

Grid Integration: Legal and Political Aspects

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Abstract

The interconnection of electricity grids has been significant in the history of electric power networks. Most national and regional power networks began as isolated systems, but later interconnected as power networks expanded. Power pools were formed to facilitate electricity trading and capacity sharing among utilities. Long-distance interconnections emerged with advancements in transmission technology, crossing national borders. Switzerland established the first international interconnection in Europe in 1906¹, connecting with France and Italy. The trade of electricity between countries is increasing, which enhances supply security and contributes to sustainable development goals. International power grid interconnection is especially crucial in regions with unevenly distributed energy resources, like Africa. International power grid interconnections enable neighboring nations to exchange power and reduce energy costs, benefiting both importing and exporting countries. These interconnections can range from small transfers of electricity to fully integrating power systems and markets. They contribute to sustainable development by increasing electricity supply and reliability, supporting education, job creation, healthcare, and other development activities. Furthermore, they help form competitive electricity markets and lower costs for developing economies. International power grid interconnections are complex undertakings, with various factors that must be carefully considered. Technical issues include grid stability and potential costs from technical problems. Economic issues involve operating requirements and costs for transmission infrastructure.

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¹Indicators for sustainable energy development, https://www.un.org/esa/sustdev/publications/energy_indicators/chapter2.pdf (Accessed on 1 October 2023).

Introduction

The imminent new decade is anticipated to embody a period of profound transformation in the global electricity industry, characterized by the expanding economic benefits and proliferation of sustainable energy sources. Because of this emerging trend, power networks and markets have embarked on a fresh phase of integration, both at the international and regional levels. The absence of larger, homogenous, and inflexible grids has hindered the integration of a smaller number of nonrenewable energy sources, thereby impeding the local contraction of transmission infrastructure and the stagnation of power grids. The trading of electricity across national borders and the facilitation of more intricate markets not only contribute to cost savings and increases in efficiency, but also become increasingly paramount considering growing demand and the escalating proportion of renewables in the energy mix. This phenomenon is evident in a multitude of developing Asian economies,² despite their inherent diversity. The evolution of international electricity grids and markets also holds significant regional political ramifications, given the crucial role of critical infrastructure in shaping trade relations and national security. Southwest Asian, South Asian, and Southeast Asian efforts towards regional power grid and market integration have significant impacts on international politics, as each sub region has its own unique story of electricity trade, and governments are faced with the challenge of developing institutions and political cooperation with neighboring countries to achieve sustainable generation capacity and economic growth, despite the high infrastructure costs associated with power sector reform and integration. The costs and benefits of infrastructure projects are specific to regions and may not necessarily outweigh political distrust and security concerns. China's Belt and Road Initiative, with its vision for global energy interconnection, offers financing and technology, but sub regional groupings face the challenge of balancing insulation from outside influence with the appeal of faster and cheaper Chinese projects³. Electrical power flow and fund transfer across borders must happen within a long-term legal framework. This ensures trust between partners and facilitates transparent dealings between trading countries and supporting institutions. A legal framework is necessary to identify responsible parties and determine prices for electricity. Agreements are needed to address disputes and harm to third parties. Legal systems in interconnected countries can have positive or negative effects on grid interconnections. A conference on "Transnational Grid Interconnections for One Sun, One World, One Grid (OSOWOG)" took place in New Delhi during recent G20 summit.⁴ India has established cross border interconnections with its neighbours. Strengthening of

² Phillip Cornell, *INTERNATIONAL GRID INTEGRATION: EFFICIENCIES, VULNERABILITIES, AND STRATEGIC IMPLICATIONS IN ASIA* ATLANTIC COUNCIL (2020), <https://www.atlanticcouncil.org/in-depth-research-reports/report/international-grid-integration-efficiencies-vulnerabilities-and-strategic-implications-in-asia/> (Accessed on 14 September 2023).

³ Id.

