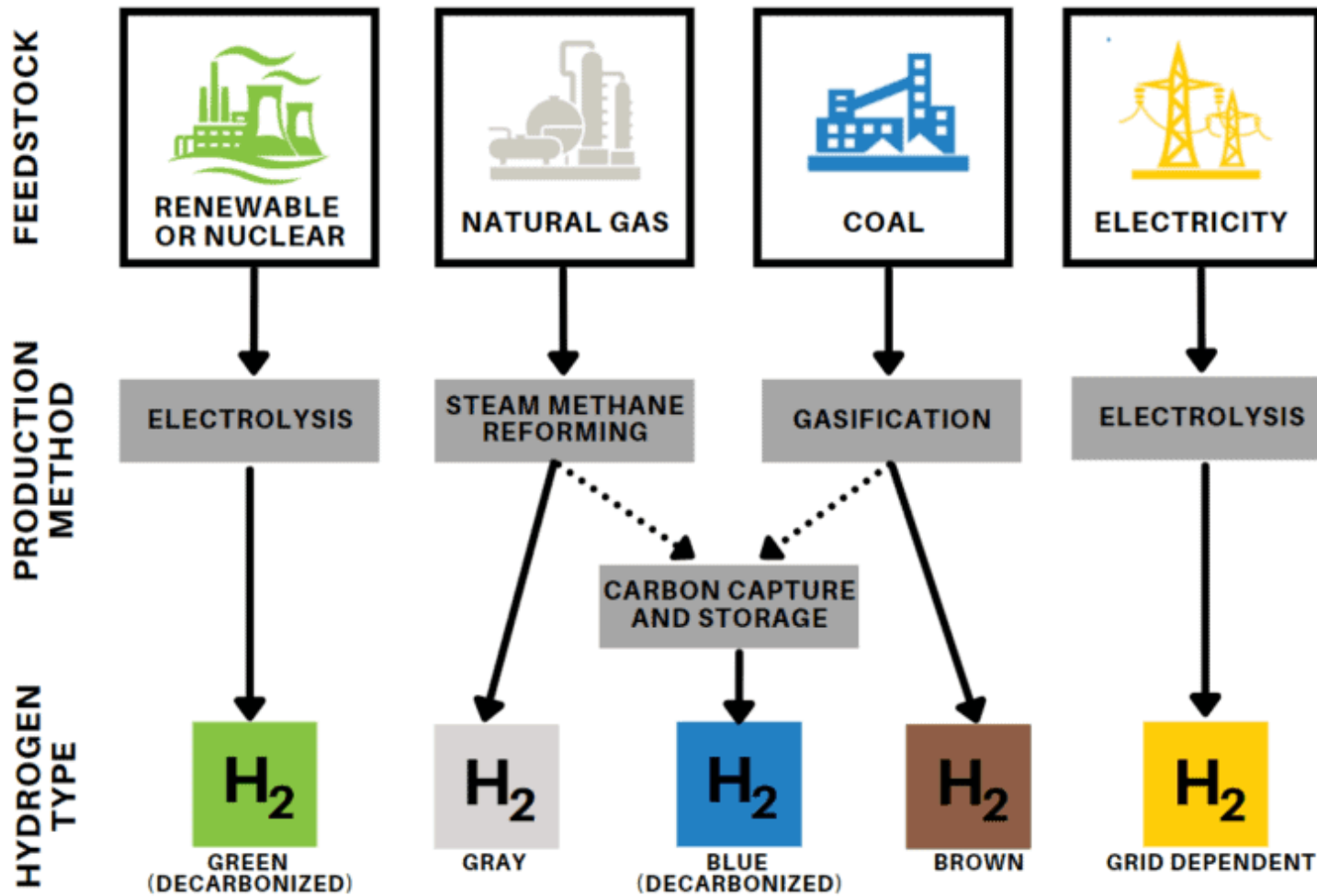
SAREP

Sahara Renaissance
Project

Hydrogen 2.0: Pioneering a
Green Energy Era

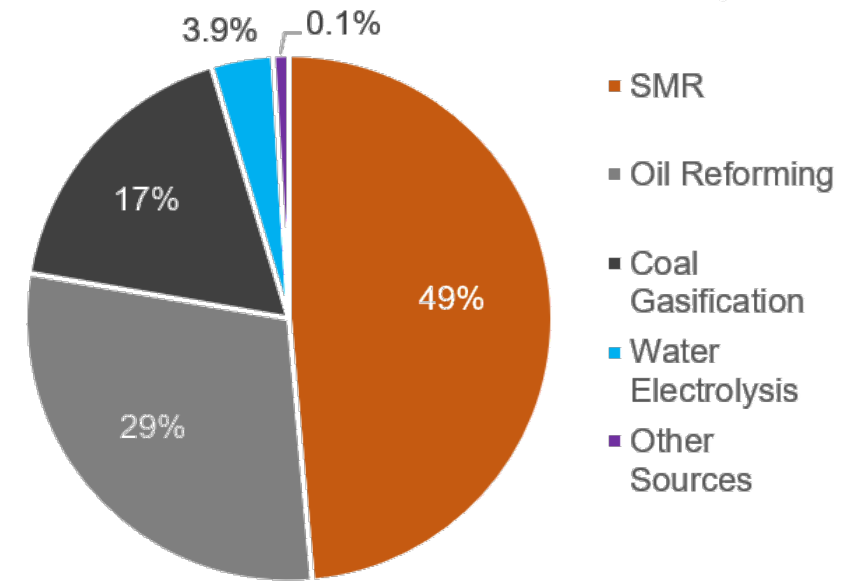
By: Bhushan Chaudhary (M.Sc. IMAT)
Designation: Project Assistant, IfaS

Production Methods



..... other production processes are dark fermentation, photo fermentation, pyrolysis, liquefaction.

