RD20 contribution to South Africa's G20 Presidency

29 September 2025

science, technology & innovation
Department:
Science, Technology and Innovation
REPUBLIC OF SOUTH AFRICA

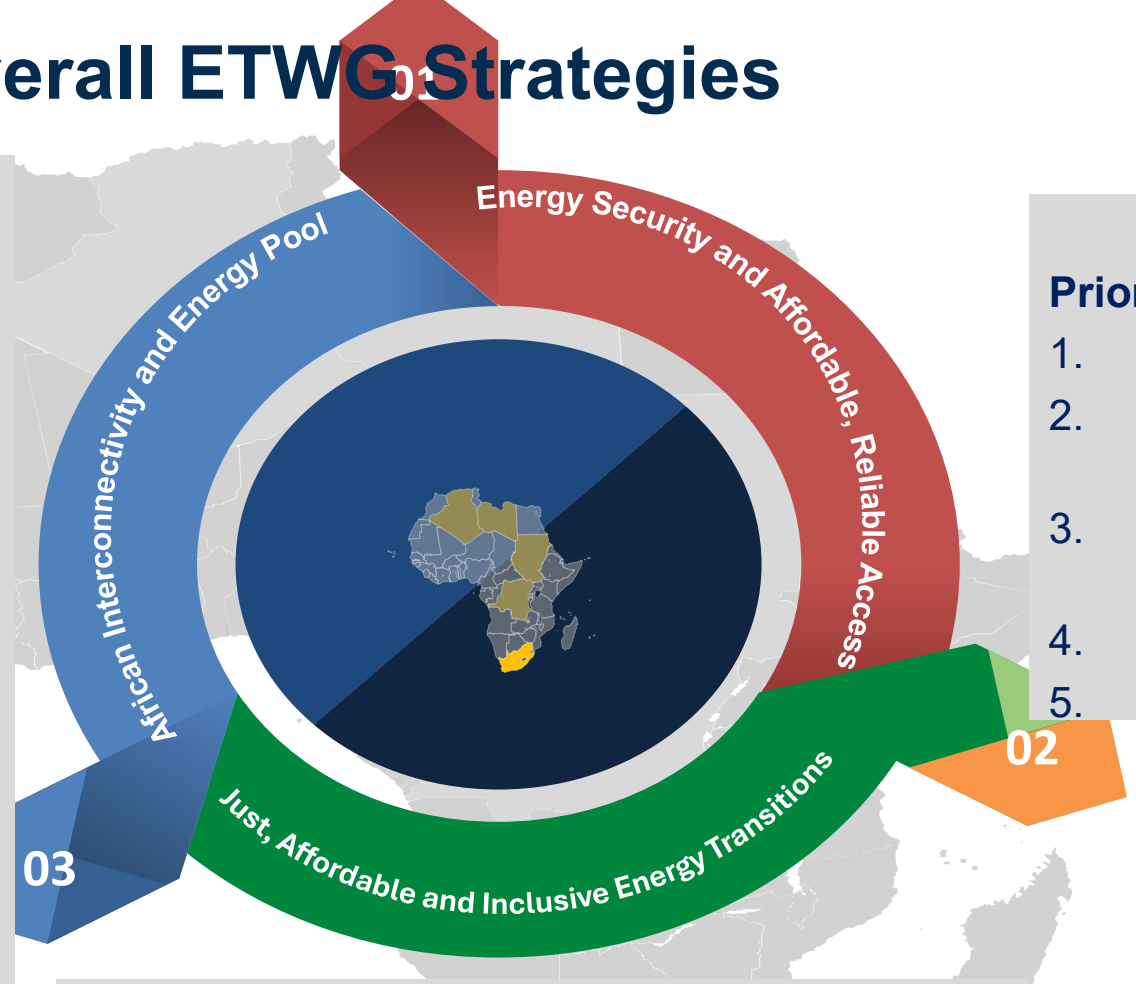
CSIR
Touching lives through innovation
80th anniversary

G20 ETWG Background

South Africa's Overall ETWG Strategies

Priority 3

1. Exchange best practices on regional interconnectivity with an action plan for achieving regional interconnectivity in Africa based on the three pillars
2. Ten-year infrastructure investment plan for Africa's Cross-Border Projects
3. Policy Harmonisation to support cross border trade.
4. Renewable Energy Corridors: Establish two corridors by 2030



Priority 1

1. Energy Security
2. Decentralised Energy Systems
3. Closing the clean cooking gap
4. Infrastructure resilience
5. Affordability framework

Priority 2

1. Sustainable Industrialisation Hubs, including hydrogen and ammonia
2. Socio-economic Safeguards for Fossil Fuel-Dependent Regions.
3. A G20 action agenda for affordable and inclusive transitions
4. Sustainable Fuels: with a focus on e-fuels for water stressed regions.

Outcome 1: Sustainable industrialisation Hubs, including Hydrogen and Ammonia

- **Priority Area:** Just, affordable and inclusive energy transitions
- **Outcome:** Sustainable Industrialisation hubs, including hydrogen and ammonia
- **Outcome Lead**: Kittessa Roro & Ebrahim Takolia (CSIR) supported by **IEA, RD20 and MI** and others

G20 Negotiated Outcome

Outcome 1

Output

G20 voluntary Principles for establishing sustainable industrial frontier hubs in Africa by 2027, including hydrogen and ammonia

Building Blocks

- Mobilise financing for sustainable industrialisation hubs
- Localising and regionalising industrialisation to enhance energy security
- Support continental and regional integration of hydrogen supply and demand

Focusing on

- Different pathways to achieve global net-zero greenhouse gas emissions / carbon neutrality.
- Creating long-term sustainable jobs and low-carbon industries.
- Funding options to enable sustainable industrialisation hubs.
- Unlock opportunities on industries such as manufacturing, steel, aviation, shipping, cement manufacturing, chemicals, refining and heavy duty logistics.
- Outlining the necessary intercontinental partnerships required to unlock funding, and advance joint R&D collaboration to accelerate technology development

RD20 Research and Development 20 for Clean Energy Technologies

MISSION INNOVATION

Outcome 3: A G20 action agenda for affordable and inclusive transitions

- **Priority Area: Just, affordable and inclusive energy Transitions**
- **Outcome:** A G20 action agenda for affordable and inclusive transitions
- **Outcome Lead:** Tshwanelo Rakaibe (CSIR) **support by IEA**

G20 Negotiated Outcomes

Outcome 3

Output

A G20 action agenda for affordable and inclusive transitions: Deepening Brazil's G20 principles and engaging the global Commission for people-centred transitions

Building Blocks

Jobs and skills

Fair distribution, affordability and access

Jobs social inclusion and participation skills

Focusing on

- Social protection, workforce development
- Local value creation in clean energy supply chains
- Transition assistance programmes for coal workers and inclusive economic growth

- Addressing energy poverty,
- Clean cooking, affordable solutions for low-income households and vulnerable groups,
- Community ownership and benefit-sharing models, and distributional effects

- Social dialogue and stakeholder engagement,
- Gender equity, indigenous rights and
- Youth participation.

