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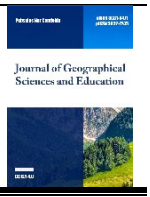

[Review Article]

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Government Policies in Egypt and Indonesia to Mitigate Carbon Emissions: A Comparative Study

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Abstract

Accelerating global climate change and increasing pressure to fulfill commitments under the Paris Agreement have positioned the effectiveness of national carbon mitigation policies as a critical policy issue for developing countries. This review article compares carbon mitigation policies in Egypt and Indonesia, both of which face similar challenges but operate within different governance contexts. The study employs a descriptive comparative analysis based on a systematic review of national climate strategies, legal frameworks, renewable energy policies, sustainable transport initiatives, private sector engagement, and climate finance mechanisms. Both countries have achieved significant policy progress; however, the effectiveness of carbon mitigation remains constrained by governance challenges, particularly policy coordination, bureaucratic efficiency, and implementation capacity. This study argues that a hybrid policy approach combining Egypt's regulatory strengths with Indonesia's long-term planning framework has the potential to enhance carbon mitigation effectiveness. These findings provide policy-relevant implications for other developing countries seeking to strengthen climate governance and accelerate progress toward global emission reduction targets.

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Abstrak

Percepatan perubahan iklim global dan tuntutan pemenuhan komitmen Perjanjian Paris menempatkan efektivitas kebijakan mitigasi karbon nasional sebagai isu kebijakan yang krusial bagi negara berkembang. Artikel tinjauan ini membandingkan kebijakan mitigasi karbon di Mesir dan Indonesia, dimana keduanya menerima tantangan serupa namun dengan konteks tata kelola yang berbeda. Kajian ini menggunakan analisis deskriptif komparatif berbasis telaah sistematis terhadap strategi iklim nasional, kerangka hukum, kebijakan energi terbarukan, transportasi berkelanjutan, keterlibatan sektor swasta, dan pembiayaan iklim. Kedua negara telah mencatat kemajuan kebijakan yang signifikan, namun efektivitas mitigasi karbon masih terhambat oleh persoalan tata kelola, terutama koordinasi kebijakan, efisiensi birokrasi, dan kapasitas implementasi. Studi ini menegaskan bahwa pendekatan kebijakan hibrida yang mengombinasikan kekuatan regulasi Mesir dengan perencanaan jangka panjang Indonesia berpotensi meningkatkan efektivitas mitigasi karbon. Temuan ini memberikan implikasi kebijakan yang relevan bagi negara berkembang lain dalam memperkuat tata kelola iklim dan mempercepat pencapaian target penurunan emisi global.

INTRODUCTION

Amid accelerating global climate change and rising carbon emissions, the effectiveness of national emission mitigation policies has become a central concern in climate governance, particularly for developing countries facing rapid economic growth and complex energy transitions (Biermann & Pattberg, 2012; Jordan et al., 2018). Carbon dioxide (CO_2) remains the primary driver of global warming, accounting for the largest share of anthropogenic greenhouse gas (GHG) emissions worldwide (Dubash et al., 2021). Despite international efforts under the Paris Agreement, many developing countries continue to struggle to translate climate commitments into coherent, effective, and well-coordinated domestic policies (Nachmany & Setzer, 2017; Hale, 2020).

This study is grounded in a comparative public policy and climate governance framework, which emphasizes how variations in institutional capacity, policy design, and implementation mechanisms shape national responses to global climate commitments (Howlett et al., 2020; Dubash et al., 2021). Within this framework, climate mitigation is not only a technical challenge but also a governance issue, influenced by political structures, administrative arrangements, and policy instruments. Using this framework, the paper examines how developing countries operationalize emission mitigation strategies under the Paris Agreement, with particular attention to governance structures and policy instruments that condition policy effectiveness (Jordan et al., 2018).

While a growing body of literature has examined carbon mitigation strategies at the national level, existing studies largely focus on single-country cases or developed economies (Purdon, 2017). Comparative analyses of emission mitigation policies in developing countries remain limited, particularly those that explicitly assess how governance arrangements influence policy outcomes and implementation performance (Nachmanyet & Setzer, 2017; Averchenkova et al., 2021). This lack of comparative evidence constrains the development of context-sensitive policy lessons applicable to the Global South.