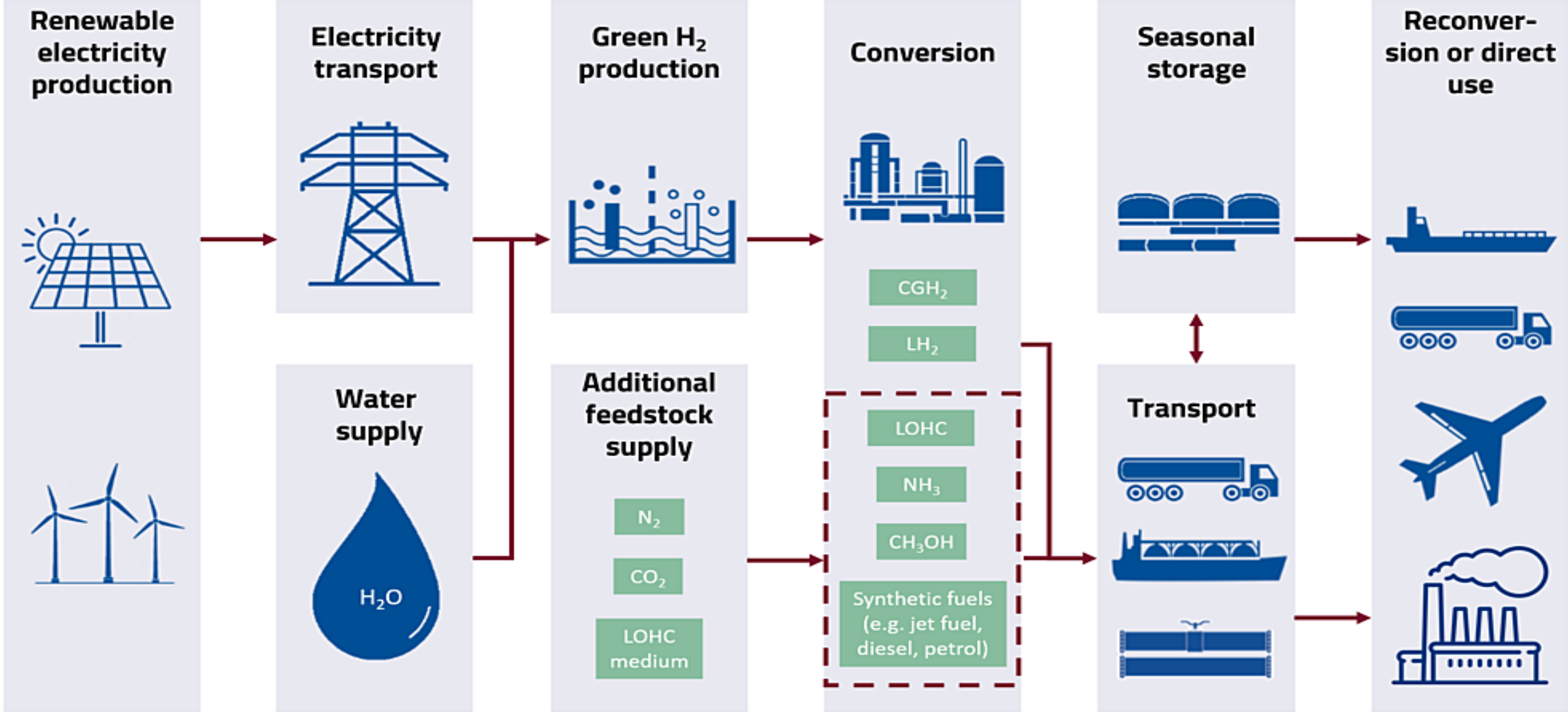
Global Hydrogen Production by Method



(Dincer & Acar, 2015)

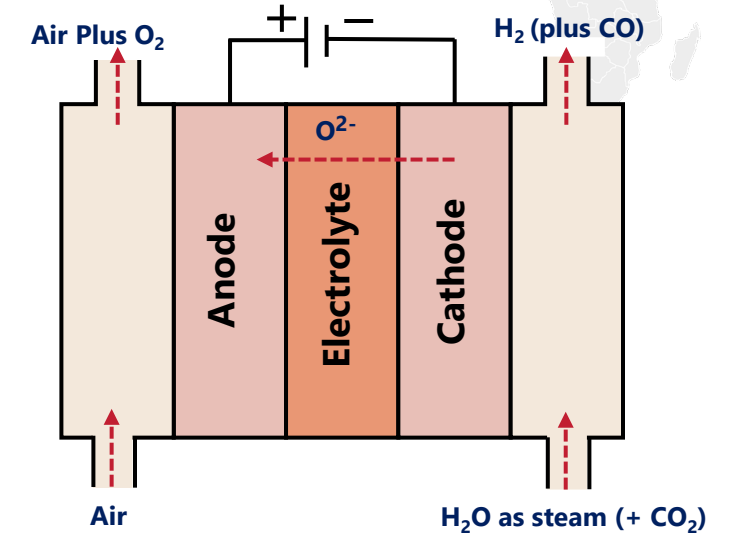
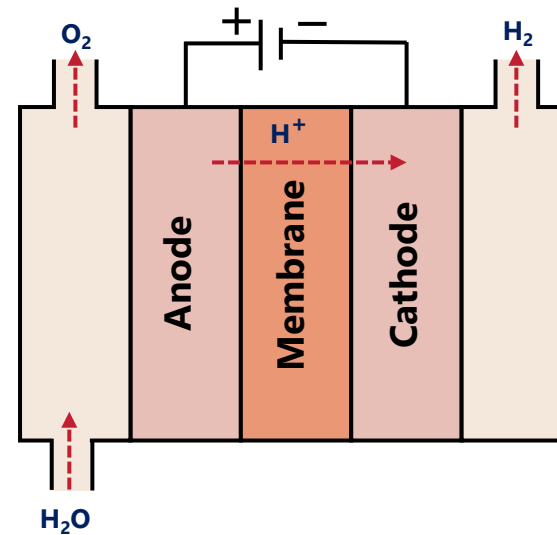
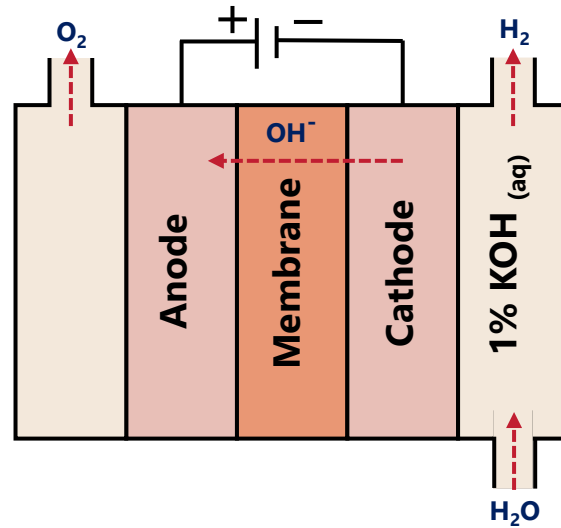
- **95%** of hydrogen sourced from fossil fuels emits approximately **830 million tons** of CO₂ annually.
- Global annual demand for hydrogen was estimated to be around **70 million metric tons**.
- Generating all current hydrogen production from electricity would require **3600 TWh**, surpassing the EU's total annual electricity generation.