5

Report Content – Negotiated Outcome

FOREWORD BY THE WORKING GROUP CHAIR

1 EXECUTIVE SUMMARY

2. INTRODUCTION AND BACKGROUND

3. GLOBAL HYDROGEN LANDSCAPE

4. SUSTAINABLE INDUSTRALIZATION HUBS

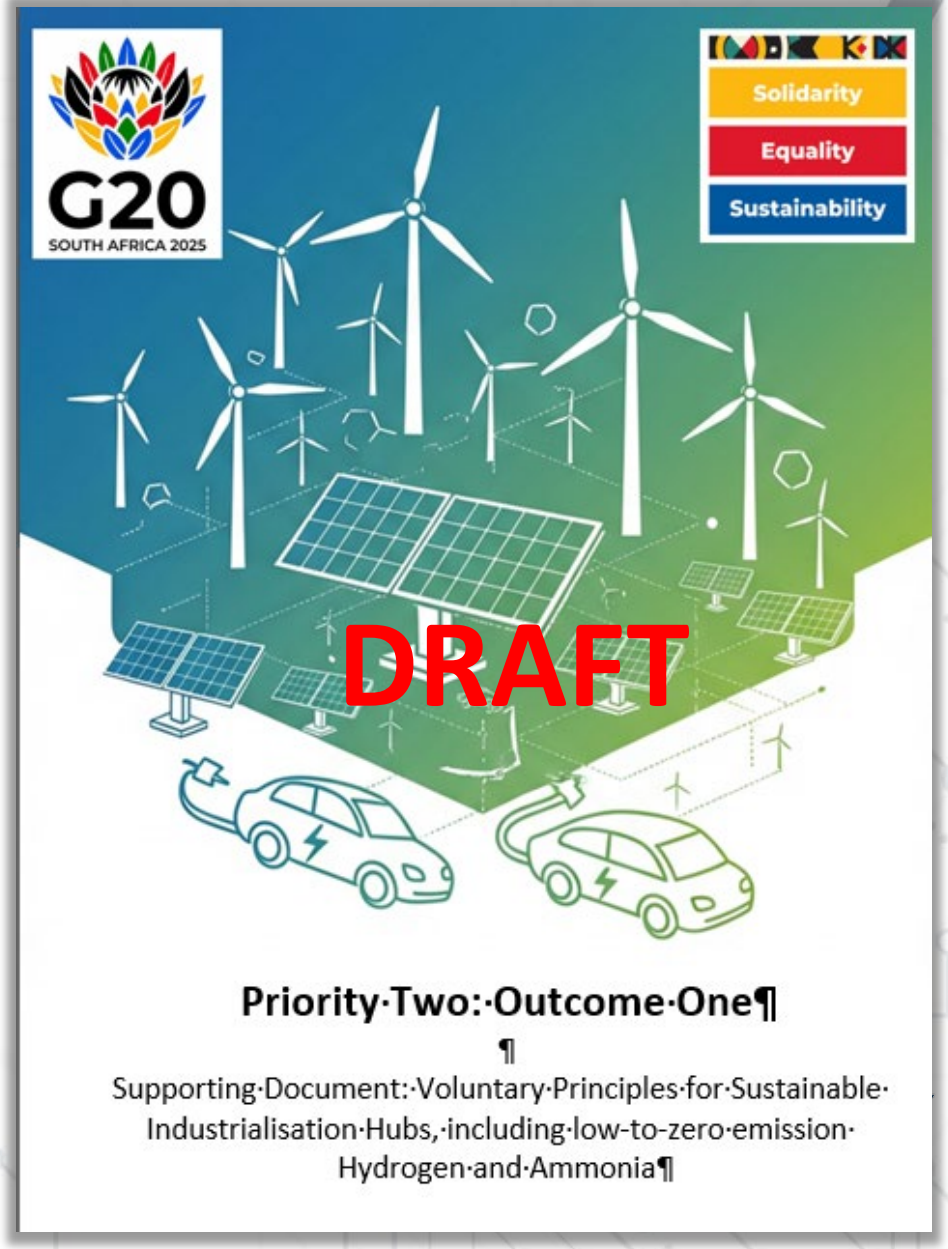
5. STRATEGIC PILLARS FOR ACTION

Current status of Ammonia technology

(Drafted by Y. Manaka, S.Y. Chen, M. Nishi, N. Iki, Y. Fan, T. Nanba, AIST)

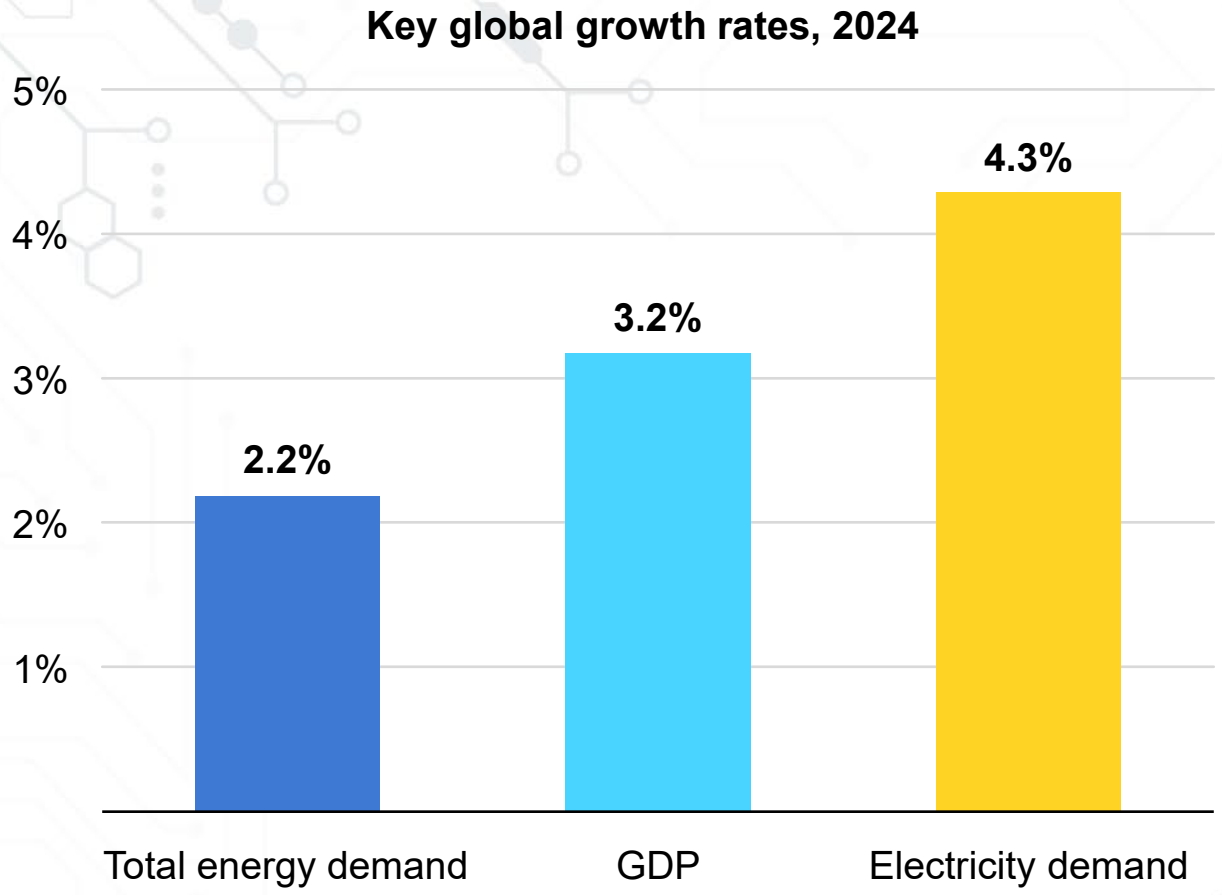
1. Fundamental Properties of Ammonia

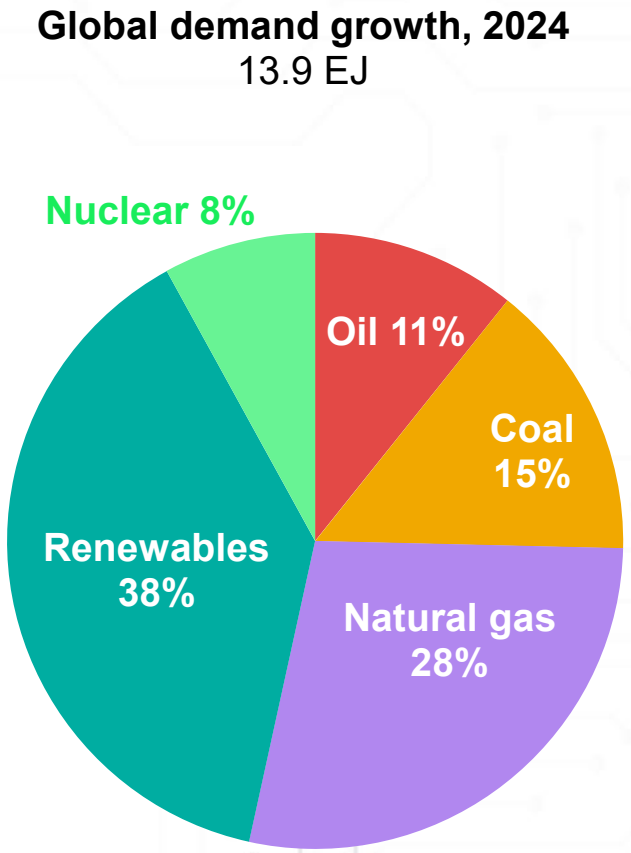
Ammonia, with the molecular formula NH_3 and a molar mass of 17.031 g/mol, is a compound that contains no carbon atoms. Under standard temperature and pressure, it is a colorless gas characterized by a pungent odor, toxic and corrosive properties. However, due to its ability to be liquefied under relatively mild conditions—such as at atmospheric pressure and −33 °C, or at ambient temperature and 0.85 MPa—it is considered relatively easy to handle.



