Hydrogen in Industrial Processes

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IEA Technology Definition

The IEA classifies the use of green and low-carbon hydrogen in industrial processes as a cross-cutting decarbonization pathway. Key applications include hydrogen direct reduction of iron (H-DRI) for steelmaking, hydrogen as chemical feedstock (green ammonia, green methanol), high-temperature industrial heat via hydrogen combustion, and hydrogen as a reducing agent in non-ferrous metallurgy. The IEA's Global Hydrogen Review tracks these applications alongside hydrogen production and infrastructure.

Technology Readiness & Deployment

Industrial use of hydrogen is well-established in oil refining and ammonia production, but these currently rely on grey hydrogen from natural gas. Green hydrogen applications in industry are at demonstration to early commercial stage. H-DRI steelmaking pilots are operational in Sweden (HYBRIT/SSAB) and several European projects. Green ammonia plants are under construction in multiple regions. The IEA notes a record number of hydrogen technologies advancing in readiness level during 2024-2025, but deployment remains far below net zero requirements.

Key Metrics & Benchmarks

Global hydrogen demand is approximately 95 Mt/year, almost entirely grey hydrogen. Industry consumes about 55% of hydrogen (primarily refining and ammonia). Green hydrogen from electrolysis represented less than 1% of total supply in 2024. H-DRI steel production costs are 20-40% higher than conventional blast furnace route. Green ammonia costs approximately USD 600-900/tonne versus USD 250-400/tonne for conventional ammonia. Cost competitiveness depends on green hydrogen reaching USD 2/kg or below.

LATAM Relevance

Latin America's potential for low-cost green hydrogen makes it well-positioned for industrial hydrogen applications. Chile's green hydrogen strategy targets export-oriented ammonia and steel production. Brazil's large steel and chemicals sectors are natural candidates for hydrogen-based decarbonization. Colombia's refinery sector in Barrancabermeja and Cartagena could transition to green hydrogen feedstock. The region's abundant renewable resources could enable green hydrogen production costs below USD 2/kg, making industrial applications economically viable.

Critical Minerals Link

Industrial hydrogen applications require the same electrolyser minerals as hydrogen production (iridium, platinum, nickel for catalysts). H-DRI steelmaking shifts mineral demand from coking coal to hydrogen and iron ore. Green ammonia synthesis uses iron-based catalysts. The overall mineral footprint of hydrogen-based industrial decarbonization is shaped primarily by electrolyser requirements for iridium and platinum group metals.

Cleantech Taxonomy Crosswalk

Maps to Cleantech Taxonomy sectors: IN (Industry) — H-DRI steel, green ammonia, industrial hydrogen heat; ES (Energy Systems) — hydrogen production and distribution; XS (Cross-Sectoral) — sector coupling, hydrogen economy, trade in hydrogen-based commodities.

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