Direct Electrification of Industry

Source Metadata

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IEA Technology Definition

The IEA classifies direct electrification of industry as end-use technologies that replace fossil fuel combustion in industrial processes with electrical alternatives. This includes electric arc furnaces for steelmaking, industrial heat pumps for low-to-medium temperature processes, electromagnetic heating (induction, microwave, infrared), electric kilns for ceramics and cement, and plasma torches for high-temperature applications. The ETP Technology Guide tracks electrification as a key pathway alongside hydrogen and CCUS for industrial decarbonization.

Technology Readiness & Deployment

Electric arc furnace (EAF) steelmaking is commercially mature and accounts for approximately 30% of global steel production using recycled scrap. Industrial heat pumps delivering temperatures up to 150°C are at early commercial stage, with emerging systems targeting 200°C and above. Electric kilns and high-temperature electrification (above 400°C) for cement, glass, and ceramics remain at demonstration to early commercial stage. The economics of industrial electrification improve as renewable electricity costs decline and carbon prices rise.

Key Metrics & Benchmarks

Industry consumes approximately 37% of global final energy, with about two-thirds as heat. Low-temperature heat (below 150°C) accounts for roughly 30% of industrial heat demand and is most amenable to electrification. EAF steelmaking uses approximately 400-500 kWh per tonne of steel. Industrial electricity's share of final industrial energy consumption needs to rise from approximately 21% today to over 30% by 2050 in the IEA Net Zero scenario.

LATAM Relevance

Latin America's abundant renewable electricity makes industrial electrification economically attractive. Brazil's steel industry already operates significant EAF capacity using hydroelectric and biomass-based electricity. Chile's mining sector is electrifying haul trucks and processing equipment. Colombia's food and beverage industry has potential for industrial heat pump adoption. Low renewable electricity costs in LATAM could attract energy-intensive industries seeking to decarbonize.

Critical Minerals Link

Industrial electrification increases demand for copper (electrical infrastructure, motors), silicon carbide and gallium nitride (power electronics), and rare earth magnets (high-efficiency motors). Electric arc furnaces require graphite electrodes. The overall mineral intensity is lower than hydrogen-based alternatives for many temperature ranges, making electrification a mineral-efficient decarbonization pathway where feasible.

Cleantech Taxonomy Crosswalk

Maps to Cleantech Taxonomy sectors: IN (Industry) — industrial process electrification, EAF steelmaking, electric kilns; ES (Energy Systems) — industrial electricity demand, grid capacity planning; XS (Cross-Sectoral) — sector coupling, demand-side flexibility from industrial loads.

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