Review of the latest Energy Trends – with a focus on Sustainable Industrialisation

Growth in global energy demand surged in 2024, driven by electricity

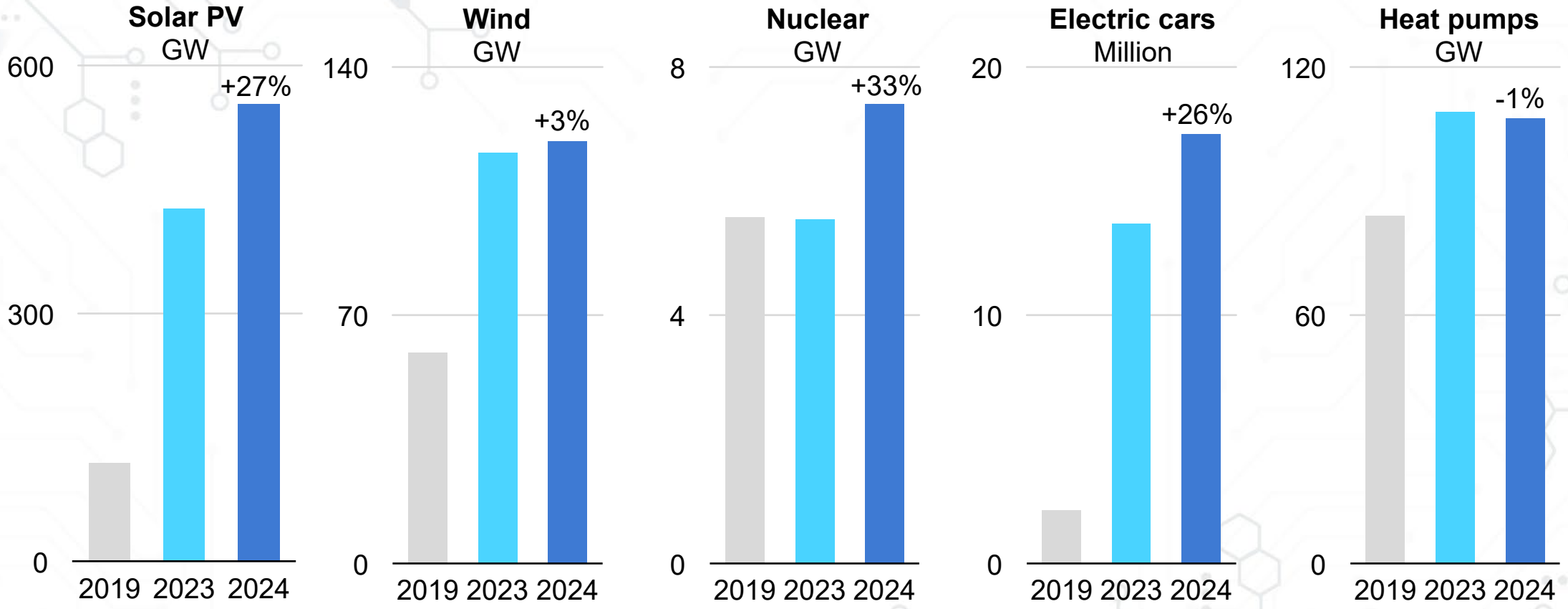




Energy demand grew faster than the average over the past decade, driven by a record increase in electricity. Despite a significant slowdown, China still accounted for most of the increase in demand, followed by India

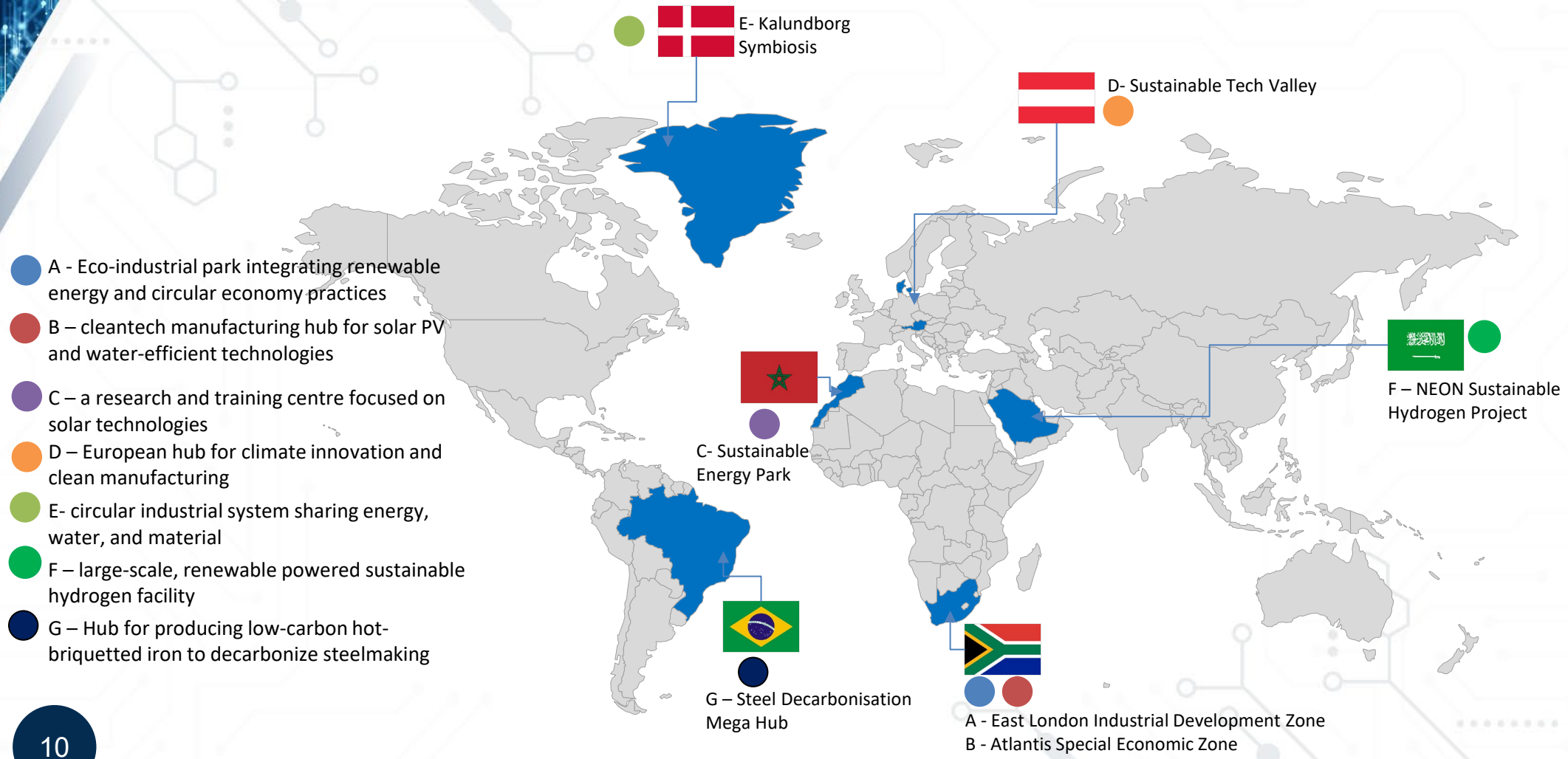
Deployment of most key clean energy technologies remained strong

Technology deployment, 2019-2024



Solar PV saw its 12th consecutive year of record additions and nuclear experienced the largest jump. Electric vehicles accounted for one-fifth of car sales, in line with IEA projections. Heat pumps sales stalled.

