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The green hydrogen economy: Are there windows of opportunity for development?

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Introduction

- Green hydrogen will play an important role in new technological trajectories across ‘hard-to-abate sectors’, energy and transport.

- The energy transition may open windows of opportunity for developing countries to catch up and forge ahead in green sectors and related value chains.

- Massive investments in green technologies are taking place. How these investments are ‘shaped’ is critical.

- **What are the green hydrogen opportunities in the Global South and what policy initiatives are needed to turn them into reality?**

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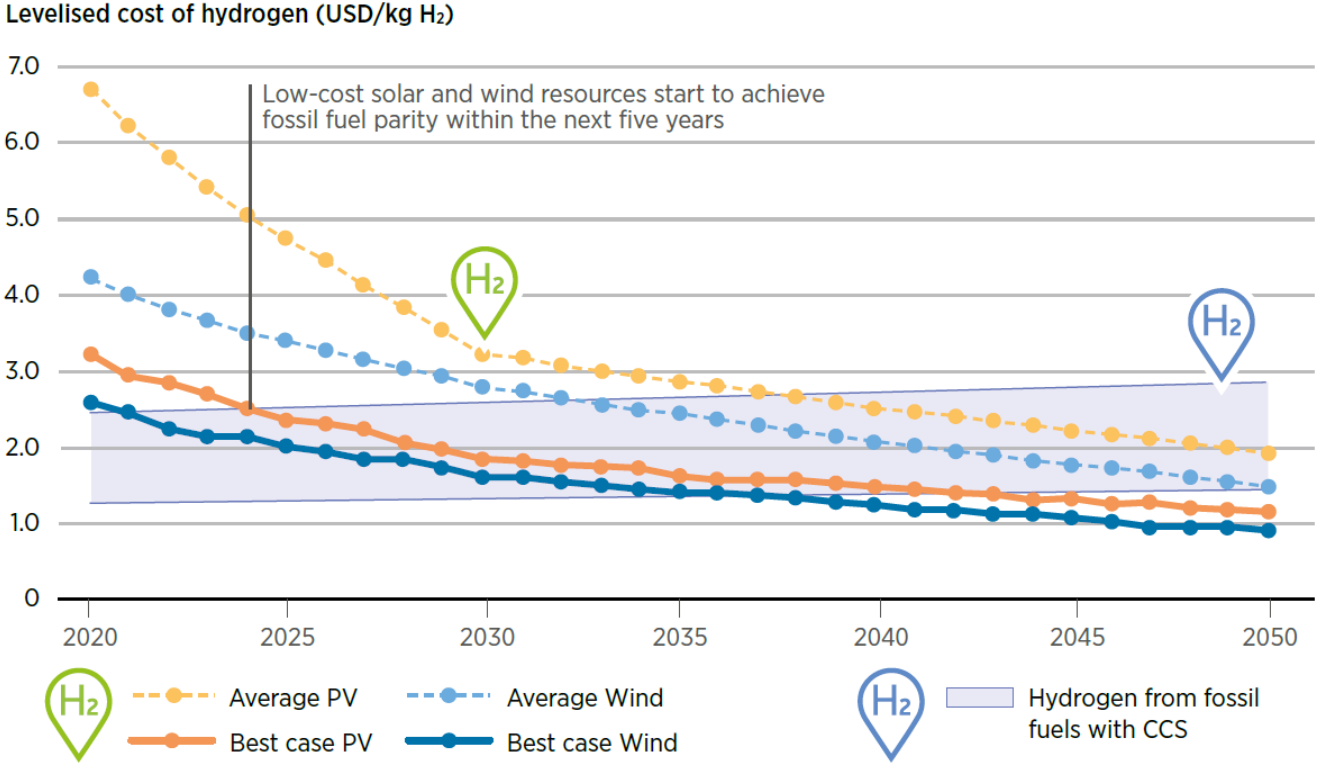
Green hydrogen production costs: Approaching competitiveness with blue hydrogen