Egypt and Indonesia are selected as comparative case studies due to their shared status as developing economies committed to the Paris Agreement, their rising energy demand, and their exposure to climate-related risks, while differing substantially in governance systems, energy structures, and institutional arrangements (Abdelmeguid & M. Ibrahiem, 2025; Ridho & Marlinda, 2025). Egypt represents a policy context characterized by relatively centralized governance and strong legal frameworks for climate and energy policy, whereas Indonesia reflects a decentralized governance system, long-term development planning, and significant land-use and forestry-related emission challenges. This contrast provides a valuable analytical basis for examining how different governance models shape the design, implementation, and outcomes of carbon mitigation policies.

Against this background, this study aims to examine the governmental policies and legislative frameworks adopted by Egypt and Indonesia to reduce carbon emissions in line with their commitments under the Paris Agreement, and to assess the effectiveness of these carbon mitigation policies by identifying key institutional and governance factors that facilitate or hinder their implementation in both countries.

LITERATURE REVIEW

Government Policies in Egypt to Mitigate Carbon Emissions

Renewable Energy Policies

Egypt has implemented several environmental policies aimed at reducing carbon emissions, with a strong emphasis on transitioning to renewable energy. The Egyptian Energy Strategy 2035 targets generating 42% of electricity from renewable sources by 2035, including solar, wind, and hydropower (IRENA, 2020). To support this goal, the government has invested in large-scale projects such as the Benban Solar Park and the Gabal El Zeit Wind Farm, which are among the largest renewable energy initiatives in the region (World Bank, 2020). These projects reflect Egypt's efforts to reduce dependence on fossil fuels and mitigate the environmental impacts of energy production.

Nationally Determined Contributions

Egypt's commitment to the Paris Agreement is articulated through its Nationally Determined Contributions (NDCs), which aim to reduce GHG emissions by 10% by 2030 (UNFCCC, 2020). These commitments reflect

Egypt's effort to balance emission reduction objectives with ongoing economic development and energy security priorities. Key strategies include improving energy efficiency, promoting cleaner industrial practices, and supporting the adoption of green technologies across multiple sectors. In addition, Egypt's NDCs emphasize the role of policy coordination, regulatory reforms, and capacity building in facilitating emission mitigation, particularly in energy-intensive sectors that contribute significantly to national emissions.

Climate Finance and International Cooperation

Climate finance plays a crucial role in Egypt's mitigation efforts. This role is particularly significant given the country's fiscal constraints and the capital-intensive nature of low-carbon transitions. The country's engagement with the Green Climate Fund (GCF) and collaboration with international organizations demonstrate its approach to financing and scaling up climate action. Through these mechanisms, Egypt seeks to mobilize external funding for renewable energy projects, energy efficiency programs, and climate-resilient infrastructure. In addition, climate finance is increasingly positioned as a strategic tool to bridge the gap between national climate ambitions and practical implementation on the ground. These partnerships are essential for mobilizing resources and enhancing the implementation of low-carbon initiatives, as well as for facilitating technical assistance, capacity building, and institutional strengthening at the national level.

Transportation and Urban Sustainability

In addition to the energy sector, the Egyptian government has highlighted sustainable urban planning and the development of electric transportation systems as part of its mitigation strategy. Rapid urbanization and population growth have intensified pressures on urban transport systems, increasing fuel consumption and traffic congestion. The transportation sector remains a major source of air pollution and CO_2 emissions, particularly in densely populated cities such as Cairo, making these measures critical for emission reduction (Abbas et al., 2021). Consequently, investments in public transport, electric mobility, and integrated urban planning are increasingly viewed as essential components of Egypt's climate mitigation agenda.

Challenges and Policy Limitations

Despite these initiatives, Egypt continues to face significant challenges, including reliance on natural gas and coal, slow policy implementation, and financial constraints. These challenges reflect broader structural and institutional limitations within the national energy and governance system. These factors limit the speed of transition toward a low-carbon economy. Nevertheless, the growing emphasis on renewable energy and alignment with international climate agreements indicate Egypt's ongoing commitment to achieving its climate mitigation goals through a gradual and incremental transition pathway (State Information Service, 2024; UNFCCC, 2024).