Emerging and operational SIH



- A - Eco-industrial park integrating renewable energy and circular economy practices
- B – cleantech manufacturing hub for solar PV and water-efficient technologies
- C – a research and training centre focused on solar technologies
- D – European hub for climate innovation and clean manufacturing
- E- circular industrial system sharing energy, water, and material
- F – large-scale, renewable powered sustainable hydrogen facility
- G – Hub for producing low-carbon hot-briquetted iron to decarbonize steelmaking

Source: UNIDO and CSIR

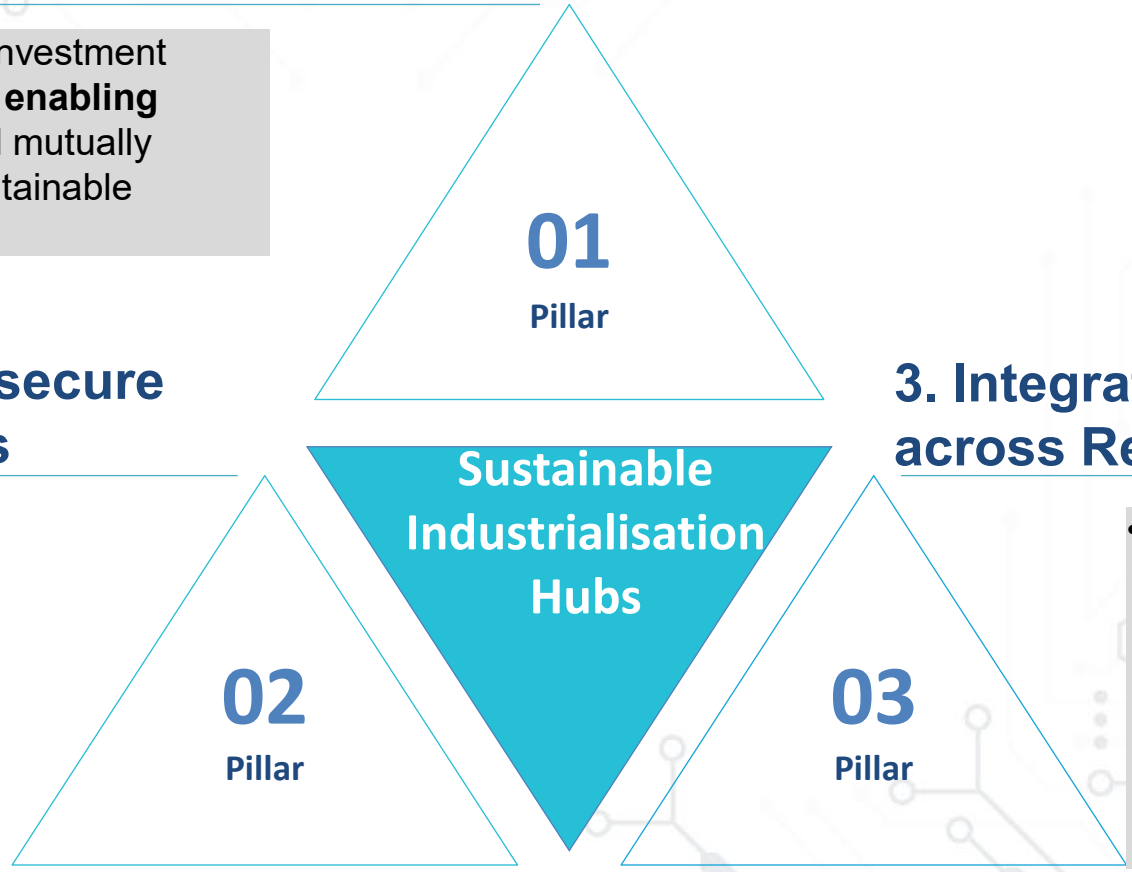
Pillars of Outcome 1 – Sustainable Industrialisation Hubs

1. Financing Sustainable Industrialisation Hubs

- **Lowering financing** and addressing investment barriers, **fostering partnerships**, and **enabling technology transfer** on voluntary and mutually agreed terms is critical to scale up sustainable industrial development.

2. Industrial strategies for secure and resilient supply chains

- **Underscores** the imperative of prioritizing **the development and adoption of these technologies**, tailored to national circumstances, needs and priorities while **promoting cooperation** and investment in **clean energy technologies.**



3. Integrating Hydrogen Economies across Regions

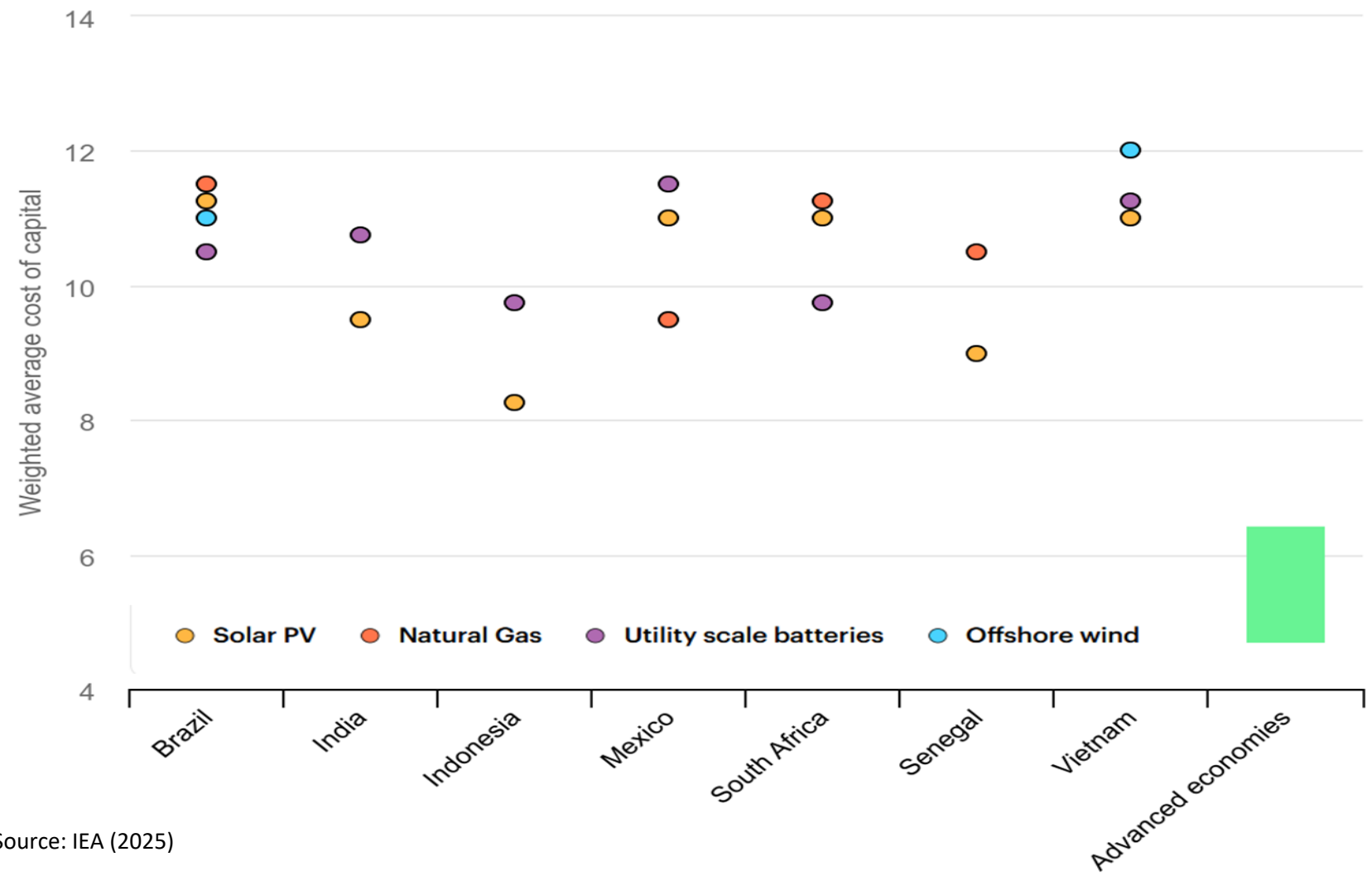
- **Facilitate** the development of regional hydrogen hubs (and derivatives) produced from zero and low-emission technologies and leverage from **global initiatives** to support developing countries through joint **R&D**, skills development and pilot projects..