⁴ *Conference on Transnational Grid Interconnections for one sun, one world, one grid held in New Delhi*, PRESS INFORMATION BUREAU (2023), <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1955243> (Accessed on 2 October, 2023).

cross border links is in progress. OSOWOG will allow nations to benefit from solar energy. This is particularly relevant as we transition to renewable energy. It will make renewable energy cheaper and reduce the need for reserves. This will lower electricity costs and aid in energy transition. In the Energy Transitions Ministerial, all G-20 countries agreed on the same thing and stated it in Para No. 5 of the ETWG Outcome Document and Chair Summary: “The role of grid interconnections, resilient energy infrastructure, and regional power systems integration enhances energy security, economic growth, and universal energy access. Modernized electricity networks are necessary to deploy zero and low emission technologies and renewables. International cooperation, research, and assistance are needed for planning and operations. Connecting regional grids to transfer renewable energy is important. Increased public and private investments, along with support from International Finance Institutions, are crucial for developing countries to benefit from interconnections.”⁵ The utilization of the complementary nature of energy resources among the South Asian Association for Regional Cooperation (SAARC), Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC), and Association of Southeast Asian Nations (ASEAN) countries can be effectively achieved by means of establishing transnational interconnections. One of the outstanding achievements in the field of engineering in the previous century has been the development of extensive synchronous alternating current (AC) power grids. These power grids are distinguished by all the interconnected systems maintaining a consistent and precise electrical frequency. In the present day, the power system in North America is comprised of four immense synchronous systems, specifically referred to as the Eastern, Western, Texas, and Quebec interconnections. The Eastern interconnection, in isolation, has been acknowledged as the largest machine worldwide. It encompasses thousands of generators, millions of kilometers of transmission and distribution lines, and over a billion distinct electrical loads.

Potential Institutions and Groups Involved in Power Trading

Various organizations and groups may be involved in power trading in international power grid interconnection systems. These include different actors who are responsible for the physical systems, the necessary institutional arrangements, and the economic arrangements. Legal agreements are required to establish the rights and responsibilities of each actor. Some potential actors in these agreements and the types of agreements they may be involved in are as follows: i. National governments, usually operating through specific ministries, are highly likely to be involved in electricity interconnection projections. Governmental agencies must certify existing rights and land use for interconnection facilities. Government agencies will be responsible for energy sector planning and licensing for interconnections. They will also provide access to publicly-owned land and pledge financial resources for loan repayment.

⁵ *G20 Energy Transitions Ministers' Meeting Outcome Document and Chair's Summary Goa, G20 2023 India* (22 July, 2023) https://www.g20.org/content/dam/gtwenty/gtwenty_new/document/G20_Energy_Transitions_Ministers%E2%80%99_Meeting_Outcome_Document_and_Chair%E2%80%99s_Summary.pdf (Accessed on 6 September 2023).

Government ministries may be buyers or sellers of electricity, requiring legal agreements for guaranteeing supplies or consumption. ii. Sub-national governments and agencies can play a significant role in grid interconnection projects. The cooperation or lack thereof of State and Local authorities can greatly influence decisions regarding such projects. Consideration must be given to the rules at the State and Local levels when formulating legal agreements for interconnection projects. iii. National utilities, whether government-controlled or semi-autonomous, own and manage electricity assets and participate in international agreements. Public or private utilities are involved in power line infrastructure and need legal arrangements to define their roles and obligations in projects. iv. Private utilities, buyers, or sellers in the power sector may need different legal structures from national utilities and may also provide construction, operation, and maintenance services to power lines. Privately-owned generators or bulk electricity buyers may arrange to buy or sell power internationally through legal contracts. Private utilities and other electricity market actors may be regulated and the regulatory body may be involved in grid interconnection contracts. v. The financing for grid interconnections and new power plants often comes from multinational development banks and private financial institutions. These institutions require contracts guaranteeing repayment from countries and/or companies that will buy and/or sell power, secured by power line or generation assets and general revenues from the countries involved.

