Grids & Storage

Transmission, distribution, battery and other storage

- Batteries & Energy Storage
- Smart Grids & Digitalization
- Electricity Transmission & Distribution

Batteries & Energy Storage

Source Metadata

Field	Value
source	iea
source_version	ETCS 2025
source_id	IEA-SUP-007
iea_category	energy_supply
technology	Batteries & Energy Storage
technology_readiness	commercial
mitigation	Y
adaptation	N
last_checked	2026-05-26

IEA Technology Definition

The IEA classifies battery energy storage systems (BESS) and other storage technologies as critical enablers of clean energy transitions. Grid-scale batteries store electricity for later dispatch, providing flexibility, frequency regulation, and peak shaving. The category also includes pumped hydro, compressed air, and emerging long-duration storage technologies such as flow batteries and thermal storage.

Technology Readiness & Deployment

Battery storage is the fastest-growing power technology today. Global deployment reached 108 GW of new battery storage capacity in 2025, up 40% from 2024. Lithium-iron phosphate (LFP) chemistry accounts for approximately 90% of grid-scale deployments. The IEA considers battery storage on track for net zero targets, though long-duration storage (beyond 4-8 hours) remains at early commercial or demonstration stage and needs accelerated deployment.

Key Metrics & Benchmarks

Lithium-ion battery pack costs have fallen below USD 140/kWh on average and continue to decline. Grid-scale BESS typically provides 2-4 hours of storage, with costs around USD 150-250/kWh installed. Battery

manufacturing capacity is concentrated in China (over 75% of global cell production). LFP dominates stationary storage while NMC and emerging sodium-ion chemistries compete for different applications.

LATAM Relevance

Battery storage deployment in Latin America is accelerating, driven by the need to integrate growing solar and wind capacity. Chile has commissioned several utility-scale BESS projects to manage grid congestion in the north. Brazil's auction frameworks are beginning to include storage. Argentina and Chile's lithium reserves position the region as a potential battery manufacturing hub, though current value-addition remains focused on raw material extraction.

Critical Minerals Link

Batteries are the single largest driver of critical mineral demand growth. LFP batteries require lithium and phosphate; NMC batteries additionally need nickel, cobalt, and manganese. Chile holds 26% and Argentina 6% of global lithium production. Battery recycling is emerging as a critical supply chain strategy, with cobalt and nickel recovery rates improving.

Cleantech Taxonomy Crosswalk

Maps to Cleantech Taxonomy sectors: ES (Energy Systems) — grid-scale storage, renewable integration; TR (Transport) — EV batteries and vehicle-to-grid; IN (Industry) — battery manufacturing; XS (Cross-Sectoral) — distributed storage, behind-the-meter systems.

Smart Grids & Digitalization

Source Metadata

Field	Value
source	iea
source_version	ETCS 2025
source_id	IEA-CRS-001
iea_category	cross_cutting
technology	Smart Grids & Digitalization
technology_readiness	early_commercial
mitigation	Y
adaptation	N
last_checked	2026-05-26

IEA Technology Definition

The IEA classifies smart grids and energy system digitalization as cross-cutting technologies that enable the integration of variable renewables, demand-side flexibility, and distributed energy resources. Smart grids encompass advanced metering infrastructure (AMI), distribution automation, real-time monitoring, demand response platforms, and AI-driven grid optimization. Digitalization spans the entire energy value chain from generation forecasting to consumer engagement.

Technology Readiness & Deployment

Smart grid components are at varying readiness levels: smart meters are commercially deployed in many advanced economies, while AI-driven grid optimization and virtual power plants are at early commercial stage. The IEA emphasizes that grid flexibility is essential for accommodating growing penetrations of solar PV, wind, EVs, and heat pumps. Investment in grid modernization needs to accelerate significantly to match the pace of renewable deployment.

Key Metrics & Benchmarks

Global investment in electricity grids reached approximately USD 400 billion in 2024. Smart meter deployment exceeds 1 billion units worldwide. Demand response capacity is growing but represents less than 5% of peak demand in most markets. The IEA estimates that digitalizing grids could reduce curtailment of renewables by 30-40% and defer significant transmission infrastructure investment.

LATAM Relevance

Latin American grids face challenges from rapid renewable growth, long transmission distances, and distribution system losses. Brazil's smart meter rollout is expanding under ANEEL regulation. Chile is investing in grid digitalization for its renewable-rich northern system. Colombia's grid modernization plan addresses integration of distributed solar and regional interconnections. Grid losses in LATAM average 15-20%, significantly above OECD norms, making digitalization economically compelling.

Critical Minerals Link

Smart grid infrastructure requires copper (wiring and power electronics), silicon (semiconductors), rare earth elements (sensors and electronics), and aluminium (conductors). The demand for power electronics components (using silicon carbide and gallium nitride) is growing rapidly with grid modernization.

Cleantech Taxonomy Crosswalk

Maps to Cleantech Taxonomy sectors: ES (Energy Systems) — grid management, flexibility services; IC (ICT) — digital platforms, AI for energy; BU (Buildings) — smart building integration; XS (Cross-Sectoral) — demand response across all end-use sectors.

Electricity Transmission & Distribution

Source Metadata

Field	Value
source	iea
source_version	ETCS 2025
source_id	IEA-SUP-008
iea_category	energy_supply
technology	Electricity Transmission & Distribution
technology_readiness	commercial
mitigation	Y
adaptation	N
last_checked	2026-05-26

IEA Technology Definition

The IEA classifies electricity transmission and distribution (T&D) infrastructure as foundational to clean energy transitions. This includes high-voltage AC and DC transmission lines, substations, transformers, power electronics (FACTS devices, HVDC converters), and distribution networks. The timely expansion and modernization of grids is identified as a critical bottleneck for achieving net zero targets.

Technology Readiness & Deployment

Conventional T&D infrastructure is fully mature and commercially deployed. HVDC technology for long-distance, high-capacity transmission is at commercial stage and expanding rapidly, particularly in China and Europe. The IEA flags that grid expansion is not keeping pace with renewable deployment in most regions. Permitting and planning processes for new transmission lines typically take 5-15 years, creating structural delays in the energy transition.

Key Metrics & Benchmarks

Global electricity grid length exceeds 80 million km. Annual grid investment reached approximately USD 400 billion in 2024 but the IEA estimates this needs to nearly double by 2030. HVDC lines can transmit power over 2,000+ km with losses below 3%. Transformer lead times have extended to 2-3 years globally due to supply chain constraints. Distribution system upgrades are critical for accommodating distributed generation, EVs, and heat pumps.

LATAM Relevance

Latin America faces significant transmission challenges connecting remote renewable resources to demand centres. Brazil's HVDC backbone transmits Amazonian hydropower and northeastern wind over thousands of kilometres. Chile's single-circuit transmission from the Atacama solar region to Santiago is a recognized bottleneck. Regional interconnections between Colombia, Ecuador, Peru, and Chile remain limited, constraining cross-border electricity trade and system resilience.

Critical Minerals Link

T&D infrastructure is the largest single demand sector for copper, which is essential for conductors, cables, transformers, and substations. Aluminium is used extensively in overhead transmission lines. Transformer cores require grain-oriented electrical steel. LATAM's copper production (Chile and Peru account for 37% of global supply) directly supports global grid expansion.

Cleantech Taxonomy Crosswalk

Maps to Cleantech Taxonomy sectors: ES (Energy Systems) — transmission planning, grid expansion, interconnections; IN (Industry) — cable and transformer manufacturing; XS (Cross-Sectoral) — electrification infrastructure enabling all sectors.