Government Policies in Indonesia to Mitigate Carbon Emissions

Renewable Energy and Regulatory Framework

Indonesia has adopted strategic policies to reduce carbon emissions, with a strong focus on developing renewable energy and implementing regulatory reforms. The National Energy Policy (Regulation No. 79/2014) aims to achieve a 23% share of renewable energy by 2025, supported by Energy Law No. 30/2007, which promotes the development of clean energy (Climate Change Laws of the World, 2014; Ministry of Finance, 2018). These regulatory instruments reflect the government's intention to reduce dependence on fossil fuels and strengthen the institutional basis for energy transition.

Nationally Determined Contributions and Development Planning

Indonesia ratified the Paris Agreement through Law No. 16/2016, committing to reduce GHG emissions by 29% unconditionally and up to 43% with international support. These commitments position Indonesia among the more ambitious developing countries in terms of emission reduction targets. These commitments are integrated into national development planning through the Low Carbon Development Initiative (LCDI), which aligns climate mitigation goals with long-term economic growth strategies (Bappenas, 2019). The LCDI framework reflects Indonesia's effort to shift from a sectorally fragmented approach toward a

more integrated and evidence-based climate–development policy paradigm. This integration enhances policy coherence and supports the mainstreaming of climate objectives across development sectors.

Green Finance and Investment Instruments

Indonesia has demonstrated leadership in climate finance by issuing the world's first sovereign green sukuk and establishing a Sustainable Finance Roadmap alongside a Green Taxonomy to guide environmentally responsible investments (Ministry of Finance, 2018; OJK, 2014). These innovative financial instruments play a critical role in mobilizing public and private capital for renewable energy, energy efficiency, and other low-carbon development initiatives. They also strengthen investor confidence and signal the government's commitment to sustainable finance.

Challenges and Policy Constraints

Despite notable progress, Indonesia continues to face challenges, particularly its heavy reliance on coal and institutional coordination issues. The persistence of coal-based power generation reflects both economic considerations and existing energy infrastructure lock-ins. Nevertheless, Indonesia's integrated policy approach combining regulation, finance, and development planning positions it as a leading model for climate mitigation policy among developing countries. This experience offers valuable lessons for other Global South countries seeking to balance economic growth with climate commitments.

METHOD

This study adopts a qualitative comparative descriptive analytical design to examine governmental policies for carbon emission mitigation in Egypt and Indonesia. The research focuses on understanding how national climate policies are formulated and implemented within different governance contexts, rather than on measuring emission outcomes quantitatively.

The research is based on a systematic documentary analysis of secondary data, including NDCs, national energy and climate strategies, environmental laws, policy reports, and international climate agreements. Documents were collected from authoritative sources such as the UNFCCC document repository, official governmental portals, and international organizations, including the World Bank and the International Renewable Energy Agency (IRENA). In addition, peer-reviewed academic literature indexed in databases such as Scopus was used to support the analysis.

Source validity was ensured by prioritizing official and peer-reviewed publications. Non-official, outdated, or non-relevant documents were excluded to maintain analytical rigor. The temporal scope of the analysis covers the period from 2015 to 2024, corresponding to the post-Paris Agreement era of national climate policy development.

Content analysis and structured comparative techniques were employed to assess similarities, differences, strengths, and limitations of carbon mitigation policies in the two countries. The comparative analysis focuses on five thematic areas: legislative and regulatory frameworks, renewable energy development, private sector participation, international climate commitments, and sustainable urban transport. These themes were selected based on established climate mitigation and governance frameworks, particularly the IPCC sectoral mitigation approach.

Overall, this methodological approach enables a focused and systematic comparison between Egypt and Indonesia. It supports the identification of policy gaps and best practices and provides transferable insights relevant to low-carbon development strategies in other developing country contexts.

