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Data Governance in the Geopolitics of Energy Transition: Comparing Regional Energy Cooperation in ASEAN and the EU

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Abstract

Data governance has become a critical enabler in the geopolitics of energy transition, influencing regional cooperation, energy security, and climate leadership. This article compares the contrasting approaches of the European Union and ASEAN to data governance in the context of energy transition and examines their geopolitical implications. The EU's centralised model is underpinned by strong institutional capacity, policy alignment, interdependence among member states, and political will. These conditions support robust data governance across regional power grids, critical raw material supply chains, and carbon markets, enhancing the EU's energy resilience and influence in global climate standard-setting. In contrast, despite advancing regional energy initiatives, ASEAN's decentralised and informal approach to data governance presents both opportunities and challenges for deepening regional data integration. Through comparative case studies, this article investigates how energy data governance is both shaped and reshapes the geopolitics of energy transition.

Keywords

carbon market; critical raw materials; data governance; energy transition; power grid

1. Introduction

Energy and geopolitics are deeply intertwined and the global energy transition is reshaping these geopolitical dynamics, with data governance taking on an increasingly critical role (Ansari et al., 2025; Ashford, 2024). While energy geopolitics has traditionally focused on fossil fuel access, supply security, and chokepoints, the Ukraine war has prompted many countries, especially in Europe, to reduce reliance on Russian energy and

accelerate their energy transitions. This shift reflects the growing significance of the geopolitics of the energy transition, centred on regional decarbonisation efforts such as power grids, critical raw material (CRM) supply chains, and carbon markets. As these efforts become increasingly transboundary and interconnected, data governance is emerging as a key enabler underpinning regional cooperation in the energy transition (Beltramo et al., 2024; Garske et al., 2024; Wang et al., 2023). Robust data governance ensures cross-border data sharing in regional power grids, mineral supply chain coordination, and standardised carbon accounting frameworks. In contrast, the lack of cohesive governance frameworks introduces risks that could undermine progress, such as politically sensitive data sovereignty, limited data availability for strategic resources, and disparities in data standards. These challenges highlight the geopolitical stakes of regional energy cooperation, which this article analyses through the lens of regional integration.

This article addresses an underexplored dimension of the geopolitics of energy transition by examining the role of data governance through a comparative analysis of the EU and ASEAN. These two regions are selected as contrasting cases: the EU operates under a supranational governance model with strong institutional enforcement, whereas ASEAN functions through intergovernmental coordination and non-binding consensus. Their differing governance structures offer a valuable foundation for analysing how data governance shapes regional cooperation and the geopolitics of energy transition. This article first explores the role of data governance in energy transition, with a focus on cross-border power grids, mineral supply chains, and carbon markets. A comparative analysis of the EU and ASEAN follows, highlighting the institutional and geopolitical factors that define their contrasting data governance models. The article concludes by reflecting on the broader geopolitical implications of data governance in regional energy cooperation.

2. Data Governance in the Geopolitics of Energy Transition

The geopolitics of energy has evolved from traditional concerns over fossil fuel security to new forms of interdependency driven by the rapid development of the energy transition. Geopolitical concerns once centred on fossil fuels—shaping global trade patterns, strategic alliances, and national security strategies—have now extended to energy transition-related technologies, resources, and market standards (Scholten, 2024). As energy systems undergo structural change, three decarbonisation trends are redefining the geopolitical landscape. First, power grids have become the backbone for scaling renewable use and integration (IRENA, 2024; Wang et al., 2023), creating new forms of cross-border interdependency. Second, energy security concerns are shifting from fossil fuels to critical minerals, essential for clean energy technologies (IEA, 2021), intensifying competition for CRMs (Nakano, 2020; Yu, 2023b). Third, tightening environmental regulations are accelerating the development of carbon markets, where competition over market standards between developed and developing countries is shaping global climate governance (Li & Kim, 2024; Lo & Yu, 2024; Wu, 2023). These trends illustrate how the energy transition is transforming not only energy systems but also the foundations of geopolitical strategy.

These emerging energy trends have introduced new forms of interdependence that reshape traditional geopolitical dynamics. As IRENA (2023) highlights, these new interdependencies can not only foster cooperation but also heighten tensions. Scholars such as O'Sullivan (2017, 2023) argue that these shifts have introduced new sources of geopolitical tension—including fragmented cooperation, uneven access to clean technologies, rising resource nationalism, and regulatory divergence—which complicate rather than resolve existing energy security concerns. The geopolitics of the energy transition is increasingly shaped by

state-led industrial policies, regional bloc formation, technological innovation, and market standard competition—all of which influence how the benefits and risks of decarbonisation are distributed.