Source: SA's G20 ETWG Priority 2: Outcome 1 " Voluntary Principles for Sustainable Industrialisation Hubs, including low-to-zero emissions Hydrogen and Ammonia

Financing Sustainable Industrialisation Hubs

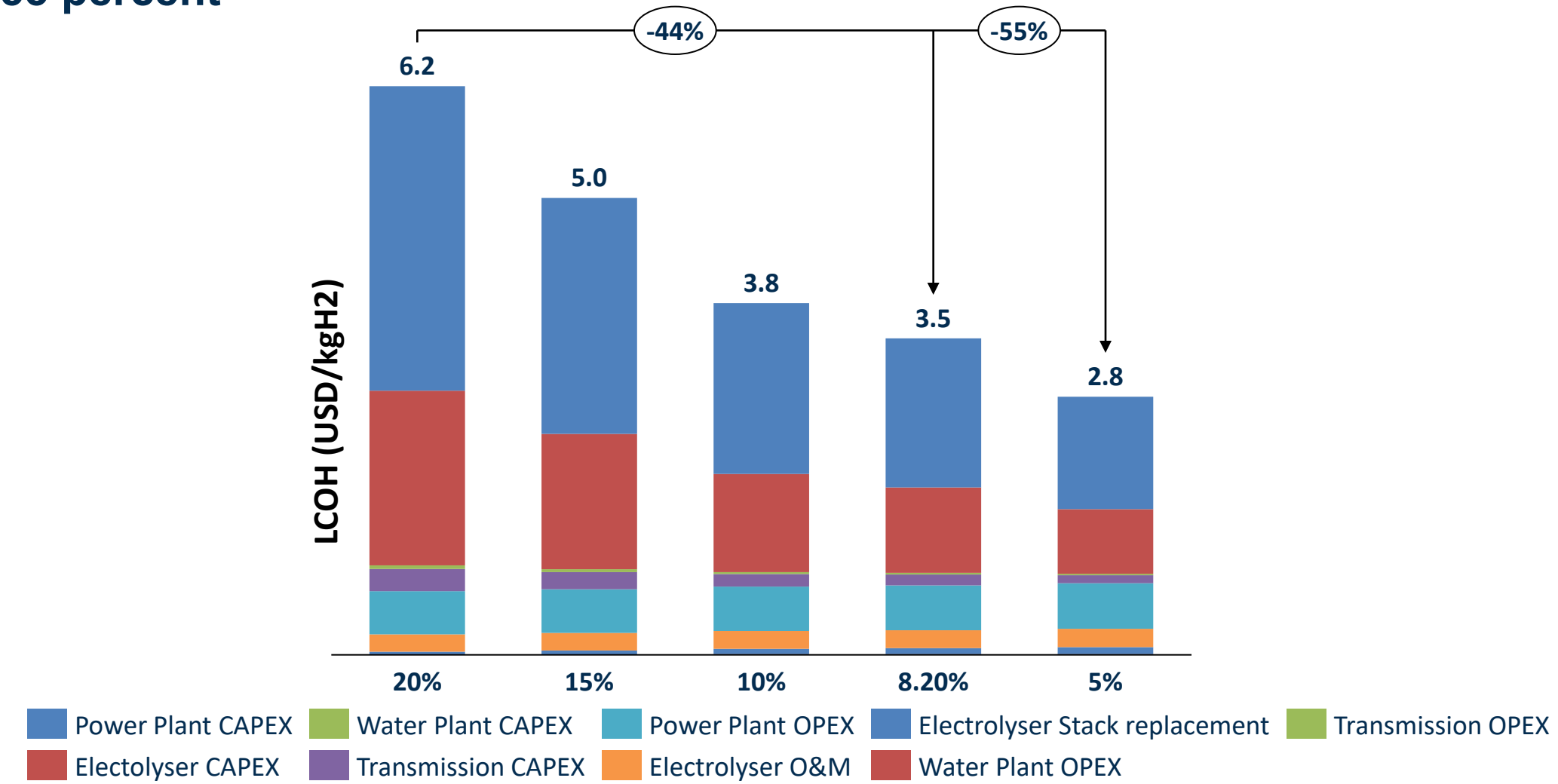
Cost of Capital

The cost of capital for solar PV and storage projects in emerging and developing economies can be more than double the value in advanced economies, making it much more challenging to get projects off the ground



Source: IEA (2025)

Assuming production cost factors remain the same, a fourfold reduction from 20 percent to 5 percent in the cost of capital could reduce the estimated LCOH by up to 55 percent



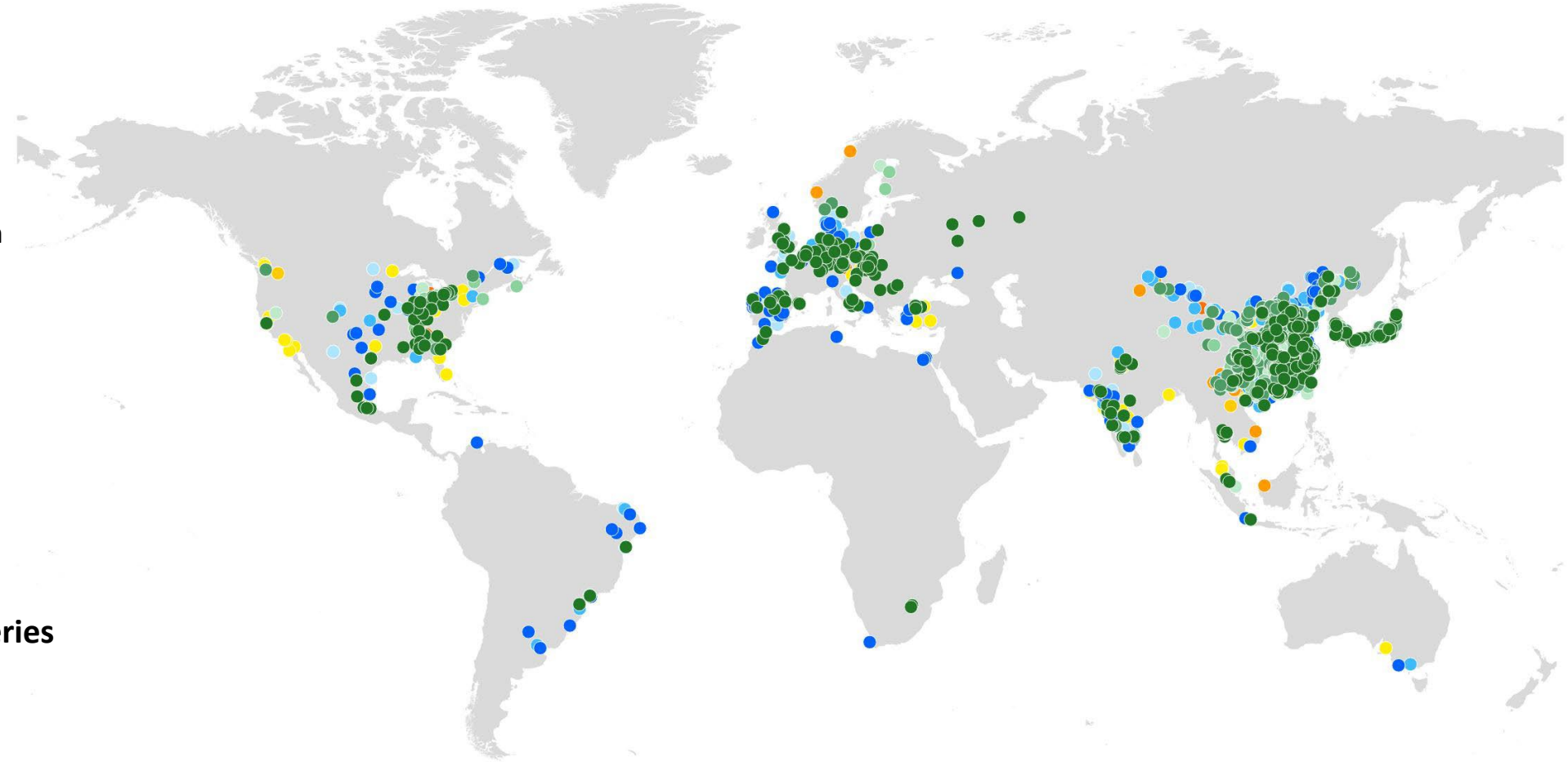
Source: CSIR Analysis (2025)