RESULTS AND DISCUSSION

Policies and Procedures have been implemented to Reduce Carbon Emissions in Egypt

Egypt's Environmental Protection Law is Law No. 4 of 1994

While Egypt's Environmental Protection Law No. 4 of 1994 provides a comprehensive regulatory framework, its effectiveness in achieving measurable environmental improvements has been mixed. Empirical evidence indicates that the law has contributed to improvements in specific sectors, particularly air quality management and industrial pollution control, but has been less effective in delivering consistent, nationwide emission reductions (Egyptian Environmental Affairs Agency, 2024).

According to reports by the Egyptian Environmental Affairs Agency (EEAA), the implementation of Environmental Impact Assessments (EIAs) and emission permitting requirements has led to improved compliance among large industrial facilities, especially in cement, fertilizer, and energy-intensive industries (OECD, 2025). Studies published in regional environmental journals report localized reductions in particulate matter (PM_{10} and $PM_{2.5}$) concentrations in Greater Cairo following the enforcement of emission standards and fuel quality regulations during the 2010s. These improvements suggest that the law can contribute to emission reductions when enforcement and monitoring are adequately resourced (Egypt's Environmental Protection Is Law No. 4 of 1994, 1994).

However, national GHG emission trends indicate that overall emissions in Egypt have continued to rise, largely driven by population growth, energy demand, and industrial expansion. This trend suggests that the law's regulatory instruments alone have been insufficient to offset structural drivers of emissions. Empirical evaluations highlight that weak enforcement, limited monitoring capacity, and relatively low penalties reduce the deterrent effect of the law, particularly for small and medium-scale enterprises and in rural areas.

Peer-reviewed evaluations further note that while Law No. 4 of 1994 has strengthened environmental governance and institutional capacity, its impact on emission reduction remains indirect rather than transformative. Its primary contribution lies in establishing regulatory procedures, raising environmental awareness, and integrating environmental considerations into development planning rather than achieving large-scale emission cuts. Recent assessments emphasize that aligning the law with climate-specific policies, market-based instruments, and updated emission standards is essential to enhance its effectiveness in reducing emissions in line with Egypt's climate commitments (World Bank, 2020).

Overall, empirical evidence suggests that Egypt's Environmental Protection Law has achieved partial success in improving environmental management and localized pollution control, but its effectiveness in reducing national emissions remains limited without stronger enforcement mechanisms, updated legal provisions, and integration with climate mitigation strategies (UNFCCC, 2020). This limitation highlights the gap between regulatory intent and implementation capacity, particularly in translating environmental protection mandates into measurable climate mitigation outcomes.

Law Egypt's Electricity No. 87 of 2015 and the National Energy Strategy to 2035

Egypt's Electricity Law No. 87 of 2015 and the National Energy Strategy to 2035 represent major policy instruments aimed at restructuring the electricity sector, attracting private investment, and supporting the transition toward a more diversified energy mix (Climate Change Laws of the World, 2015). Empirical evidence suggests that these policies have achieved partial effectiveness, particularly in expanding generation capacity and accelerating renewable energy deployment, though their impact on emission reduction remains mixed (World Bank & International Finance Corporation, 2020).

According to government and international energy assessments, Egypt has made measurable progress in increasing the share of renewable energy, particularly solar and wind power. Large-scale projects such as the Benban Solar Park have contributed to a growing installed renewable capacity, supporting the strategy's target of increasing renewable energy penetration in electricity generation. International Energy Agency (IEA) data indicate that renewable electricity capacity in Egypt increased significantly after 2016, reflecting the positive role of regulatory reforms and investment incentives introduced under Law No. 87 of 2015 (IEA, 2023).

However, national emissions trends show that overall GHG emissions from the energy sector have continued to rise. This increase is largely driven by rapid growth in electricity demand, population expansion, and continued reliance on natural gas and fossil fuels for base load power generation. As a result, while the policy framework has facilitated cleaner electricity generation at the margin, it has not yet led to an absolute reduction in energy sector emissions at the national level.

Empirical evaluations from the World Bank highlight that structural constraints limit the effectiveness of these policies. The 2019 Creating Markets in Egypt report identifies delayed market liberalization, continued state

dominance in transmission and pricing, and incomplete subsidy reform as key barriers. Persistent electricity subsidies reduce price signals that could encourage energy efficiency, demand-side management, and a faster shift toward renewable energy sources. These factors weaken the law's ability to deliver emission reductions despite improvements in generation efficiency and renewable capacity (Wahba & Abourayia, 2025).