These geopolitical dynamics have been further intensified by recent crises and uneven regional responses. For example, energy market disruptions during the Ukraine war prompted many countries, especially in Europe, to accelerate energy transition, but this shift has also increased interdependency pressure on CRM supply chains and exposed regional grid limitations amid rapid renewable expansion (Chestney, 2025). In Southeast Asia, while there is also growing pressure to scale up the energy transition, underlying geopolitical frictions—such as intra-regional competition and limited strategic alignment—continue to hinder broader cooperation on cross-border solutions like regional grids and coordinated carbon markets. This shift away from fossil fuels to energy transition efforts introduces new dependencies and vulnerabilities, reshaping the geopolitics of the energy transition through trade dependencies, resource access, and market standards (Ashford, 2024).

Amid this shifting geopolitical landscape, data governance has emerged as a critical enabler of the energy transition, which is becoming increasingly data-reliant. In electricity systems, cross-border grids rely on real-time data and predictive analytics, including weather data, to optimise daily operations, supply stability, and integration of variable energy sources (Wang et al., 2023). In mineral supply chains, transparent and interoperable data platforms help track flows, assess risks, and coordinate responses to disruptions, thereby enhancing supply security (Krol-Sinclair, 2023; Stuermer & Wittenstein, 2023). In carbon markets, consistent and credible data systems are essential for emissions monitoring, verification, and alignment with evolving international standards (Lo & Yu, 2024). Furthermore, risks such as cybersecurity threats, uneven data access, fragmented standards, and data nationalism highlight the growing need for more robust and cooperative data governance frameworks to support an effective and equitable energy transition (H. Gao, 2021; X. Gao & Chen, 2024; KPMG, 2023).

Robust data governance—referring to the rules and institutions that guide how energy data is collected, shared, and used (Wang et al., 2023)—is essential for regional cooperation under rising geopolitical pressures, as the energy transition becomes increasingly data-reliant. The modern concept of data sharing emerged in the 1980s and has evolved across various industries (Beltramo et al., 2024). It refers to the process of making datasets accessible, usable, and reusable under clearly defined terms, often guided by internationally accepted principles (UNESCO, 2021). Advocacy for open science, including the 2001 Budapest Open Access Initiative and the 2015 OECD initiative, has further advanced the adoption of open data and data sharing practices (BOAI, 2021). Foundational initiatives, such as the findable, accessible, interoperable, and reusable (FAIR) principles, have been pivotal in standardising data collection and dissemination practices (GoFair, 2016). These frameworks facilitate cross-border collaboration by ensuring high-quality data is accessible, even in resource-constrained circumstances. They reduce barriers to use through open licensing, data protection laws, and the provision of machine-readable formats (Beltramo et al., 2024).

The international community has also increasingly recognised the importance of data sharing in addressing regional energy challenges (Wang et al., 2023). The UN Conference on Trade and Development (2021) highlights the need for a coordinated governance approach to facilitate the flow of data across borders. This has driven efforts to improve data governance in energy and commodity markets through regional initiatives aimed at enhancing transparency, reliability, and accessibility of critical data. For example, the IEA provides open access to energy datasets for energy policy planning, the EITI ensures transparency in mineral

extraction data, and the World Bank's Open Data Initiative supports carbon market registries (EITI, 2023; IEA, 2025; World Bank, 2025). Such initiatives play a vital role in supporting informed decision-making and fostering market stability within interconnected energy systems across regions, especially in times of geopolitical crisis.

These developments reveal the growing intersection between geopolitics, regional integration, and data governance. Effective management of these interconnected systems and cross-border issues hinges on robust data governance within regional cooperation, a challenge that regional integration theory offers a lens through which to examine. Regional integration refers to a cooperative framework where states within a region promote economic cooperation through established institutions and rules aimed at reducing barriers to free trade, capital flows, and human mobility (Ginsberg, 2007; Sapir, 2011). Its foundation rests on the principle that collective action strengthens capacity, promoting development and security (Chingono & Nakana, 2009). Scholars, notably Schimmelfennig (2018), emphasise that the effectiveness of regional integration depends on four key conditions: institutional capacity, policy alignment, interdependence, and political will. These conditions collectively determine how states coordinate governance, establish binding agreements, and sustain long-term cooperation.

Within energy scholarship, regional integration is widely regarded as a key mechanism for enhancing the energy transition and energy security (ADBI, 2020; Feng et al., 2024; Naeher & Narayanan, 2020; Yu, 2019, 2023a). Its importance stems from the transboundary nature of energy systems, where activities span interconnected networks and require coordinated strategies. The UNDP (2011) highlights that, beyond trade liberalisation, regional integration involves coordinated infrastructure investment, regulatory alignment, unified macroeconomic policies, shared resource governance, and enhanced labour mobility. These characteristics create a governance environment in which data plays a central role in facilitating cooperation and addressing complex geopolitical challenges.