Green Hydrogen Supply Chain



Source: Roland Berger

AEM vs PEM vs SOEC



Parameter

Electrical efficiency (%)

57-69

Cell pressure (bara)

< 35

Operating temperature (°C)

60–80

Stack lifetime (operating hours)

60000 – 90000

Energy source

100% electrical power

CAPEX (USD/kWe)

500 – 1400

PEM

50-83

< 70

50–80

30000 – 90000

100% electrical power

1100 – 1800

SOEC

45-55

< 10

750-850

30000 – 90000

**25% heat from steam,
75% electrical power**

1100 – 1800

Hydrogen Storage Solutions

The most common hydrogen transportation routes

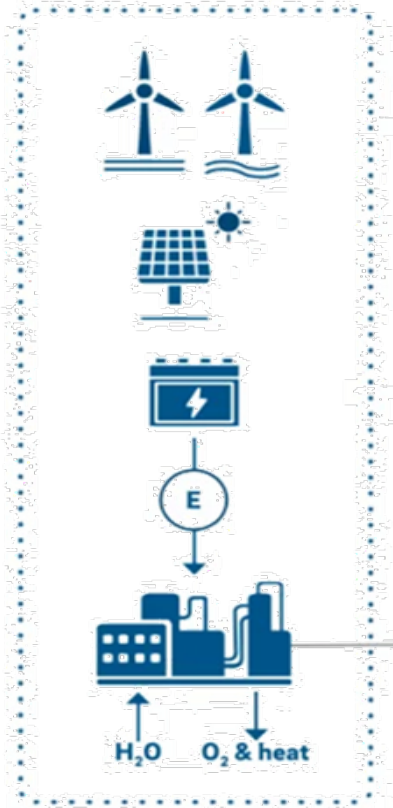
Clean hydrogen production, e.g. from renewable sources

Pipeline route (gaseous H_2)

Clean ammonia route (NH_3)

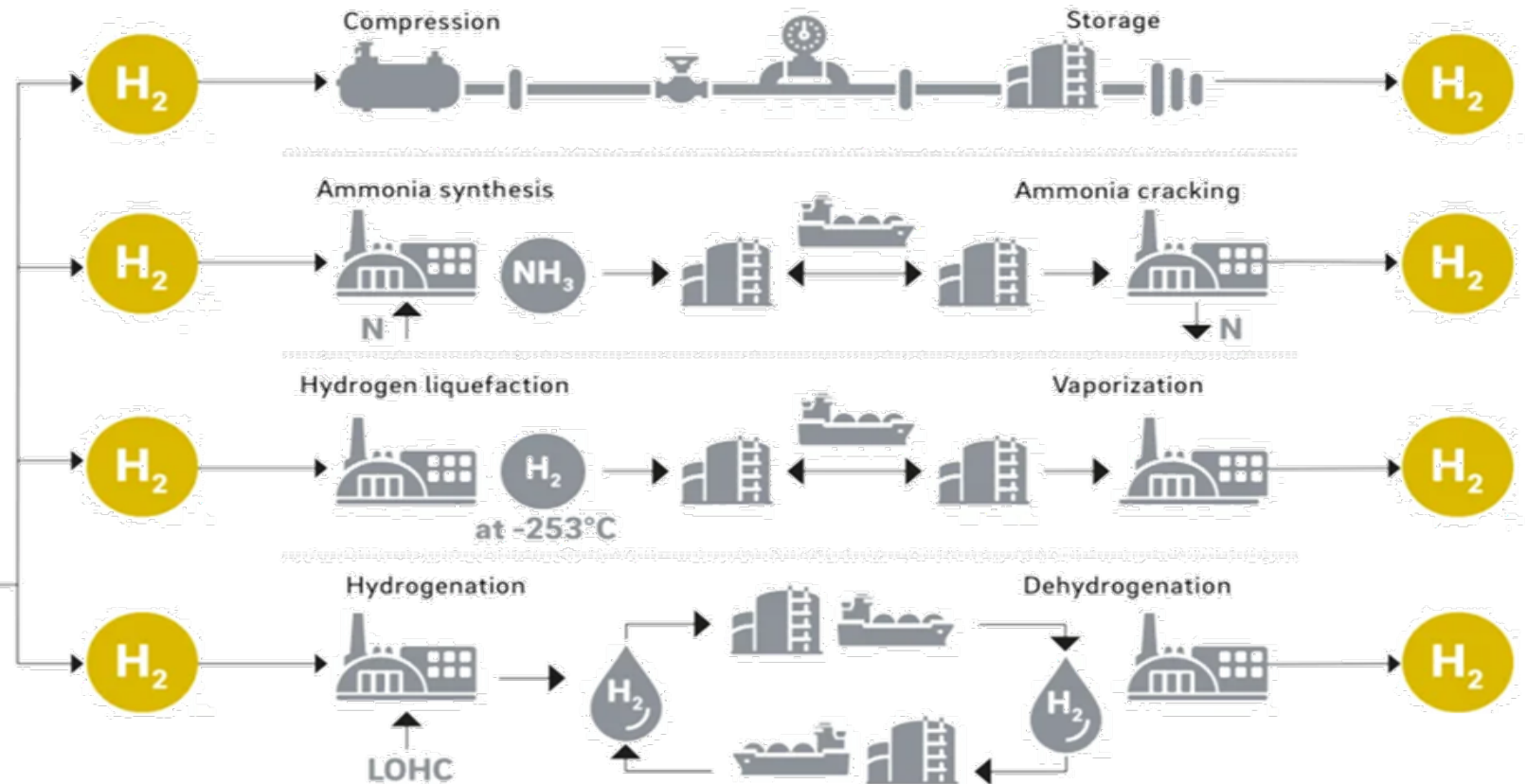
Liquefied hydrogen route (LH_2)