Peer-reviewed policy analyses further note that while Egypt's electricity reforms have improved energy security and investment attractiveness, their climate mitigation impact remains indirect. The policies have been more successful in modernizing infrastructure and positioning Egypt as a regional electricity hub than in achieving substantial emission cuts. Strengthening incentive-based pricing mechanisms, accelerating market competition, and integrating climate-specific emission targets into electricity regulation are, therefore critical to enhancing the effectiveness of these policies in reducing emissions by 2035.

Overall, available empirical evidence indicates that Egypt's Electricity Law No. 87 of 2015 and the National Energy Strategy to 2035 have delivered tangible achievements in capacity expansion and renewable energy deployment, but their effectiveness in reducing emissions remains constrained by structural and regulatory limitations.

Renewable Energy Law Law No. 203 of 2014, in Egypt (Benban Solar Power Plant)

Benban Solar Power Plant is Egypt's biggest success story in renewable energy. It was the outcome of the application of Law No. 203 of 2014, which governs renewable energy projects and enabled the private sector to generate and sell electricity through clean means like the feed-in-tariff. This political environment has attracted over $2 billion in local and foreign investments and made Benban the world's largest solar energy facility with an estimated output of about 1,650 megawatts, equal to about 90% of High Dam production at some points in time. In spite of all these achievements, the project has been criticized for not integrating renewable energy into the country's power network. A 2020 World Bank report, "Middle East and North Africa Integration of Renewable Energy", discovered Egypt's aging electricity grid infrastructure to be an actual hindrance to maximizing the potential of such ventures like Benban. It also discovered solar energy projects having to produce less than their capacities because of transmission and distribution limitations, an act that is referred to as curtailment (Republic of Egypt, 2014).

Moreover, other studies have attributed Egypt's procrastination in moving away from the rigid feed-in tariff scheme to more efficient competitive means like open auctions, which ensure better competitive prices and better financial sustainability for the state. Furthermore, an IRENA study predicted that to keep up with solar growth momentum, institutional reforms must continue, especially in electricity prices, and allow new projects access to the grid (IRENA, 2018). Therefore, although Law 203 of 2014 was a successful law for the utilization of renewable energy schemes in Egypt, like the Benban Solar Park, long-term success will be achieved through the improvement of laws, improving the national grid's flexibility, and adopting more competitive market policies to help Egypt fulfill its energy strategy objectives until 2035.

The Role of the Green Climate Fund in Advancing Sustainable Development in Egypt

The GCF is a global framework of the United Nations aimed at assisting developing nations to adapt to the effects of climate change and mitigate greenhouse emissions. Egypt started its cooperation with the Fund through the Ministry of Environment as the National Designated Authority to raise green financing for green development projects. This direction was also dealt with legislatively by Law No. 162 of 2020 for regulating the issuance of sustainable finance instruments, opening the door to the issuance of green sukuk and bonds for the first time in Egypt and helping to create the legislative foundation necessary to attract climate investments. The GCF in Egypt is looking to bolster the country's climate resilience and speed up the transformation into a green economy through the promotion of financing for renewable energy projects, climate-resilient infrastructure, and smart agriculture ventures (United Nations Industrial Development Organization, 2024). Some of the key achievements include securing crucial financing like the Climate-Resilient Water Infrastructure Project for USD 1.2 billion, the

Greening Financial Systems Program for USD 1.3 billion, and the issuance of funding to issue the first ever sovereign green bond worth USD 750 million in 2021. All these complaints have been raised regarding unnecessary prolonged bureaucratic processes, dependence on foreign intermediary institutions that deny direct national benefit, and weak involvement of the local people in project planning and implementation. These observations are supported by findings from the study which emphasized the need for improving green finance governance, enhancing transparency, and ensuring wider access to funding mechanisms, especially for vulnerable regions (Elsherif, 2023). The study further recommended the establishment of a dedicated national authority for climate finance to ensure effective implementation and equitable distribution of resources.