The following sections examine the data governance models of the EU and ASEAN across three key areas—power grids, CRM supply chains, and carbon markets—that underpin the evolving geopolitics of the energy transition.

3. Case Study of Data Governance in the EU's Energy Transition

The EU, a leader in climate policy and regional integration, relies on data governance as a central part of its decarbonisation strategy, strengthening regional energy cooperation to achieve climate goals (van Boven, 2023). Built on transparency, accountability, and teamwork, this approach has driven major progress in the energy transition in Europe, including cross-border power grid integration, CRM management, and carbon market development. Supply disruption during the Ukraine crisis since 2022 has accelerated these efforts as a way to boost the EU's energy security and global position (Kirkegaard, 2023; Patrahau, 2023; Ye et al., 2025).

3.1. The EU's Power Grid Integration

For over two decades, the EU has maintained an efficient and integrated electricity market delivering both supply security and decarbonisation. To reduce reliance on Russia's energy supply and to align with its 2050 net-zero target, the EU is reforming this market to raise renewable shares from 37% in 2022 to 69% by 2030

(ACER, 2023). Investment in modernising power grids has surged to support this ambition, with grid-related investments reaching $65 billion in 2023 (IEA, 2023). To optimise electricity distribution, the EU relies on advanced data analytics to distribute electricity efficiently, reduce congestion, and address renewable intermittency. To manage data in the energy sector, the EU has set overarching frameworks, including the Regulation on Wholesale Energy Market Integrity and Transparency (REMIT), the Clean Energy for All Europeans Package, the Third Energy Package, and the Green Deal (European Commission, 2010, 2016, 2019; Regulation (EU) No 1227/2011 of the European Parliament and of the Council of 25 October 2011, 2011). These regulations underpin this effort by requiring data-sharing rules to align with standardised practices and market integrity across member states, while also establishing data transparency and accuracy, mandating real-time information sharing.

Data governance in the EU's electricity market integration is facilitated by coordination efforts from the Agency for the Cooperation of Energy Regulators in collaboration with other agents such as the European Network of Transmission System Operators for Electricity (ENTSO-E) and the National Regulatory Authorities (NRAs; ACER, 2025). Established in 2011, ACER fosters cooperation among NRAs to ensure a well-functioning, integrated EU electricity market. It develops frameworks like network codes to standardise data collection and sharing for cross-border electricity trade and grid management. It supports data interoperability for cross-border grids and balancing markets, critical for renewable integration and regional cooperation. It also collects trading data to support the integrity and transparency of the wholesale energy market—a role that has been strengthened since the 2022 Ukraine crisis to address market volatility (Regulation (EU) 2024/1106 of the European Parliament and of the Council of 11 April 2024, 2024). ACER's 2025-2027 Work Programme highlights reforms to the REMIT framework, strengthening data governance through improved reporting and analysis to navigate uncertainties and reduce reliance on Russian energy (ACER, 2024). Its impact is amplified by collaboration with ENTSO-E, which manages technical data flows to ensure interoperability across EU member states (ENTSO-E, 2017) and NRAs, which implement ACER's guidelines at the local level. These measures embed standardised reporting, real-time data sharing, and interoperable systems into the EU's energy framework, reflecting a sustained commitment to collaboration and resilience.

3.2. The EU's Critical Raw Material Initiative

The EU's pursuit of mineral security is driven by a global resource race and surging demand for CRM essential to the energy transition, heightened by the 2022 Ukraine crisis. With renewable energy and digital technologies projected to increase the EU's CRM demand six-fold by 2030, securing reliable supplies has become a strategic priority to meet the EU's 2050 net-zero target and reduce import vulnerabilities (European Parliament, 2023). This urgency has prompted regional cooperation among member states to address mineral supply risks and market competition since the early 2000s. EU mineral policies, including the Raw Materials Initiative (RMI), the Circular Economy Action Plan, and the Critical Raw Materials Act (CRMA), have evolved to strengthen this cooperation by enabling data sharing on resources, risks, and recycling across the region (European Commission, 2008, 2020a, 2023). These policies advance CRM cooperation of EU member states by encouraging digital tools and platforms for sharing data among member states, boosting transparency and efficiency to identify risks and guide EU-wide supply strategies.