Note: A 20 MW alkaline electrolyser mounted in 2030 in Mossel bay, powered by a hybrid solar PV / wind renewable plant located at Albertinia, 48.98 km from the electrolyser by a purpose built transmission line. The electrolyser stack life is assumed to be 95 000 hours. The wind farm comprises Vestas V100-1.8 wind turbines, mounted at 120 m hub height. Power production from the wind turbines is assumed to degrade by 0.1% per year. The solar PV is single-axis tracking with back-tracking, performance is expected to degrade by 0.4% per year. The renewables plant is oversized by 150% relative to the electrolyser capacity 20 MW, i.e. it is 250% of the electrolyser capacity, or 50 MW. The solar fraction of the hybrid plant is 50%, i.e 25 MW solar PV, 25 MW wind. Water is supplied by a desalination plant. The electrolyser is assumed to consume 25 kg water per kg of hydrogen produced, for feedstock and for cooling. All plant is assumed to have a 25 year life. Assuming an islanded grid, i.e. any excess electricity is curtailed, it is not sold back to the grid for 5 WACC values: 5%, 8.2% (default), 10% and 15% and 20%.

Industrial strategies for secure and resilient supply chains that ensure opportunities for shared value creation

Investment in clean technology manufacturing is booming

Clean technology manufacturing facilities in operation, 2023



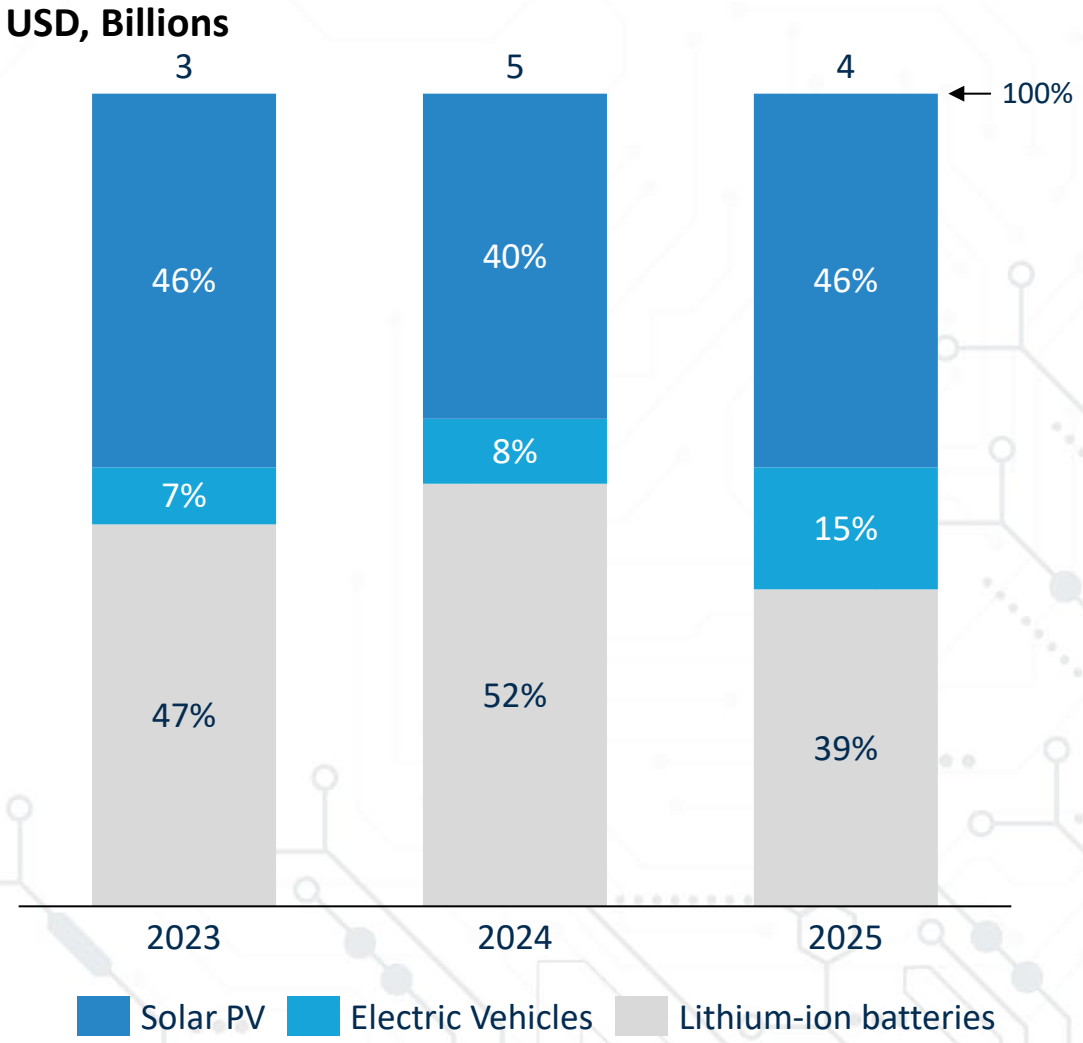
Imported value of solar PV modules, assembled electric vehicles and lithium-ion batteries into Africa, 2022 - 2024

$266bn
African export of raw and processed critical minerals (2023)

$4bn
Import value of solar PV Modules, batteries and Electric vehicles (2024)

$8bn
Projected import value Of solar PV modules alone in Africa (2025-30)

146,000
Annual jobs in solar PV assembly along (2024 – 50)

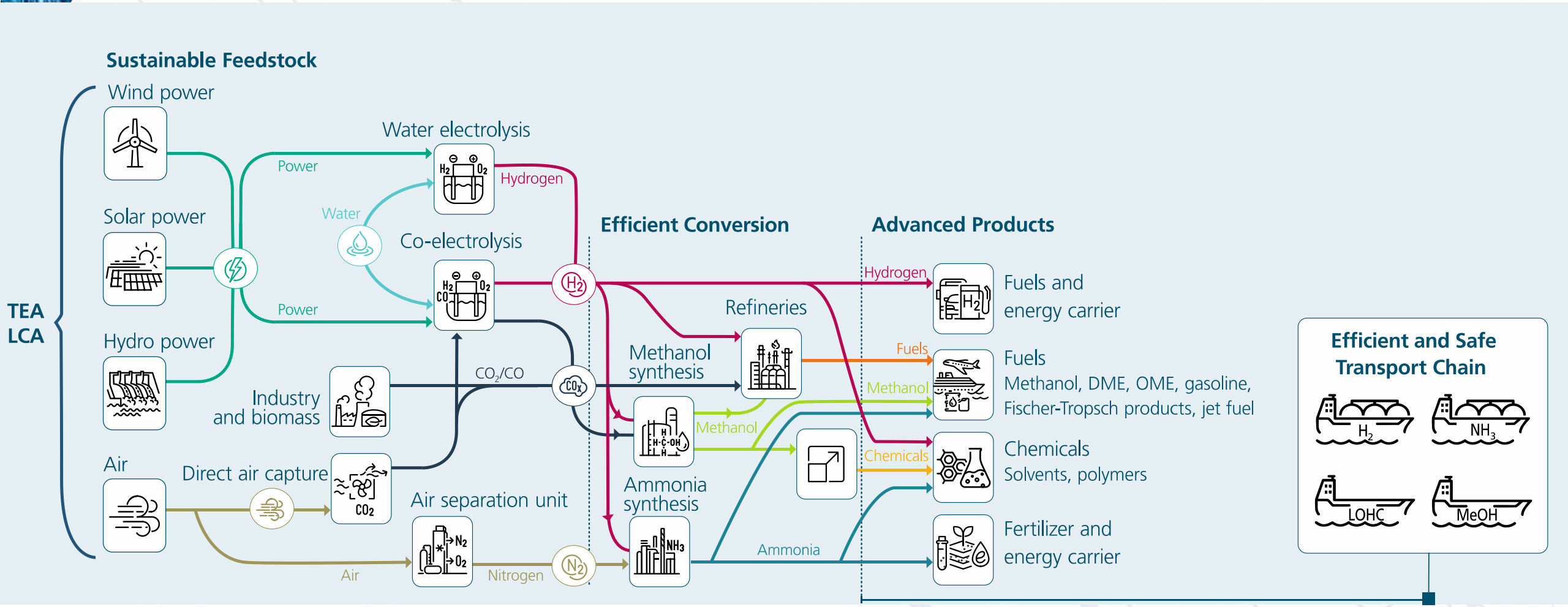


Source: UN Comtrade Database (n.d.). Note: Based on HS Codes: 854143, 850760, 870380.