Sustainable Urban Planning and Electric Transportation Systems in Egypt

The Egyptian Sustainable Urban Planning and Electric Transportation Systems Law is a legislative and strategic guidance that is set to direct urban growth in a balanced and sustainable way. It was started in 2014 through working with UN-Habitat and was set to focus on land use control and city planning legislation reform in order to fight informal sprawl and allow local governments to undertake integrated and efficient development plans. The main aim of this bill is to establish more efficient and sustainable urban spaces by connecting urban planning with green, innovative, public transport systems. This vision has been actualized in the form of mass electric transportation schemes such as the Light Rail Transit (LRT), the Monorail, the Cairo Metro extensions, and the Bus Rapid Transit (BRT) system which has recorded an impressive amount of emissions reduction, with forecasted reduction by as much as 9 million tons of CO_2 a year by 2030, coupled with yearly savings of as much as $8 billion on fossil fuel expenses (World Bank, 2022).

But the operation faces such intimidating challenges as project completion delays, unevenness in the rural-urban gap in coverage of services, and minimal participation of communities in decision-making, which can limit the fulfillment of the law to its maximum social and environmental impacts. These issues are tested stringently against the Sustainable Urban Transition Theory that sustainable urban transformation necessitates structural intervention, institutional innovation, and systemic reform in transport and energy modes. To test this, the 2021 World Bank report on Transforming Transportation in Developing Cities reaffirmed that integrating urban policy with sustainable transport solutions improves urban livability considerably and poverty reduction effectively (Ardila-Gomez et al., 2021). Therefore, the legislative and infrastructural actions of Egypt are a good step toward urban sustainability, but sustained public accountability, policy improvement, and participatory governance are needed.

Policies and Procedures have been implemented to Reduce Carbon Emissions in Indonesia

Indonesia's National Energy Policy under Presidential Regulation No. 79 of 2014

Indonesia's National Energy Policy (NEP), enacted under Presidential Regulation No. 79 of 2014, provides a long-term strategic framework aimed at strengthening energy security, diversifying the national energy mix, and supporting sustainable development. The policy set an ambitious target of achieving a 23% share of renewable energy in the national primary energy mix by 2025, alongside reduced reliance on oil and improved energy efficiency (Climate Change Laws of the World, 2014).

Empirical evidence indicates that the effectiveness of the NEP has been partial and uneven. Government statistics show that Indonesia has made progress in expanding renewable energy capacity, particularly in geothermal, hydropower, and solar, supported by feed-in tariffs and public-private partnerships. According to the Ministry of Energy and Mineral Resources, the share of renewable energy in the national energy mix increased steadily after 2015, reflecting the NEP's contribution to institutionalizing renewable energy development and improving public awareness (Bridle et al., 2019).

However, the policy's effectiveness in reducing emissions has been limited. National GHG emission trends reveal that emissions from the energy sector have continued to rise, largely due to sustained dependence on coal for electricity generation and growing energy demand driven by economic and population

growth. Despite renewable energy expansion, coal has remained the dominant source of power generation, undermining the NEP's mitigation potential. Studies published in energy policy journals indicate that Indonesia's coal-heavy electricity structure offsets gains achieved through renewable deployment, resulting in only marginal emission intensity improvements rather than absolute emission reductions (KESDM RI, 2024).

Empirical evaluations further highlight significant implementation challenges. Bridle et al. (2019) demonstrate that Indonesia is unlikely to meet the 23% renewable energy target without substantial regulatory reform, citing institutional fragmentation, inconsistent pricing mechanisms, and policy uncertainty as major barriers. Similarly, the IEA and World Bank assessments note that limited grid infrastructure, especially in remote and eastern regions, constrains renewable energy integration and reduces the overall effectiveness of the NEP (IEA, 2019).

Overall, available evidence suggests that Indonesia's NEP has been effective in establishing a strategic vision and expanding renewable energy capacity, but has fallen short in delivering significant emission reductions at the national level. Strengthening interagency coordination, reducing coal dependency, improving incentive-based pricing, and accelerating infrastructure development are critical to enhancing the policy's effectiveness in achieving a low-carbon energy transition (OJK, 2014).