Data governance in the EU's CRM initiative is facilitated by key agencies that enhance regional cooperation through data-sharing frameworks, with the European Commission's Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW) as a central agent (European Commission, 2020b). Since launching the Raw Materials Initiative (RMI) in 2008, DG GROW has fostered member state collaboration by establishing early data-sharing platforms on supply and trade. It supported projects like MINATURA 2020 (2015–2018) and MIN-GUIDE (2016–2019), which standardised mineral deposit data and enhanced policy data for sustainable supply (IMA, 2020). DG GROW has also chaired the European Critical Raw Materials Board under the CRMA, overseeing advanced data-sharing frameworks with member state representatives and the European Parliament as an observer (European Commission, 2025c). It coordinates supply chain monitoring and strategic projects through subgroups like monitoring and circularity to unify regional CRM strategies. The Joint Research Centre (JRC) has managed the Raw Materials Information System (RMIS) since 2015, providing a centralised platform that enables member states to share data on supply risks and circularity, strengthening regional resilience (European Commission, 2025e). The European Raw Materials Alliance (ERMA), formed in 2020, connects industry, research, and policymakers across the EU, fostering data exchange to align supply chain efforts (ERMA, 2025).

3.3. The EU's Carbon Market

As part of the EU's climate action since 2005, the EU Emissions Trading System (ETS) employs a cap-and-trade mechanism to reduce greenhouse gas emissions across member states (European Commission, 2025a). Amid rising global climate pressures, the ETS aims at driving a 62% emission reduction by 2030 from 2005 levels, aligning with the EU's 2050 net-zero target under the European Climate Law (European Commission, 2025a). Since 2013, the ETS has generated cumulative revenues of over €200 billion, which are channelled into the Innovation Fund and Modernisation Fund, which finance low-carbon technologies and infrastructure projects (European Commission, 2025b). EU carbon policies, including the ETS Directive (2003/87/EC), the EU Climate Law (2021), and 2023 revisions under the "Fit for 55" package, have evolved to foster regional cooperation by establishing robust data-sharing frameworks (Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003, 2003; European Commission, 2021; European Parliament, 2023). Participants in the ETS, such as power plants, industrial facilities, and airline companies, are required to meticulously monitor and report emissions, which are independently verified to maintain data accuracy and credibility.

Data governance within the EU's carbon market is facilitated by key agencies such as the European Commission's Directorate-General for Climate Action (DG CLIMA), the European Environment Agency (EEA), and the European Securities and Markets Authority (ESMA). Since the ETS's launch in 2005, DG CLIMA has overseen emissions data integrity by enforcing standards under the Monitoring and Reporting Regulation and the Accreditation and Verification Regulation, which standardise monitoring, reporting, and verification (MRV) across member states to ensure consistency and reliability in emissions reporting (European Commission, 2025d). DG CLIMA also manages the Union Registry Public Website, which replaced the EU Transaction Log Public in 2024, providing a centralised market system that enables member states and operators, such as power plants and airlines, to share verified emissions and trading data under the Union Registry (European Commission, 2025f). This platform standardises data reporting across the region, ensuring compliance with ETS and Effort Sharing obligations, while facilitating regional cooperation by recording member state allowance transfers and supporting harmonised climate policy development and market integrity. The EEA supports this governance by aggregating and disseminating ETS data, supporting

policy and solutions of Europe's transition on the ground (EEA, 2025). Since 2011, ESMA has enhanced market stability by enforcing financial data-sharing standards under the Markets in Financial Instruments Directive II (ESMA, 2022), thereby addressing trading risks. These agencies collectively underpin regional decarbonisation with data exchange coordination and equitable standard enforcement, ensuring the EU's competitiveness in global carbon markets and the broader climate agenda.

4. Case Study of Data Governance in ASEAN's Energy Transition

Similar to the EU, the ASEAN pursues its energy transition through regional cooperation, exemplified by initiatives in cross-border power grid integration, carbon pricing, and CRM strategies, aiming to balance economic growth with sustainability. Despite these efforts, ASEAN's diverse energy landscape and rapid demand growth expose gaps in data governance, which is essential for effective coordination and transparency across member states. Rising regional energy needs, projected at 7.3% annually through 2030, underscore the urgency to strengthen data frameworks to enhance ASEAN's energy security and decarbonisation ambitions.

4.1. ASEAN's Power Grid Integration

ASEAN's pursuit of energy security and sustainability is illustrated in the ASEAN Power Grid (APG), a regional initiative first included in the ASEAN Plan of Action for Energy Cooperation (APAEC) in 1999 (Huda et al., 2023). The APG aims to interconnect the power systems of ASEAN's 10 member states to facilitate cross-border electricity trade and integrate renewable energy sources, supporting a regional electricity demand projected to triple by 2040 (Huda et al., 2023). A major progress of this regional cooperation is the Lao PDR–Thailand–Malaysia–Singapore Power Integration Project (LTMS-PIP), which transmits 100 MW of hydropower from Lao PDR to Singapore via Thailand and Malaysia (Rufaidah, 2023). Operational since June 2022, the LTMS-PIP marks ASEAN's first initiative in multilateral electricity trade, serving as a model for further cooperation in cross-border power grids, such as the proposed Brunei–Indonesia–Malaysia–Philippines Power Integration Project (Huda et al., 2023; Rufaidah, 2023). Although APAEC provides an overarching framework to promote harmonised technical standards for grid interconnections through the Heads of ASEAN Power Utilities/Authorities (HAPUA), development in regional data-sharing frameworks remains limited, and member states tend to rely on bilateral data exchange protocols managed by national utilities (Huda et al., 2023; Rufaidah, 2023). As a result, ASEAN has yet to establish a centralised platform or binding authority that mandates data governance for grid operations or cross-border electricity flow.