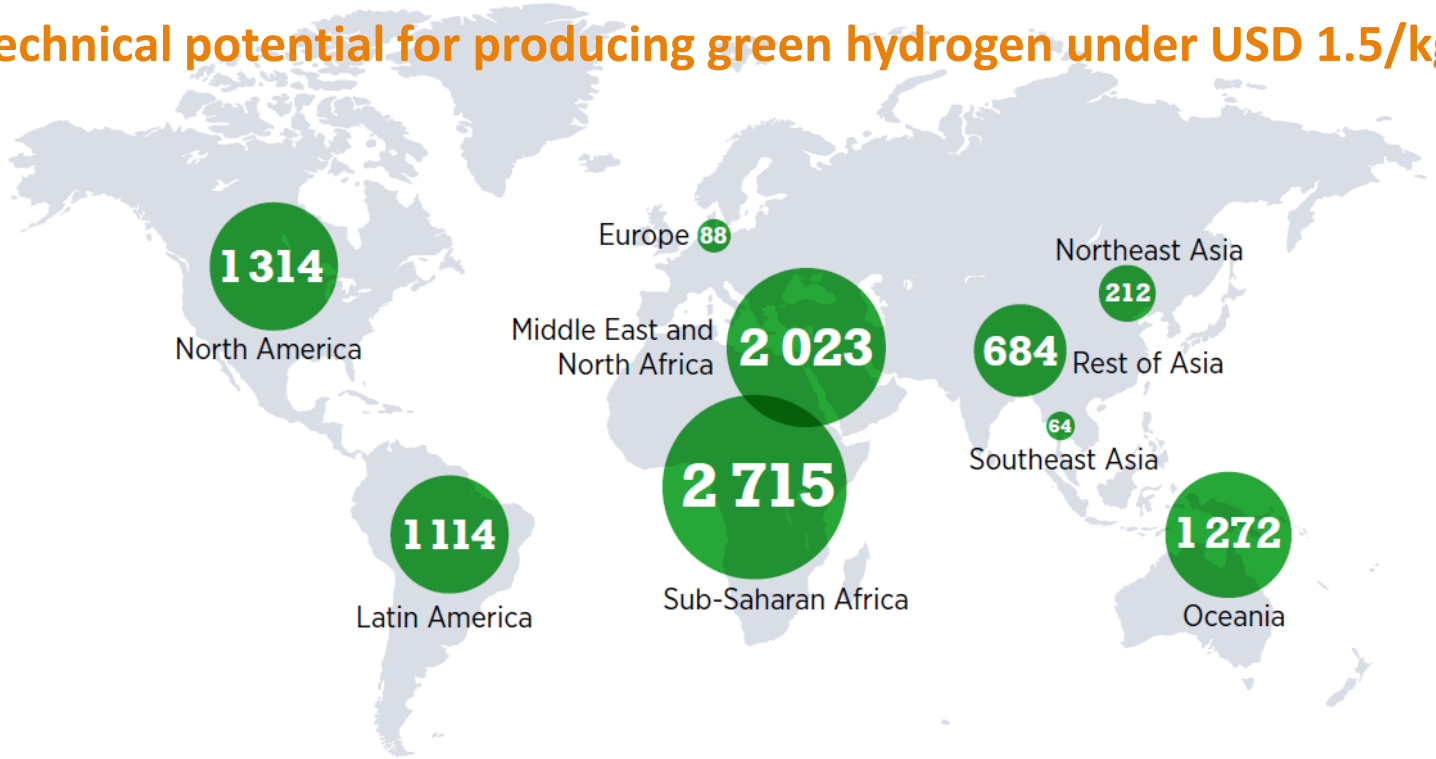
Hydrogen production costs from solar and wind vs. fossil fuels with carbon capture and storage, 2020-2050



Note: Electrolyser costs: 770 USD/kW (2020), 540 USD/kW (2030), 435 USD/kW (2040) and 370 USD/kW (2050). CO_2 prices: USD 50 per tonne (2030), USD 100 per tonne (2040) and USD 200 per tonne (2050).

Source: Irena 2020

Technical potential for producing green hydrogen under USD 1.5/kg by 2050, in EJ



Source: IRENA (fothcoming-a). Map source: Natural Earth, 2021

Note: Assumptions for capital expenditures (CAPEX) 2050 are as follows: PV: USD 225-455/kW; onshore wind: USD 700-1 070/kW; offshore wind: USD 1 275-1 745/kW. Weighted average cost of capital: Per 2020 values without technology risks across regions. Technical potential has been calculated based on land availability considering several exclusion zones (protected areas, forests, permanent wetlands, croplands, urban areas, slope of 5% [PV] and 20% [onshore wind], population density). Water availability was not considered in the analysis. EJ = exajoule; kW = kilowatt.