Liquid organic hydrogen carrier route (LOHC)



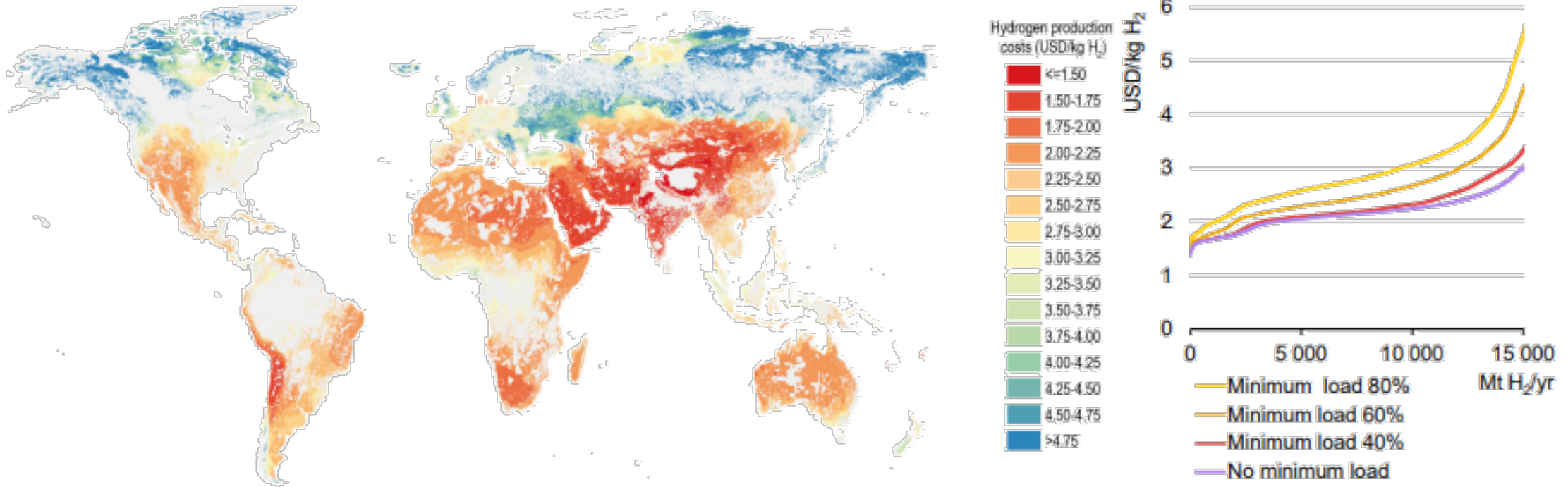
Converting hydrogen for storage, transport and reconversion

Hydrogen offtake



Hydrogen production costs from hybrid solar PV and wind systems for a minimum load of 40%, 2030 (left map)