The Renewable Energy law in Indonesia, represented by Law No. 30 of 2007 on Energy, Covers all Forms of Energy

Indonesia's Energy Law No. 30 of 2007 established the legal foundation for promoting renewable energy development and strengthening national energy security through institutional coordination under the National Energy Council (DEN/BEN). Rather than its legal design, empirical evaluations suggest that the law's primary contribution lies in improving policy coherence and signaling long-term government commitment to renewable energy development (Asia Pacific Energy, 2007).

In terms of measurable outcomes, evidence indicates that the law has supported increased policy attention to renewable energy and facilitated initial investment flows, particularly in geothermal and rural electrification projects. However, its effectiveness in accelerating large-scale renewable deployment and reducing carbon emissions has remained limited. Energy sector assessments show that Indonesia's overall energy mix continues to be dominated by fossil fuels, especially coal, indicating that the law has not yet produced significant emission reductions at the national level.

Empirical studies highlight implementation challenges as the main constraint. Bistline et al. (2021) find that while Law No. 30 of 2007 improved strategic planning and regulatory alignment, its impact at the operational level has been weakened by bureaucratic complexity, limited financial support, and weak coordination between central and local governments. These factors have reduced the law's ability to translate policy objectives into measurable renewable energy expansion.

Overall, the evidence suggests that Law No. 30 of 2007 has been more effective as an institutional and planning framework than as a direct driver of emission reduction. Strengthening investment incentives, simplifying administrative procedures, and enhancing public-private partnerships are critical for improving the law's effectiveness in delivering tangible renewable energy growth and climate mitigation outcomes (Bistline et al., 2021; Halldén et al., 2025; Wojtaszek, 2025).

Implementation of the Paris Agreement (December 2015) in Indonesia

The Paris Agreement, adopted in December 2015, represents one of the most ambitious global initiatives to combat climate change. Its central goal is to limit the rise in global temperatures to well below 2°C, ideally not exceeding 1.5°C above pre-industrial levels. The agreement relies on NDCs, voluntary climate action plans submitted by each country. It also aims to strengthen countries' resilience to the impacts of climate change and provide financial and technical support to developing nations (UNFCCC, 2015).

In this context, Indonesia ratified the agreement through Law No. 16 of 2016 and submitted its NDC, committing to a 29% reduction in GHG emissions by 2030 using domestic resources, and up to 41% with international support. The agreement has

influenced Indonesia's climate policy framework, including the adoption of initiatives such as REDD+ to reduce deforestation, and national targets to increase renewable energy to 23% of the energy mix by 2025 (Goverment of Indonesia, 2016).

However, several challenges hinder effective implementation. Indonesia still relies heavily on coal as a primary energy source, and deforestation rates remain high. At the international level, the Paris Agreement has also faced criticism for being legally non-binding and lacking enforcement mechanisms, as it depends largely on countries' voluntary intentions. A study notes that even if current national commitments are fully implemented, they would still fall short of limiting global warming to under 2°C, highlighting the urgent need for more ambitious and coordinated international action (Schleussner et al., 2016).

Low Carbon Development Initiative in Indonesia

Indonesia's LCDI is an innovative model of harmonization between economic and environmental development. It was initiated by the Ministry of National Development Planning (Bappenas) in 2017 and then included in the National Medium-Term Development Plan (RPJMN 2020–2024), where it became the central element of Indonesian development policy (Bappenas, 2019). The project aims to lower GHG emissions, enhance resource efficiency, and transition towards a cleaner, greener, and more inclusive and equitable economy without a trade-off on the growth rate and poverty alleviation efforts. The LCDI relies on modelled and evidence-led dynamic planning for development (UNDP, 2021). It has yielded major global partnerships, such as with the United Kingdom, which funded the second phase of the program worth 514 billion rupiah (2023–2027). Environmental values have also been integrated into provincial development plans in provinces like West Java and Bali, as a process of localizing environmental goals.