Creation and appropriation of economic co-benefits is key!

The primary benefits

- Climate change mitigation
- Energy supply and security

The secondary benefits (the economic co-benefits)

- Local jobs created
- Local supply chains developed
- Local technological capabilities improved
- Local competitiveness improved

Seizing green windows of opportunity (GWO) means that BOTH types of benefits are captured

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Co-benefits: Green hydrogen windows of opportunity

Backward links

- Renewables

- Development of competitive RE industries and supply chains

Green hydrogen

- Electrolysers
- Fuels
- Fertilisers

- Green hydrogen exports
- Exports of transformed outputs
- Green hydrogen technology exports

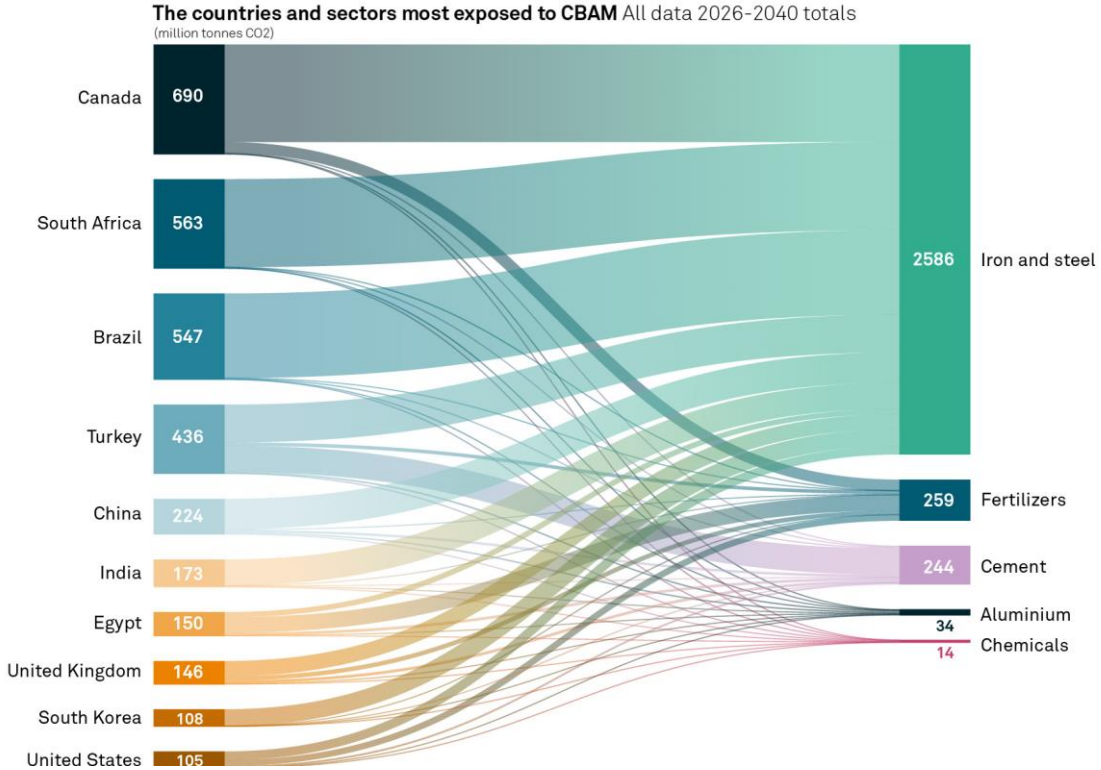
Forward links

- Industry
- Transport
- Agriculture

- Competitiveness in decarbonised production

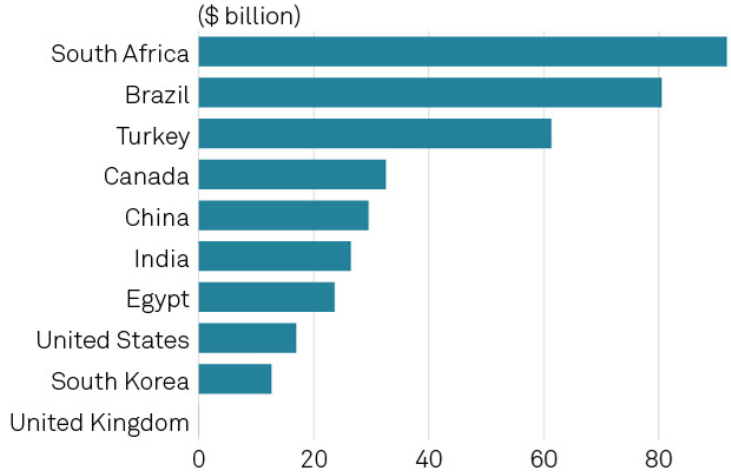
Developing economies hit hardest by EU's carbon border tax

The EU's Carbon Border Adjustment Mechanism is set to have far-reaching impacts on world trade and the wider energy transition. Phasing in from 2026, CBAM will levy a carbon tax on imports of selected energy intensive materials and products into the EU, removing the gap between the EU's ETS carbon price and the export country of origin's carbon price. Analysis by S&P Global Commodity Insights shows Canada, Brazil, South Africa and Turkey will be most exposed to the mechanism, with iron and steel by far the biggest sector targeted.



South Africa, Brazil, Turkey at most risk due to high iron and steel exports

Forecast CBAM cost, 2026-2040



S&P Global
Commodity Insights

Source: S&P Global Commodity

There is nothing automatic about co-benefits!

They depend on sectoral systems of production and innovation:

- **Preconditions**
  - Natural conditions
  - Home market
  - Industrial structure and capabilities
- **Responses**
  - Public sector
  - Private sector
- **Sector characteristics**
  - Technological maturity
  - Tradability

Seizing green windows of opportunity: four scenarios

Preconditions / Responses	**Strong**	**Weak**
Strong	**Scenario 1:** **Realised opportunity** Effective GWO seizing	**Scenario 2:** **Missed opportunity** Insufficient response
Weak	**Scenario 3:** **Actively addressed** Opportunity within reach	**Scenario 4:** **Distant opportunity**

	Natural resources endowments	Government (Policies, agencies)	Private Sector (Lead firms, suppliers)
