Industrial Decarbonization (steel, cement, chemicals)

Source Metadata

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IEA Technology Definition

The IEA classifies industrial decarbonization technologies as solutions targeting the three hardest-to-abate industrial sectors: steel, cement, and chemicals. These sectors produce approximately 70% of industrial CO2 emissions. Key technology pathways include hydrogen-based direct reduction of iron (H-DRI), electrification of process heat, alternative cement chemistries (including supplementary cementitious materials), catalytic process innovation in chemicals, and circular economy approaches.

Technology Readiness & Deployment

Most deep industrial decarbonization technologies are at demonstration or early commercial stage. Hydrogen-based steelmaking (H-DRI) is being piloted by SSAB/HYBRIT in Sweden and others in Europe. Low-clinker cements and supplementary materials are commercially available but adoption is slow. Green ammonia and methanol production from green hydrogen are at pilot to early commercial scale. The IEA rates heavy industry decarbonization as not on track for net zero, requiring massive scale-up of investment and innovation.

Key Metrics & Benchmarks

Steel production accounts for approximately 7% of global CO2 emissions, cement for 7%, and chemicals for 4%. H-DRI steel currently costs 20-40% more than conventional blast furnace steel. Global steel production exceeds 1.9 billion tonnes annually. Cement production reaches approximately 4.2 billion tonnes. The IEA estimates that reaching net zero requires near-zero-emission steel and cement to reach commercial scale by 2030.

LATAM Relevance

Brazil is the world's ninth-largest steel producer and a major cement and chemicals market. Colombia and Peru have significant cement industries. LATAM's access to low-cost renewable electricity and green hydrogen potential positions the region for low-carbon industrial production. Brazil's charcoal-based steelmaking (using planted eucalyptus) is already partially decarbonized. Carbon pricing mechanisms in Chile, Colombia, and Mexico create incentives for industrial decarbonization.

Critical Minerals Link

Industrial decarbonization increases demand for hydrogen (requiring electrolyser minerals), advanced catalysts (platinum group metals for chemical processes), and specialty alloys for high-temperature electrification. Circular economy approaches in industry can reduce overall mineral demand by improving recycling rates of steel, aluminium, and copper.

Cleantech Taxonomy Crosswalk

Maps to Cleantech Taxonomy sectors: IN (Industry) — steel, cement, chemicals decarbonization; ES (Energy Systems) — industrial hydrogen demand; XS (Cross-Sectoral) — circular economy, carbon pricing, green procurement.

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