Integrating hydrogen economies across regions

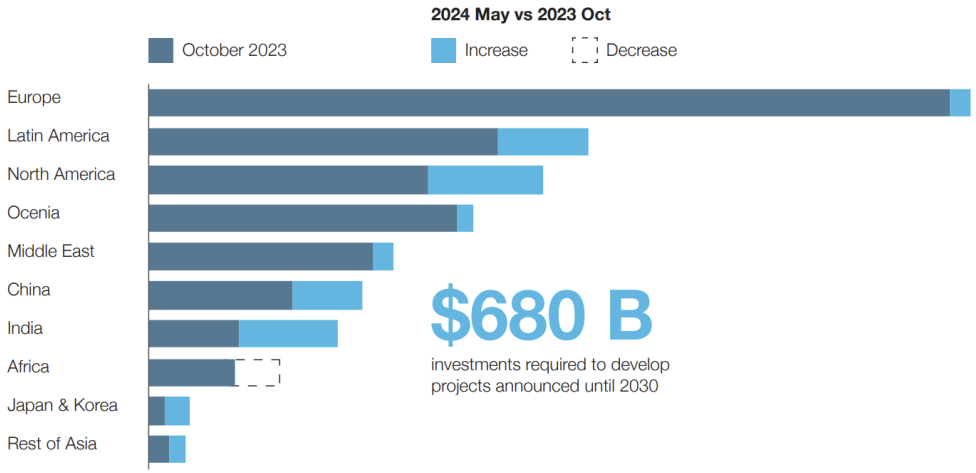
Sustainable Energy Carriers, Fuels and Base Molecules

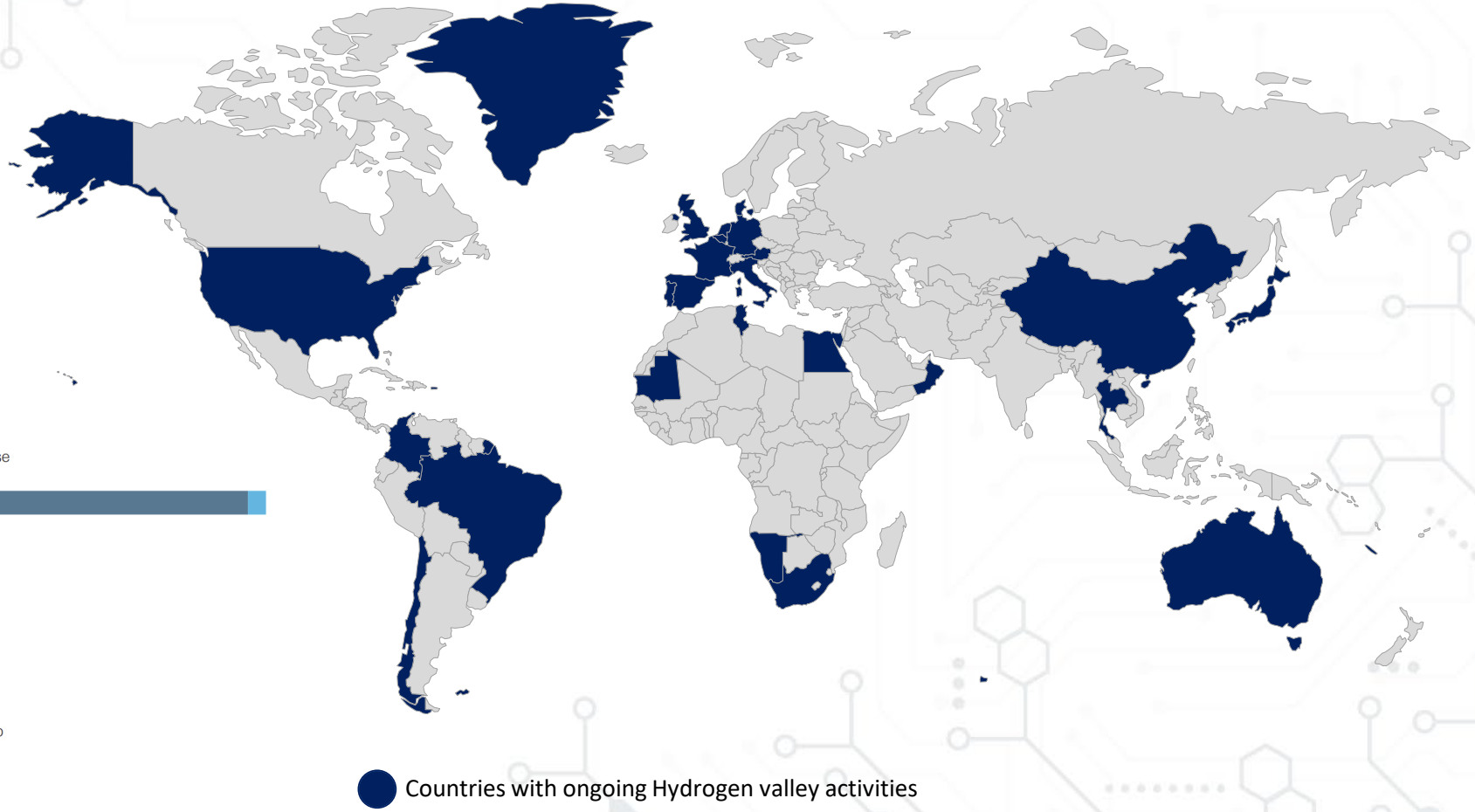
The promise of salvation: Power-to-X | H_2-based sustainable molecules for mobility, industry & chemistry



Source: Fraunhofer Inst.