Preconditions	• RE potential • Water resources	• Pre-existing capacities and landscapes for industrial and energy/climate policy	• Relevant capabilities in the local supply-base • Size and structure of the existing hydrogen market/demand • Production capacity of potential demand markets
Responses		• Policies and incentives for REs (backward links) • Policy incentives for GH technology and capacity • Policy incentives for potential GH demand sectors (forward links)	• Private investments in Green hydrogen • Private sector R&D

Industrial development and sectoral specificities

For assessment of preconditions and responses, note that green hydrogen combines:

- **Eventual but not current tradability of output:** Enables export of natural resources based on imported technology. Depending on preconditions, can support rapid expansion of renewables and requires investment in prerequisite infrastructure.

- **Low tradability of production facilities:** Increases the role of FDI and project-based modes of technological learning. Strategies for 'dynamic localisation' can be devised with adaptive local content strategies and supply-side support.

- **Low technological maturity:** Creates need for investment in technology monitoring and foresight as well as in domestic R&D capability. May open opportunities for leapfrogging.

Key points and issues for discussion (a)

- Green hydrogen is an **important opportunity** stemming from:
  - (A) the expected development of a significant demand window
  - (B) factor endowments with big potential for renewables in large parts of the Global South, including not least South Africa.
  - (C) the potential dynamic effects of the green hydrogen sector

- **Responses** to the GWO need to be tailored to **preconditions** and associated opportunities and constraints related to:
  - (A) Core technology such as electrolysers and infrastructure
  - (b) Backward linkages to renewables
  - (C) Forward linkages to industry, transport and agriculture

Key points and issues for discussion (b)

- Green hydrogen is **not an inclusive technology** by default:
  - (A) Green hydrogen is very capital intensive
  - (B) Requires high-upfront investments
  - (C) Labour absorption is rather low
  - (D) Skills/capabilities are rather specialised and demanding

- Green hydrogen comes with important **opportunities** but beware of overly **optimistic expectations**!

- There are **extraordinary requirements for cross-sectoral coordination** and **joint design-of policies** for relevant sectoral systems of production and innovation. **Progressive global partnerships are needed.**

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