Deployment of the Global Energy Interconnection



Overview

Global energy interconnectionThis White Paper has been prepared by the Global Energy Interconnection project team, in the IEC Market Strategy Board (MSB).

Key Takeaways

The Global Energy Interconnection (GEI) is being deployed in phased stages to create a worldwide ultra-high voltage electricity network integrating renewable energy and smart grid technologies.

Overview of GEI Deployment

The Global Energy Interconnection is a proposed global electricity network designed to link 80 countries through an eighteen-line backbone of ultra-high voltage (UHV) connections, incorporating smart-grid technology and significant renewable energy sources. The deployment is planned over a 50-year horizon and is structured in three main phases: Phase One focuses on integrating national grids, constructing new smart grids, and increasing renewable energy usage within countries. Phase Two aims to connect continental grids, enabling cross-border energy flows and regional energy optimization.

Phase Three (2030–2070) envisions Afro-Eurasian transcontinental grids linked by UHV systems, creating a truly global energy network. Technical InfrastructureGEI relies on a UHV grid backbone to transmit large-scale renewable energy efficiently across long distances, overcoming the intermittency and uneven distribution of clean energy resources. The system integrates: Smart grid technologies for real-time monitoring, automation, and energy management.

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High levels of interoperability across countries, technical domains, and equipment life cycles. International standards and specifications to ensure system stability, procurement efficiency, and global acceptance. By 2017, China had already constructed or was operating 25 UHV projects, transmitting hydropower from resource-rich regions to high-demand load centers.

International Collaboration and Policy Alignment

The GE

I initiative is strongly supported by China and international organizations, including the International Energy Agency (IEA) and the United Nations. It aligns with global climate and sustainability frameworks: Supports Nationally Determined Contributions (NDCs) under the Paris Agreement. Promotes Sustainable Development Goals (SDGs), particularly SDG 7 on universal access to clean energy.

Encourages cross-border cooperation, knowledge sharing, and joint investment in renewable energy infrastructure. Economic and Environmental ImpactsGEI deployment is expected to: Accelerate clean energy transitions, reducing reliance on fossil fuels and lowering carbon emissions. Enhance energy security by diversifying energy sources and enabling global energy sharing.

Drive economic growth through new industries, job creation, and market expansion in renewable energy sectors. Promote ecological restoration and resource efficiency, including significant water savings and reduced environmental impact.

Challenges and Considerations

Despite technological readiness, GEI faces challenges in: Financing and investment mobilization for large-scale infrastructure. Capacity building and innovation acceleration to manage complex, transcontinental systems. Political commitment and regulatory harmonization to enable cross-border energy integration.

Standardization and interoperability to ensure seamless operation across diverse national grids.

Conclusion

The deployment of the Global Energy Interconnection represents a transformative approach to global energy management, combining UHV transmission, smart grids, and renewable energy integration. Its phased implementation, international collaboration, and alignment with climate and sustainability goals position GEI as a cornerstone for a resilient, low-carbon, and interconnected global energy future.

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Article Content

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This White Paper has been prepared by the Global Energy Interconnection project team, in the IEC Market Strategy Board (MSB), with major contributions from the project partner, the International

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GEIDCO has carried out more than 100 researches, released more than 50 innovative results globally, and published more than 50 monographs and reports in Chinese and English, enhancing its

Global energy interconnection

Large-scale implementation of clean energy (notably renewables) Transmission of power over long distances (ultra-high voltage) Smart grid solutions Benefits of GEI: Optimize renewable energy

Large-scale electricity interconnection – Analysis

In keeping with IEA scenarios, the report assesses the short- and medium-term technical, market, regulatory and policy measures, benefits, costs, and investments required to accelerate regional

Global Energy Interconnection: an effective solution to climate

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Battery energy storage systems (BESS) now sit at the heart of the global shift toward flexible, renewable-dominated grids. Understanding the regional trends

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Storage deployments since the beginning of 2025 have focused on improving grid reliability and firming renewable energy generation. By storing excess solar electricity produced during the day and

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The global battery energy storage system market is valued at USD 81.6 billion in 2026, supported by accelerating renewable energy deployment, grid modernization programs, and rising

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Hyperscaler energy strategies have rapidly matured from simply procuring renewable energy credits to deploying a sophisticated and integrated portfolio of

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The U.S. Interconnection Challenge: Why Renewables Are Stuck in Line

But connecting new energy projects to the grid, known as interconnection, has become a major bottleneck, slowing the deployment of new renewable energy sources.

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