With no regional institution dedicated to data governance, oversight for the APG is primarily coordinated by the ASEAN Centre for Energy (ACE), established in 1999, alongside the HAPUA, the ASEAN Power Grid Consultative Committee (APGCC), and the ASEAN Energy Regulators Network (AERN). The ACE has supported studies like the ASEAN Interconnection Masterplan Study, which recommends harmonising regulatory frameworks, standards, and data availability through digital platforms to enhance regional grid connectivity (ACE & HAPUA, 2021). The LTMS-PIP Working Group exemplifies effective coordination, uniting utility companies (e.g., EGAT in Thailand, TNB in Malaysia, and SP Group in Singapore), regulators, and ministries through four task forces, which have developed trade and emergency protocols and a web-based platform for real-time data exchange (Huda et al., 2023). However, this group lacks representation from international financial institutions, such as multilateral development banks, limiting

funding for scalable data systems beyond bilateral protocols (Huda et al., 2023). HAPUA, the specialised body tasked with implementing the APG, focuses on harmonising technical standards and operational procedures (HAPUA, 2025), supported by the APGCC and AERN. Although these efforts emphasise digitalisation of bilateral trade, studies indicate that data sharing across borders and long-term commitment to data governance remain limited, impeding trade flexibility (Huda et al., 2023; IEA, 2022).

4.2. ASEAN's Critical Raw Materials Strategy

Abundant in CRM resources, ASEAN nations play an increasingly influential role in the global supply chain for clean energy technologies, such as electric vehicles, batteries, and solar panels. According to Bhaskara (2025), the region accounts for 63% of the world's nickel production and 42% of tin, alongside smaller outputs of manganese (3%), REE (8%), and copper (4%). ASEAN also demonstrates downstream processing capacity, notably through Indonesia's development of an integrated battery industry that leverages its extensive nickel reserves to support EV production. In the renewables market, Vietnam, Malaysia, Cambodia, Indonesia, and Thailand also collectively contribute around 9–10% to global solar PV cell and module production (Bhaskara, 2025). On the regional level, ASEAN formulates the ASEAN Minerals Cooperation Action Plan (AMCAP-III 2016–2025), an overarching policy positioning ASEAN as a competitive minerals investment destination. It aims to advance the mineral sector by fostering investment, sustainability, capacity building, and data management, primarily through the ASEAN Minerals Database and Information System (AMDIS; ASEAN Secretariat, 2021). It employs coordinated mechanisms such as the ASEAN Minerals Exploration Strategy (2023) to improve geological data availability and support exploration (ASEAN Secretariat, 2025). However, these data approaches seek to consolidate resource information, but the scarcity of quality geological data and mineral development data constrains standardised data-sharing efforts (IGF, 2023).

Data governance of CRM in ASEAN involves a network of regional and national actors, yet lacks a centralised authority to enforce consistent data-sharing or policy alignment. The ASEAN Ministerial Meeting on Minerals (AMMin), established in 2005, acts as the primary policy-making body, guiding strategic directions through biennial meetings and declarations (ASEAN Secretariat, 2025). The ASEAN Senior Officials Meeting on Minerals supports AMMin by overseeing implementation, directing four working groups, including the Working Group on Minerals Information and Database, which manages the AMDIS (ASEAN Secretariat, 2025). It aims to centralise data on reserves, production, and trade of minerals in the region. However, poor coordination across member states results in uneven data quality and capacity disparities, hindering data sharing and standardisation in regional mineral cooperation. Although the ASEAN Secretariat facilitates AMCAP-III coordination, it lacks regulatory power, resulting in gaps in data governance (ASEAN Secretariat, 2022).