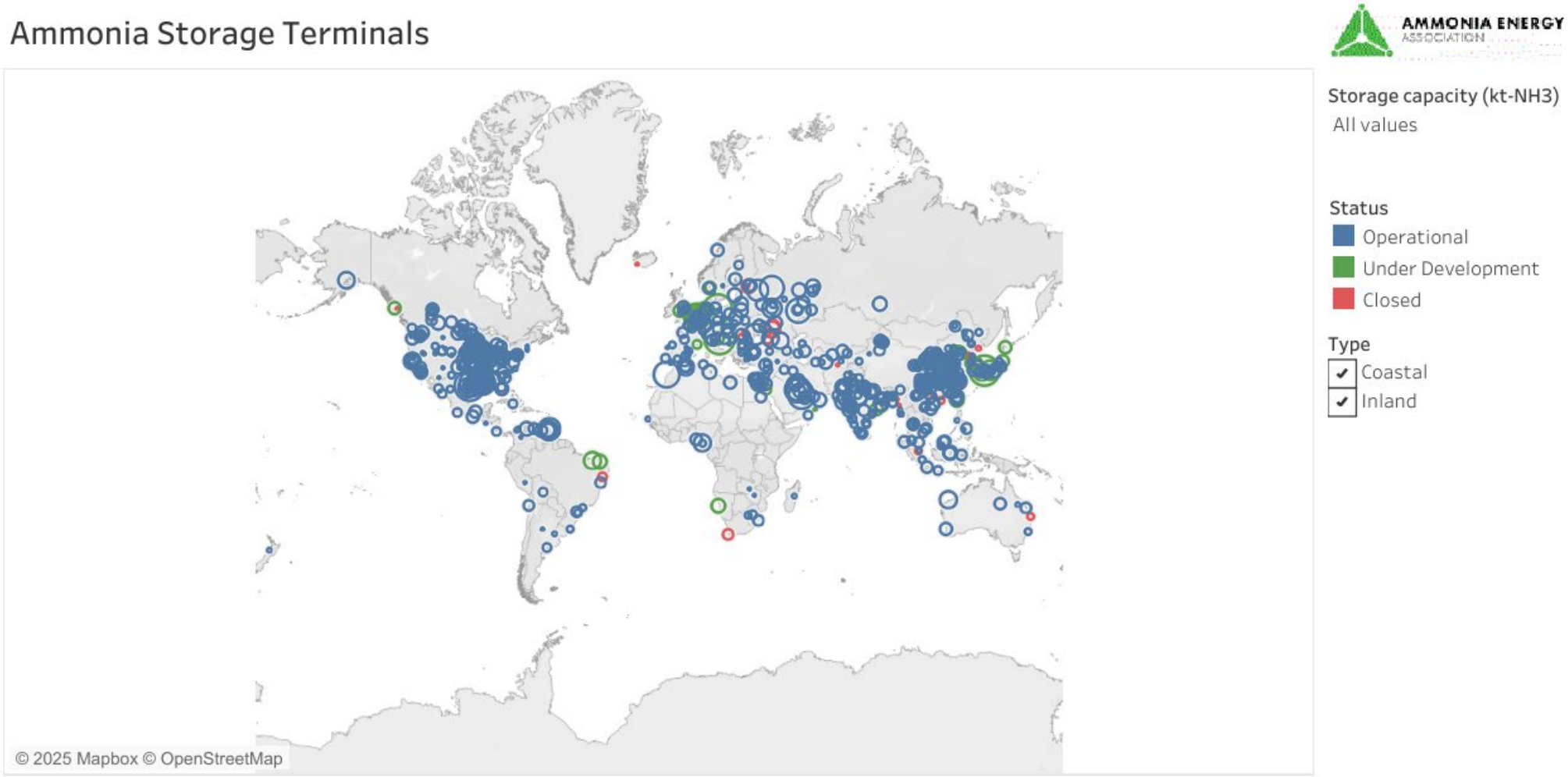
Global hydrogen valley – projects from mission innovation hydrogen valley platform





Source: Mission Innovation (Hydrogen valley)

Ammonia Storage terminals



Source: Ammonia Energy Association (2025)

Current Status of Ammonia technology

01 Demand

- Fertiliser feedstock (traditionally),
- Global ammonia production exceeds 185 million tonnes annually and it's expected to grow at **roughly 2% per annum**

02 Potential of ammonia

- Low carbon fuel driving innovation across multiple sectors
- **Power Generation** – demonstration projects achieved up to 20% ammonia co-firing in coal plants without increasing Nox emission
- **Maritime transport**, duel-fuel ammonia diesel engines are already undergoing commercial trials
- **Industrial applications** are also emerging including partial fuel switching in glass, cement, metals, and ceramics production

03 R&D Role in ammonia production

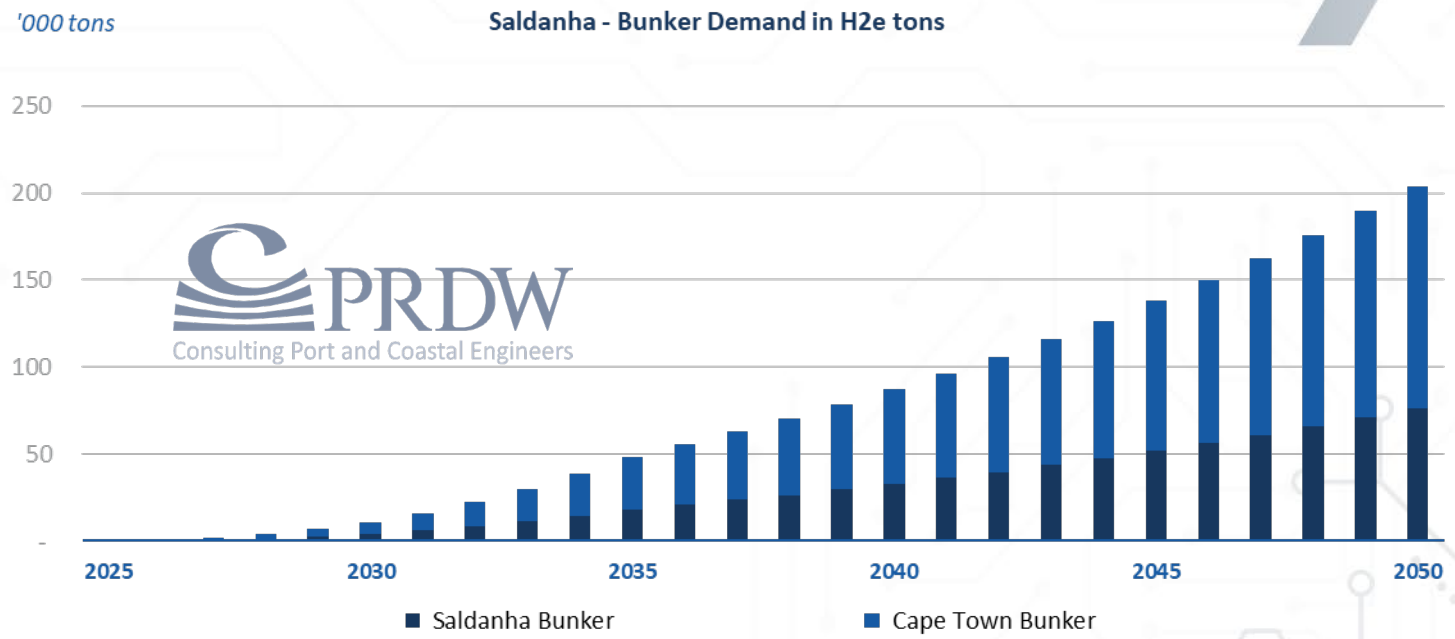
- Safety
- Efficiency
- Environmental impact for large scale deployment

Design Drivers: Market Demand – South Africa's Perspective

Hydrogen Demand: Saldanha

- Via Saldanha, bunkers could be supplied to Cape Town to offer **green ammonia** as bunker fuel in this port

- Transport between the ports can be conducted by various means:
  - By pipeline
  - By trucks
- Apart from the investments in a larger scale facility, investments are required to make transport of bunker fuels between the two ports possible



Bunker Demand	2025	2026	2027	2028	2029	2030	2035	2040	2045	2050
Saldanha - Base Case – tons	-	153	623	1,425	2,593	4,117	18,250	32,655	51,963	76,599
Saldanha - Vessels Bunkered - #	-	0	1	2	4	7	31	55	88	130
Cape Town - Base Case – tons	-	254	1,034	2,369	4,289	6,853	30,326	54,384	86,022	127,226
Cape Town - Vessels Bunkered - #	-	1	2	5	10	15	68	122	193	286
Total – Base Case - tons	-	407	1,657	3,794	6,882	10,970	48,575	87,040	137,985	203,825
Total – Vessels Bunkered - #	-	1	3	8	14	22	99	177	281	415

Source: https://documents1.worldbank.org/curated/en/099091924182027103/pdf/P177583192b9f70b318ca31e282e97622fb.pdf

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Recommendations

Recommendations

01 Collaboration:

Leveraging global initiatives like the RD20, Breakthrough Agenda, and Clean Hydrogen Mission to support developing countries through joint R&D, skill development, pilot projects, and policy alignment on standards and certification for zero and low emissions hydrogen and derivative sectors

02 Development of regional hubs

Facilitating the development of regional hydrogen hubs produced from zero and low-emission technologies produced from zero and low-Emission that connect producers, users, financiers, and technology technologies providers, with a focus on shared value creation and skills development.

03 Enhancing regional and global alliances

Create enabling environments for trade, certification, and investment in hydrogen produced from zero and low-emission technologies, especially in Africa and other emerging regions.

04 Harmonising methodologies for certification systems

Thank you