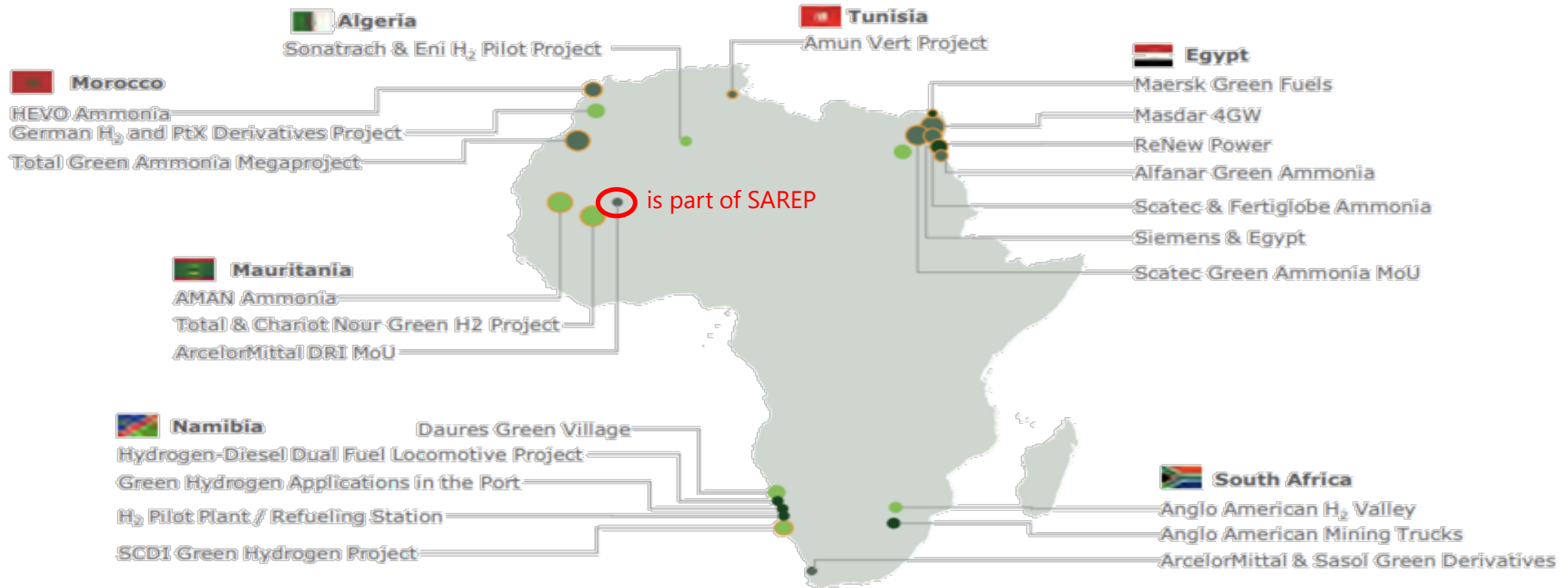
Global supply cost curves for different minimum load factors (right figure)



- Solar and onshore wind can power hydrogen production at **low costs** and **high load factors** when combined or coupled with storage.
- In Mauritania production cost to fall below **2.5 USD/kg H₂** by 2030, this is equivalent to energy costs of **60 USD** a barrel of fossil fuel.

Announced Green Hydrogen Projects

End use ● Mobility ● Industry feedstock¹ ● Various ○ Export
Size in MW ○ n/a ○ 0-10 ○ 100-3,000 ○ >3,000



23
green hydrogen
projects

3%
of globally
announced
projects

48 GW
electrolysis
capacity

USD 30 bn
announced
investment in
hydrogen value chain

* As on Oct 2022

Thank you for your
attention!



