Feasibility of Global Energy Interconnection



Overview

Evaluating the economic and social benefits of global energy. The Global Energy Interconnection (GEI) development will bring various economic and social.

Key Takeaways

Global Energy Interconnection (GEI) is technically feasible with current and emerging technologies, but its implementation faces significant economic, geopolitical, and standardization challenges. Technical FeasibilityGEI relies on ultra-high voltage (UHV) transmission systems, including high-voltage direct current (HVDC) links, to connect separate AC grids across countries and continents, enabling large-scale integration of renewable energy sources such as wind and solar. Studies by CIGRE and IEC indicate that the technologies required for GEI—such as smart grids, HVDC converters, and advanced control systems—are largely available or in development.

A global network can exploit time zone and seasonal diversity, balancing intermittent renewable generation and reducing reliance on fossil fuels.

Economic and Environmental Considerations

While the initial investment for GEI is substantial, long-term benefits include improved energy efficiency, reduced greenhouse gas emissions, and enhanced electricity access in underserved regions. System Dynamics modeling suggests that regional and transcontinental interconnections can stimulate economic growth, create jobs, and optimize resource allocation. Additionally, GEI supports a low-carbon energy transition by enabling large-scale deployment of clean energy and reducing the need for fossil generation.

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Geopolitical and Policy Challenges

The feasibility of GEI is influenced by geopolitical factors, including cross-border cooperation, regulatory harmonization, and energy security concerns. International standards and specifications are critical to ensure interoperability, procurement efficiency, and market acceptance. Governance frameworks, trading rules, and coordinated policies are necessary to manage the complex interactions among multiple countries and regions.

Implementation OutlookPre-feasibility studies indicate that significant benefits can be achieved by 2050, particularly in terms of decarbonization, cost reduction, and renewable energy utilization. However, realizing GEI requires incremental deployment, starting with regional interconnections, standardization initiatives, and pilot projects to address technical, economic, and regulatory challenges. The combination of smart grid technologies, energy storage, and demand response will further enhance the system's reliability and efficiency.

Conclusion

In summary, GEI is technically feasible and offers substantial environmental and economic benefits, but its global implementation demands careful planning, international cooperation, and robust standardization. The pathway to a fully interconnected global electricity network involves phased deployment, policy alignment, and investment in advanced transmission and control technologies.

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Global Energy Interconnection Journal Press

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Global energy interconnection | IEC

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