4.3. ASEAN's Carbon Market Development

ASEAN and its member states have identified carbon markets, projected to reduce 1.1 gigatonnes of CO_2 annually (Pandey, 2024), as a key low-carbon solution to balance economic development and sustainability, but regional frameworks remain in the early stages. Across the region, carbon market development varies, with a mix of carbon taxes, ETS, and voluntary carbon markets. Indonesia launched a compliance-based ETS for its coal-fired power sector in 2023, while Singapore advances its carbon market industry through its carbon tax

and exchange platforms (Rakhiemah et al., 2024). Meanwhile, Malaysia and Thailand are exploring domestic trading mechanisms to attract investors (Rakhiemah et al., 2024). The overarching policy, embedded in the ASEAN Strategy for Carbon Neutrality, seeks to operationalise carbon markets by fostering collaboration, with a focus on alignment with Article 6 of the Paris Agreement, and high-quality carbon credits for global trade (Siew, 2025). Highlighting the importance of reliable emission data, ASEAN aims to develop a regional MRV framework to ensure credit quality and facilitate trade (ASEAN Secretariat, 2023).

Data governance for ASEAN's carbon markets involves a mix of regional and national actors, yet lacks a centralised authority to enforce standardisation. The ASEAN Climate Change Working Group (ACCWG), under the ASEAN Senior Officials on Environment, leads the development of a regional MRV framework, coordinating data protocols to support the ASEAN Strategy for Carbon Neutrality (OECC, 2025). The ASEAN Alliance on Carbon Markets, through its COP29-established ACCF, contributes by setting minimum governance standards for carbon project data, aiming to enhance transparency across member states (Lau, 2024). At the national level, Singapore-based Climate Impact X, a global carbon exchange platform developed by SGX, began spot trading in November 2024. It employs satellite monitoring and blockchain technology to strengthen data integrity, ensuring robust validation and tracking of credits to support market credibility (Fogarty & Tan, 2024). Additionally, regional initiatives, such as TRACTION, launched by Singapore's Monetary Authority (MAS) in December 2023 with nearly 30 partners, including banks and international organisations, aim to standardise transition credit data protocols and enhance market integrity (MAS, 2023). Although a comprehensive ASEAN-wide platform for data integrity or registry standards has yet to be established, these regional initiatives highlight the importance of data governance in fostering trust and scalability in ASEAN's carbon markets despite disparities in national capacities hindering progress.

5. Comparison of Data Governance and Geopolitical Considerations

Through the lens of regional integration theory, this section compares the EU's centralised and formalised data governance, applied across power grids, CRM supply chains, and carbon markets, with ASEAN's more informal and decentralised coordination. While the core focus is on the institutional and policy structures of data governance, these differences also influence how each region navigates the evolving geopolitics of energy transition.

5.1. Comparison of EU–ASEAN Data Governance

5.1.1. Comparison 1: Institutional Capacity

Institutional capacity reflects differences in policy enforcement structures and coordination mechanisms. In the EU, data governance for energy transitions is anchored in centralised institutions with executive authority and binding mandates to oversee data-sharing and standardisation (ACE, 2019; Do & Burke, 2022; Huda, 2025; Sung & Ho, 2024). Agencies like ENTSO-E, ACER, DG CLIMA, and DG GROW play key roles in ensuring effective data cooperation in cross-border electricity trade and supply chain coordination across member states. In contrast, whilst government-to-government collaboration has supported energy trade in Southeast Asia, studies have highlighted the need to strengthen ASEAN's institutional capacity to facilitate multilateral electricity trade (ACE, 2019; Huda, 2025; Sung & Ho, 2024). ASEAN has yet to establish a centralised governance body for energy integration with an enforcement authority comparable to that of

the EU. Instead, it relies on a network of informal cooperation among regional and national agencies, including the ACE, ACCWG, and AMMin (Andrews-Speed, 2016). ASEAN's preference for bilateral negotiations and informal arrangements over binding mechanisms is also reflected in the absence of a regional dispute resolution body or neutral arbitration centre (Aalto, 2014; Do & Burke, 2022). This decentralised institutional approach limits ASEAN's ability to formalise and implement regional data-sharing mechanisms (Do & Burke, 2022; Huda, 2025).

5.1.2. Comparison 2: Policy Alignment

Policy alignment reflects the extent to which countries prioritise coordinated approaches to data governance. In the EU, consistent data policies are enforced through binding regulatory frameworks such as REMIT, ETS, and the CRMA. These frameworks established standardised data-sharing obligations, market integrity measures, and emissions monitoring systems. High levels of policy alignment minimise regulatory inconsistency and facilitate regional cooperation in power grid operation, CRM management, and carbon markets. In contrast, ASEAN's data policy landscape demonstrates varying degrees of alignment, often shaped by national and geopolitical priorities (IRENA, 2018). Regional strategies such as APAEC, AMCAP-III, and the ASEAN Strategy for Carbon Neutrality provide strategic direction but remain non-binding, resulting in informal institutional cooperation (Andrews-Speed, 2016). This contributes to inconsistencies in data availability and coordination across member states (Do & Burke, 2022). Unilateral actions, such as Indonesia's and the Philippines' nickel export restrictions, emphasise the preference for national policy interests (Bhaskara, 2025).