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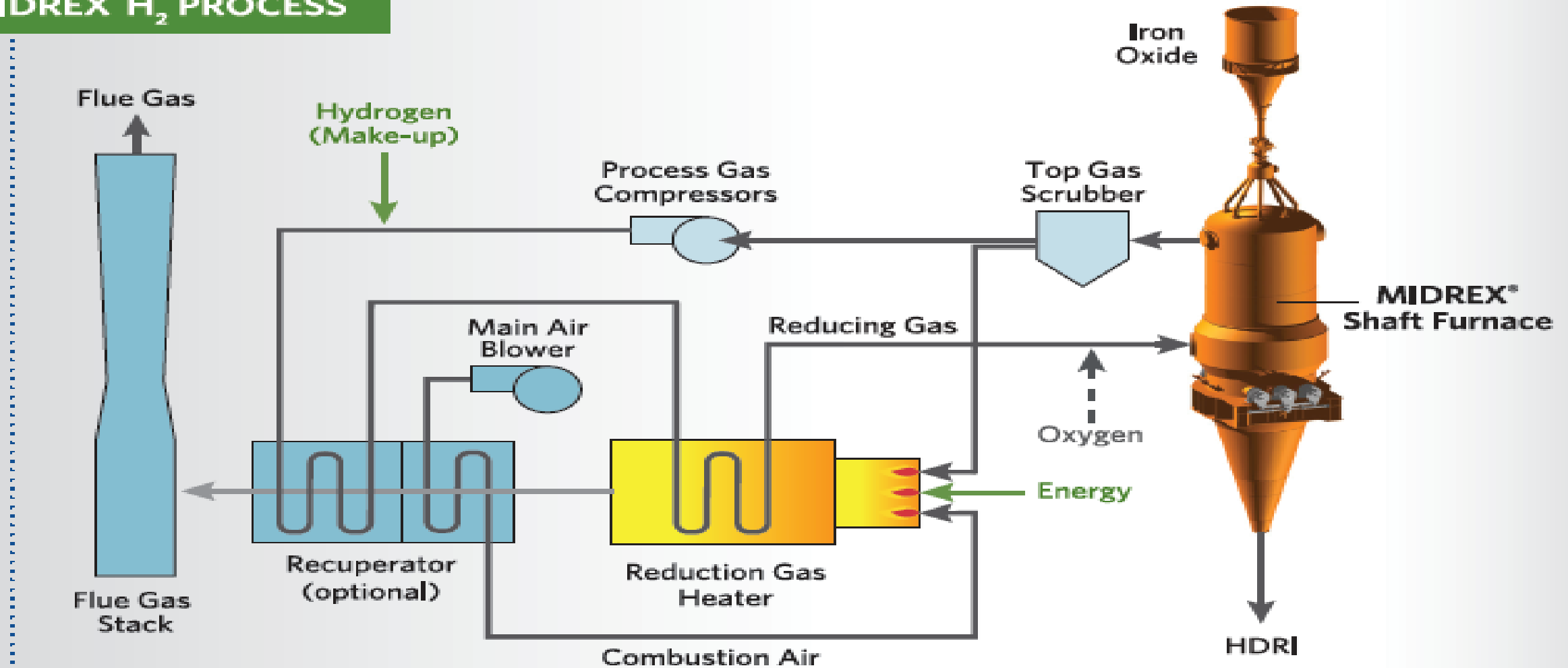
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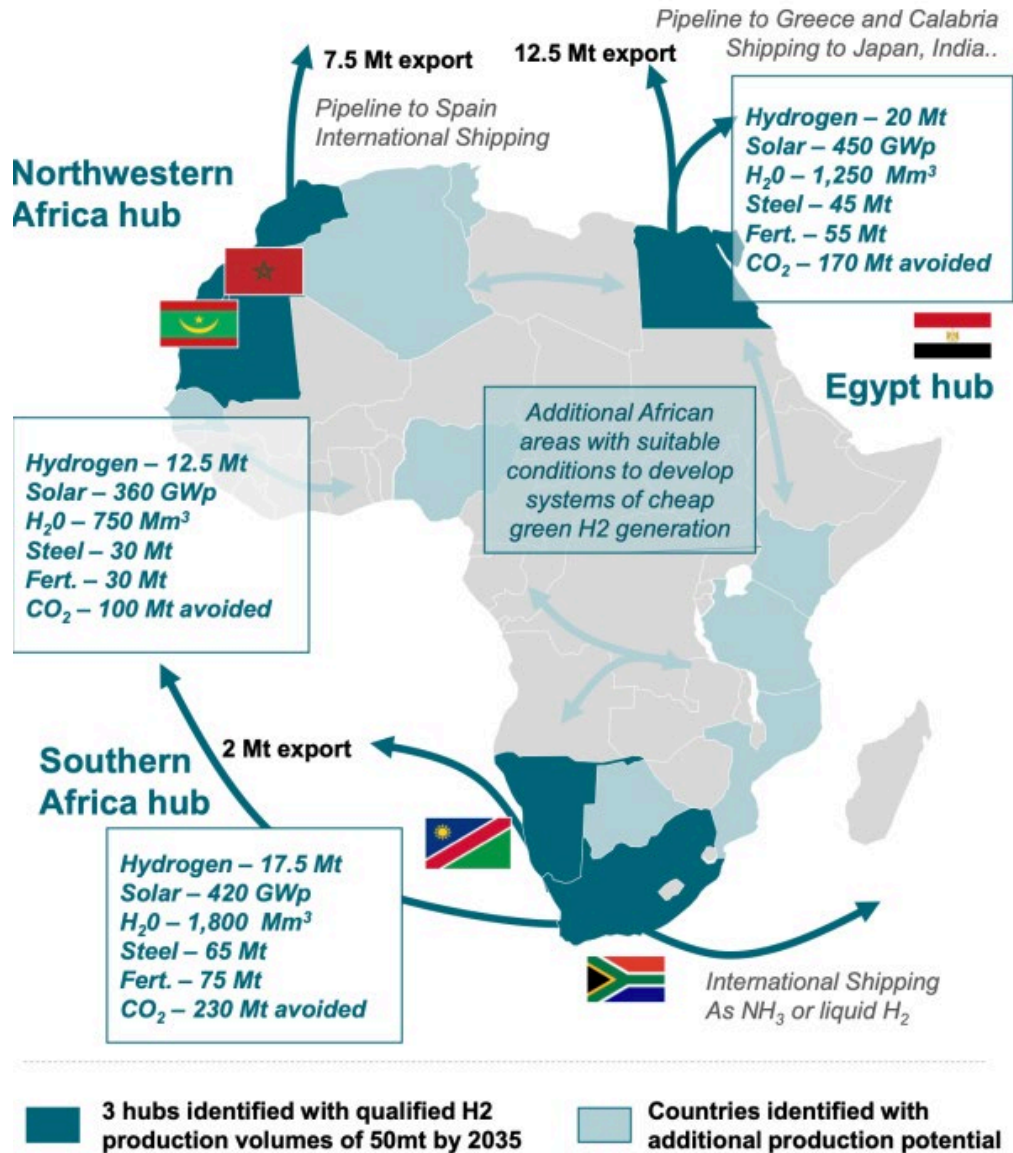
Website: www.stoffstrom.org