Legal and Regulatory Considerations

Hosting an international grid interconnection requires legal agreements with various parties, including financial institutions, contractors, utilities, and governments. These agreements involve power purchase, pricing, siting, and operation. There are specific requirements and considerations for successful grid interconnection. The presence of a robust legal framework is crucial for successful contract enforcement in the countries involved in the interconnection. Contractors feel more secure in engaging in interconnection activities when there is an established judiciary process for addressing legal complaints. The existence of reliable national courts also instills confidence in trading partners regarding the fair resolution of interconnection-related disputes.⁶ Some provisions of contracts in interconnection projects between countries may require using international courts. If the national parties involved in the interconnection have a history of abiding by international court rulings, especially on trade matters, certain aspects of interconnection contracts addressing dispute resolution between countries may be more efficiently handled through agreements to defer such issues to international jurisdictions. Agreements are needed for selling and purchasing power between countries in an interconnection. These agreements specify the amount of power to be sold and purchased, with minimum and maximum amounts. Some contracts require buyers to take a certain amount of energy or pay a penalty. Agreements furthermore consist of penalties for sellers who do not adhere to their obligations. There are clauses in contracts to address

⁶ United Nations, *Legal Aspects of Grid Interconnection (United Nations Division for Sustainable Development 23rd February 2007)* < <https://www.un.org/esa/sustdev/publications/energy/chapter4.pdf> > (accessed on 12 May 2023)

circumstances beyond the supplier's control, such as natural disasters or war. Power supply disruptions due to equipment installation or maintenance are not considered a breach of contract. In some instances, cross-border power exchanges are established not primarily for sales between countries, but to enable countries with different resources or electricity demand to trade power and reduce capacity requirements. Power contracts may be structured differently in such cases.

Energy price agreements determine the rate for electricity between the purchaser and vendor. These agreements usually last a long time to cover the costs of power infrastructure. Prices can be fixed, increase over time, or be tied to international energy prices. International agreements also determine the currency for payments. In some areas, contracts require payment in stable currencies to protect against inflation and provide income in hard currency. A case study of the Theun-Hinboun Hydropower Project in Lao PDR demonstrates this⁷. The project aimed to boost economic growth by exporting electricity to Thailand. The Power Purchase Agreement (PPA) for the project requires 50% of payments in Thai Baht and 50% in US dollars, held in an offshore escrow account. The nature of the electricity buyer and seller in interconnection arrangements is important for power prices and pricing arrangements. In the case of integrated monopolies, the price for electricity depends on the costs of the exporting country and the outside option for the importing country. Long-term contracts are necessary for the importing country if they need to construct new power plants. If short-term prices are negotiated, the importing country can choose between inefficient diesel generators or cutting power supply. Long-term contracts are crucial for the importing country if power trade is based on commercial interests and there is no competitive market or short-term substitute for electricity imports. In international power purchase agreements, nations are usually the legal guarantors of purchases or sales. Examples include the Lao PDR Theun-Hinboun Hydropower Project and the Bujagali Hydro Project in Uganda.⁸ The respective governments borrowed funds to finance these projects. The government guarantees all payments in the Bujagali project. If the Uganda Electricity Board defaults, the government will cover the costs. Governments are the legal guarantors of loan repayments.

National Requirements for Legal Agreements

For nations to effectively engage in the legal agreements and actively contribute to their negotiation and formulation, it is imperative to establish a domestic legal framework. While countries without a robust "rule of law" structure may still achieve success in grid interconnection projects, those with well-established mechanisms for contract enforcement, a substantial pool of legal and judicial professionals, efficient and consistent regulatory systems, politically stable environments, and prior experience in international legal agreements will encounter fewer obstacles in interconnection endeavours. The presence of an effective legal framework is important for smooth negotiation and enforcement of contracts related to international electricity grid interconnections. An independent and experienced

⁷ Id.