5.1.3. Comparison 3: Interdependence

Interdependence reflects the necessity for robust data governance in the energy transition. In the EU, high interdependence among member states incentivises the development of strong data-sharing mechanisms across power grids, CRM management, and carbon markets. The ENTSO-E Regulation facilitates coordinated cross-border electricity flows, while the EU ETS ensures a standardised framework for emissions trading. This mutual reliance creates a strong impetus for transparent and harmonised data governance. In contrast, due to geopolitical complexities, ASEAN's regional energy cooperation is predominantly bilateral, limiting the collective demand for a fully integrated data-sharing framework (Aalto, 2014; Andrews-Speed, 2016). While initiatives such as the APG and LTMS-PIP demonstrate progress toward cross-border electricity integration, ASEAN has yet to establish a comprehensive governance structure to support coordinated data management (Huda, 2025). Similarly, the governance of CRM and the carbon market continues to be shaped primarily by national strategies (Rakhiemah et al., 2024), which tend to limit progress towards the regional standardisation of data reporting interoperability.

5.1.4. Comparison 4: Political Will

Political will is a critical prerequisite for achieving high levels of market integration, particularly when it involves the exchange of sensitive data. In the EU, robust data governance is supported by strong political commitment among member states to align their data policies and delegate authority to supranational institutions (Ricart, 2023). This institutional trust facilitates the cross-border sharing of sensitive data and contributes to the development of a unified digital market. In contrast, ASEAN faces greater challenges in

this area due to differing levels of political will and institutional coordination (Do & Burke, 2022; Yao et al., 2021). Sensitive surrounding data sovereignty, particularly concerning energy-related information such as production, trade, and reserves, can complicate regional cooperation. In some cases, concerns over economic competitiveness have led governments to prioritise domestic energy development and maintain control over their energy sectors, often favouring bilateral arrangements over broader regional integration (Shi & Kimura, 2013; Wu et al., 2012; Yao et al., 2021). These dynamics can limit cross-border data access and hinder efforts to enhance market integration (Do & Burke, 2022; Long, 2023).

Regional integration theory underscores the EU's comparatively higher effectiveness in data governance integration for energy transition, enabled by stronger institutional capacity, policy alignment, mutual interdependence, and political commitment. These conditions support cross-border electricity trade, CRM coordination, and harmonised carbon market frameworks. By contrast, ASEAN's varied institutional capacities, limited policy coordination, and lower levels of political will result in a more informal, fragmented approach to data governance. Additionally, gaps in data availability further hinder the development of a regional data-sharing framework, reinforcing reliance on national systems and bilateral approaches. This divergence highlights the EU's cohesive and strategically aligned model in contrast to ASEAN's coordination challenges, with important implications for each region's role in global energy and climate governance.

5.2. Geopolitical Implications of EU–ASEAN Energy Data Governance

As discussed in Section 2, the geopolitics of energy transition is increasingly shaped by data-enabled cooperation underpinning decarbonisation efforts. Within this context, the EU and ASEAN have diverging approaches to energy data governance that shape their geopolitical positioning. The EU's centralised data governance enhances its energy security and allows it to project a unified stance in the global climate agenda, reinforcing its geopolitical influences (Kivimaa, 2024; Maltby, 2013; Yu, 2018). In contrast, ASEAN's informal approach limits its geopolitical leverage, making it more vulnerable to external market pressures and regulatory pressures. This section explores how the differences in data governance influence their geopolitical leverage with a focus on energy security and the climate agenda.

Both case studies show that a strong data governance framework is crucial for enhancing energy security, as it enables regional integration to diversify sources and reduce vulnerability to external threats. Robust data systems facilitate coordinated cross-border energy flows and renewable integration, whereas weak governance leaves regions vulnerable to supply disruptions. In the EU, data governance is considered a critical enabler of energy integration (European Commission, 2024a), which is intertwined with its energy security and geopolitical strategy. This became particularly evident following the escalation of tensions with Russia, especially after the outbreak of the war in Ukraine. In response to the resulting energy supply risks, the EU made a concerted effort to reduce its dependency on Russian fossil fuels. In 2023, the EU's natural gas imports from Russia declined to about 15% from 45% in 2021 (European Commission, 2024b). This reduction reflects the EU's strategic shift towards energy diversification and resilience. Central to this approach was the diversification of energy sources, including increased imports of US LNG and Norway's pipeline gas. The EU also accelerated investments in renewable energy infrastructure, aligning with initiatives like the REPowerEU plan, which seeks to phase out dependence on Russian fossil fuels (European Commission, 2024b). Within this context, geopolitical disruptions have heightened pressures on both energy security and energy transition, reinforcing the need for more robust data governance to support the coordination of diversified energy flows and the operation of an integrated energy system.