Production of Green DRI

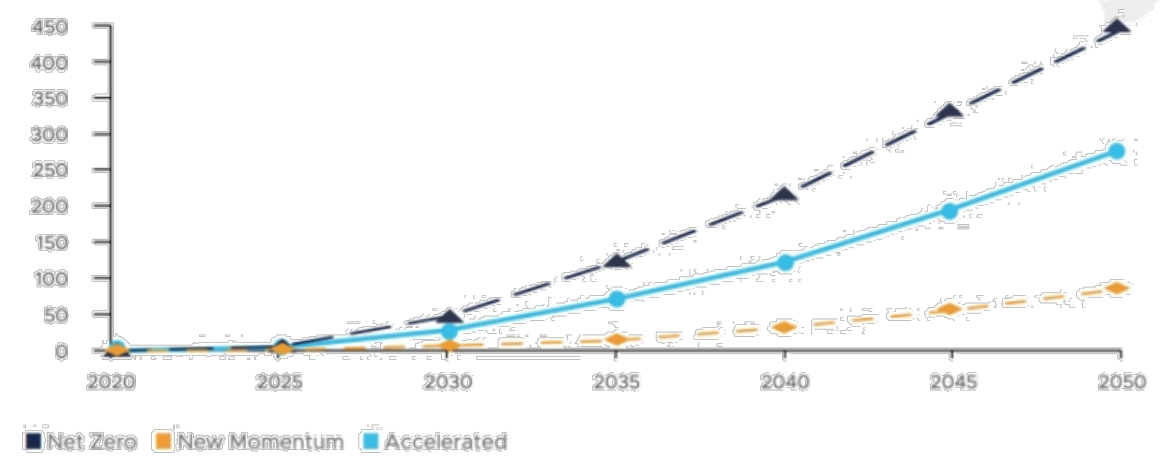
MIDREX H₂ PROCESS



Mauritania's Potential



Forecasted production of low-carbon hydrogen to 2050, MMt



- National strategy to increase renewable share upto **60%** by **2030**.
- Annual production capacity of **2 million tonnes** of green hydrogen by **2030**.
- Estimated **USD 60 billion** in investments by **2030**.
- **1 T€** green hydrogen investment can deliver the equivalent of more than one-third of Africa's current energy consumption.
- Boost GDP, improve clean water supply and empower communities.