⁸ Id.

judiciary allows contractors to proceed with confidence and gives trading partners assurance that grievances will be addressed. Reliable and independent national judiciaries enable clear jurisdiction over disputes that may occur during interconnection contracting, construction, and operation. Effective and consistent regulatory systems are important for professional legal capacity. Utilities, including non-government-owned utilities, also require regulation. When countries have functioning regulatory structures, and especially when they share common structures or membership in organizations like southern Africa's Regional Electricity Regulators Association (RERA) and African Forum of Utility Regulators (AFUR),⁹ the regulatory requirements for organizations participating in interconnections can be simplified. Independent regulatory authorities help ensure fairness in tariffs and rules for businesses involved in interconnections. Contracts in interconnection projects between countries may require international court appeals. If the national parties involved have a history of abiding by international court decisions, especially in trade-related matters, agreements to refer disputes between countries to international jurisdictions can facilitate resolution of interconnection contract issues.

Potential Legal Complications

The legal requisites for a project as intricate as a grid interconnection, as denoted in the preceding portion of this chapter, are frequently more than considerable. These requisites become even more intricate when contracts must connect the endeavours within nations that may not solely possess diverse legal systems and customs, but even dissimilar languages. The ongoing process of restructuring in the electricity sector—which often resides in significantly distinct phases in diverse nations—further complicates the negotiation and execution of legal agreements pertaining to grid interconnections. Complications may occur when drafting contracts for grid interconnections involving countries with different legal systems and traditions. Countries with independent judiciaries may have reservations about relying on courts in neighbouring countries with politically controlled judiciaries. Additional complications may arise when a partner in an interconnection project adheres to both religious and secular law. Agreement must also be reached regarding the language(s) used in contract documents, and a procedure is necessary to ensure that all translations of legal documents are functionally equivalent. The impacts of privatization or restructuring in the utility industry may complicate legal aspects of grid interconnection arrangements. State-run utility electricity service providers may cease to exist within near future. Many nations may transform their utilities into market-oriented companies. The changing structure of the electricity sector must be considered when preparing interconnection contracts. Power may be sold through regional power markets. Interconnection contracts should include clauses for renegotiation. Restructured electricity markets may clarify the role of power imports and exports.

Addressing Technology Gaps for Energy Transitions

⁹ Id.

Tracking investment in energy technology innovation is crucial for identifying gaps and opportunities in resource allocation. Measuring progress in clean energy innovation requires looking beyond investment flow to performance indicators. The priority is to reduce costs. The main objective of innovation is to make low-carbon technologies widely accessible and financially independent from the government. This will speed up the adoption of low-carbon technology, regardless of fossil fuel prices or climate policies. SDG 7 is connected to goals like poverty eradication, food security, water, education, health, gender, environment, climate change, and economic growth. Innovation can help achieve these goals. SDG 9 focuses on innovation, but clean energy technology innovation can also contribute to other goals if their interlinkages are understood. Countries using nuclear energy support its role in providing clean energy, reducing GHG emissions, achieving SDG 7, ensuring safety and resilient infrastructure, and contributing to baseload power and grid flexibility. These countries plan to collaborate in research, innovation, and development of civil nuclear technologies, including advanced and Small Modular Reactors (SMRs). They also aim to build resilient nuclear supply chains and uphold high standards of nuclear safety and security. These countries promote responsible decommissioning and waste management, mobilize investments, and strengthen international cooperation for nuclear safety. They also focus on cultivating a skilled workforce and exchanging knowledge for energy transitions through civil nuclear technologies.

Political Aspects of Grid Integration

International electric grid interconnections can potentially yield political advantages for the interconnected nations, encompassing heightened experience and political ease in international collaboration, additional incentives to avoid conflicts with neighbouring countries, enhanced democratization (depending partially on the design and administration of the interconnection), and an augmentation of internal political stability. Conversely, in certain instances, the presence of an interconnection may be utilized as a pretext for internal political suppression, afford one of the interconnected nations greater political and economic influence over another, ensnare nations in each other's internal affairs, offer opportunities for political corruption, and may entail substantial political expenses for power line protection. The connections between nations trading power also offer the potential for government cooperation, grid interconnections facilitate communication between governments. International energy infrastructure provides channels for communication on various issues, it also furthers cooperation for countries with a history of conflict.