In ASEAN, however, informal data governance constrains the region's coordinated efforts to enhance energy security. While there are regional initiatives and projects to facilitate energy trade, they mostly rely on bilateral agreements rather than a centralised governance approach (Andrews-Speed, 2016). Moreover, protectionist approaches could undermine regional energy cooperation. The use of market leverage, such as export control over energy resources, which can be intertwined with regional rivalries, results in discontinuities in energy trade policy (Huda et al., 2023). The lack of a centralised institution constrains ASEAN's ability to integrate renewables or manage energy trade effectively, risking supply disputes and geopolitical vulnerabilities.

Data governance also plays a pivotal role in enhancing competitiveness in climate agendas and standard-setting. High data integrity and unified standards enable countries to shape global markets, whereas fragmentation erodes climate leadership and reduces economic advantages. This strategic use of data governance is well demonstrated in the EU's Carbon Border Adjustment Mechanism (CBAM), which is backed by advanced monitoring and verification systems and imposed carbon prices on imports like steel and cement. Benchmarking its price against the EU ETS, CBAM helps level the playing field for EU industries while compelling global trading partners to align with its stringent environmental standards (Benson et al., 2023). By embedding robust data governance into its climate agenda, the EU not only fosters the adoption of transparent and accountable frameworks globally but also strengthens its influence over international carbon markets. Policy alignment and data cohesion reinforce EU industries' competitiveness, pressuring trade partners to adopt stricter carbon reporting norms (Benson et al., 2023). With strong data governance, it is in a better position to set global standards, leveraging detailed emissions registries to enforce compliance and gain economic leverage (Boocker & Wessel, 2024).

In contrast, ASEAN's informal approach to data governance presents challenges to its competitiveness in the global climate agenda, potentially undermining its attractiveness as a trade partner and investment destination (Elder et al., 2025). The absence of a centralised framework of carbon pricing schemes and project registry hinders the development of a unified market. This regulatory gap risks placing the region at an economic disadvantage, with its exports becoming subject to higher carbon-related tariffs under mechanisms such as the EU's CBAM (Elder et al., 2025). Without robust data governance, ASEAN risks becoming a rule-taker in global climate governance and remains vulnerable to evolving international climate regulations and trade measures imposed by more data-driven regulatory blocs such as the EU. Countries with weaker data systems could face higher costs in aligning with these standards and risk losing market influence, deepening economic disparities. These findings reflect the broader risks identified in Section 2, where fragmented data governance in energy transition can exacerbate geopolitical vulnerabilities.

6. Conclusion

Data governance in the energy transition is both shaped by geopolitics and reshapes geopolitical dynamics, with the EU and ASEAN exemplifying divergent paths through regional integration. This article has shown how the EU and ASEAN diverge in their regional integration strategies and institutional capacities, shaping not only their regional energy cooperation but also their ability to influence global climate governance. While the EU leverages centralised frameworks to strengthen energy security, coordinate resource supply chains, and set international carbon market standards, ASEAN's decentralised and informal approach constrains its strategic leverage. The comparative analysis offers three broader implications for regions navigating the energy transition.

First, it underscores the need for regionally tailored data governance frameworks that reflect national capacities. While energy transition is a global consensus, not all governments can advance at the same pace due to differing domestic capabilities and constraints (Finley & Gross, 2025). Developed economies are better positioned to absorb the upfront costs of renewable expansion, whereas many developing economies remain reliant on fossil fuels while pursuing alternative decarbonisation pathways, often constrained by affordability, infrastructure deficits, and fragmented markets (Huda, 2022). Recognising this divergence is essential for crafting inclusive regional strategies that accommodate differentiated capabilities.

Second, it highlights that data governance is not only a technical consideration but also a strategic enabler of energy transition. Robust data frameworks underpin effective cooperation in cross-border power grids, CRM tracking, and carbon market transparency, each of which is essential for managing the new geopolitical risks of decarbonisation. For regions like ASEAN and other developing regions, improved data governance presents a pathway to overcome institutional fragmentation and enhance regional energy resilience. However, it requires targeted reforms in capacity-building to address existing coordination challenges, in particular institutional disparities.

Third, as global decarbonisation accelerates, the capacity to govern energy data has become a key factor in shaping energy resilience and strategic influence. With energy systems becoming increasingly data-intensive, regional blocs—both formal and informal—are under growing pressure to adopt more integrated and transparent data-sharing frameworks while still respecting national sovereignty. The ability to govern energy data collaboratively will influence not only decarbonisation outcomes but also regional positioning in the evolving geopolitics of energy.

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Conflict of Interests

The author declares no conflict of interest.

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