Grid interconnections can encourage democratization¹⁰ if they are developed, decided upon, and managed properly. Transparent and inclusive planning processes with input from different groups can lead to democratization. Participatory decision-making in power grid interconnections can have positive impacts on public participation in other important

¹⁰ United Nations, *Legal Aspects of Grid Interconnection* (United Nations Division for Sustainable Development 23rd February 2007), <https://www.un.org/esa/sustdev/publications/energy/chapter5.pdf> (Accessed on 5 October 2023)

decisions. Grid interconnections can also promote democratization by providing stable electricity supplies and increasing opportunities for education and obtaining news.

The grid interconnection may make state utilities pay more attention to costs and income and subsidies for certain groups may become unsustainable. Changing these subsidies may have a high political cost. Cross-subsidies may continue with an interconnection, but it will require financial transparency. Agreements between countries on sharing power resources require political agreement and can be challenging due to historical rivalry. Internal political discussions are needed within each country to ensure the interconnection is a wise use of resources and that political actors are accepting of long-term international responsibilities. Nations with previous cooperation are more likely to have inclination and structure for interconnection. Countries engaging in trade, transportation, cultural exchange, and political cooperation are more likely to embrace grid interconnection opportunities and successfully negotiate and implement necessary agreements. The countries of Europe are a prime example of multiple ties developing over a long period, which has facilitated grid interconnections. Europe has a history of active trade¹¹, transport linkages, and political cooperation. Currently, electricity trade is active between European nations, with some countries relying on their neighbours for a significant portion of their power needs. The European Union aims to establish an integrated market for electricity.

Conclusion

International electricity grid interconnections can be complex legal undertakings involving various parties. Agreements are necessary for planning, building, and operating power lines across borders. These agreements should be transparent and enforceable, requiring legal capacity to draft, review, enforce, adhere to, and adjudicate contract issues. A country's unpredictable or corrupt legal system can hinder power trading deals. Conversely, a nation's adherence to the Rule of Law can facilitate power-sharing agreements. Interconnection agreements can pave the way for other important matters, such as trade and joint projects. Negotiating and complying with international agreements for interconnection can build confidence in a country's legal system and provide experience in international-standard legal system operations. The investment in increased energy access will result in reduced carbon emissions, cheaper living expenses, and improved livelihoods. Furthermore, it will enhance the viability of solar projects, promote international cooperation, and contribute to meeting the Paris Agreement targets for sustainable development. Power purchase and pricing agreements, including agreements on payment currency, price escalation/indexing, and penalties for not meeting minimums. Agreements on power line siting, infrastructure placement, and interconnection operation/governance. Agreements on power line security and liability for damage. Agreements on environmental performance and safety standards. Agreements on liability for power line failure and damages. Agreements for selecting contractors to build and maintain infrastructure. Across the globe, there is increasing

¹¹ Id.

uncertainty regarding the models of unelected supranational economic governance, notwithstanding the potential efficiencies it can yield. Development organizations such as the World Bank and the ADB have consistently advocated for the integration of international energy markets in developing nations, drawing inspiration from the European framework. This approach aims to reduce costs, enhance access, and improve service reliability, while also promoting noble objectives such as peace through economic interdependence and environmental sustainability. However, the endeavors undertaken by said establishments in order to execute the integration of energy economics akin to the European Union as well as the liberalization reforms¹² of the Organization for Economic Co-operation and Development (OECD) during the 1990s did not achieve substantial progress due to their inadequate consideration of regional preferences, political circumstances, and the requirement for consensus.

¹² *The OECD report on Regulatory Reform Synthesis*, OECD, <https://www.oecd.org/gov/regulatory-policy/2391768.pdf> (Accessed on Oct 7, 2023)