But the program is being confronted with numerous challenges. Some of these are a lack of capacity at the local government level, intersectoral coordination issues, and partially relying on donor money, which could undermine its long-term sustainability. There is an immediate need to convert policy promises into legally enforceable action through legislation and concrete budgetary provisions. The LCDI can be theoretically legitimized by the Sustainable Development Theory that came out of the 1980s and 1990s environmental and social economics literature, and further supported by Our Common Future (World Commission on Environment and Development, 1987). The theory seeks to meet current needs without prejudicing the ability of future generations to meet their own needs. Low-carbon development is also extremely aligned with such a principle of lessening the environmental footprint of growth while fostering an economically and environmentally resilient economy. Additionally, the initiative aligns with Ecological Modernization Theory, which believes that technological and institutional advancement can be an environmental magic bullet if only it is channeled through strong policy machinery. Therefore, LCDI not only serves as a handbook of environmental policy but also as a tangible representation of world sustainable development precepts. It is a prototype other developing countries can emulate, provided institutional and financial constraints are addressed effectively.

Green Finance in Indonesia

Green finance in Indonesia is a strategic tool to support the transition toward a sustainable and low-carbon economy by channeling capital into environmentally friendly projects that help mitigate the effects of climate change. This includes financing for renewable energy, waste management, sustainable transportation, and eco-friendly agriculture. These efforts align with Indonesia's commitments under the Paris Agreement, particularly its target to reduce GHG emissions by 31.89% unconditionally and 43.2% with international support by 2030 (OJK, 2014; Ministry of Finance, 2018).

The primary goals of green finance include promoting investment in green sectors, enhancing environmental infrastructure, and fostering economic growth without depleting natural resources. The Indonesian government has implemented several initiatives to support this direction, such as issuing the world's first sovereign green sukuk in the Islamic finance sector in 2018, launching the Sustainable Finance Roadmap, and introducing the Green Taxonomy to define environmentally

sustainable economic activities (OJK, 2014). In terms of impact, green finance has contributed to the expansion of clean energy projects and the provision of sustainable financing alternatives. It has also raised awareness among financial institutions about the risks of climate change. Financial instruments like green sukuk have attracted international investors interested in environmental sustainability, thereby strengthening long-term project financing.

However, green finance in Indonesia faces several challenges. These include the limited number of eligible green projects, low awareness among some traditional banks, and the lack of clear data on the actual environmental impact of funded initiatives. Additionally, the regulatory framework is still evolving, which creates gaps in oversight and environmental classification. The importance of green finance can be supported by the theory of Socially Responsible Investing, which posits that incorporating environmental and social considerations into investment decisions does not compromise returns; rather, it may reduce long-term risks and enhance financial stability (Renneboog et al., 2008). A 2020 World Bank study further supports this, showing that countries implementing green financial policies attracted greater foreign investment and improved their credit ratings.

Results-Oriented Comparative Analysis Between Egypt and Indonesia

To move beyond a descriptive narrative, the comparison between Egypt and Indonesia is structured around measurable indicators, including NDC targets, renewable energy share, emission trends over the past decade, and renewable energy investment flows (Table 1). This indicator-based approach allows for a clearer assessment of how policy design and implementation differences translate into divergent outcomes.

Both Egypt and Indonesia have adopted comprehensive climate and energy policy frameworks; however, differences in policy orientation have produced distinct results. Egypt's approach emphasizes sector-specific legislation and large-scale infrastructure deployment, particularly in renewable energy and urban transport. In contrast, Indonesia's policy framework prioritizes long-term planning integration, alignment with international climate commitments, and market-based instruments such as green sukuk.

Table 1. Comparative Framework of Climate Mitigation Policies Between Egypt and Indonesia Across Key Governance and Environmental Sectors.

Indicator	Egypt	Indonesia	Comparative Interpretation
NDC Target	Unconditional ~10%, conditional up to ~33% by 2030	29% (unconditional), up to 43% (conditional) by 2030	Indonesia has more ambitious and explicit mitigation targets aligned with the Paris Agreement.
Renewable Energy Share	~20% of electricity mix (2023); target 42% by 2035	~13–15% of primary energy mix (2023); target 23% by 2025	Egypt is ahead in actual deployment; Indonesia lags despite strong policy targets.
Emission Trends (2013-2023)	Emissions continue to rise, but at a slower rate; improved emission intensity	Emissions are rising steadily, driven by coal expansion	Egypt shows relative decoupling trends; Indonesia shows structural fossil fuel lock-in.
Renewable Energy Investment	>USD 2 billion (Benban Solar Park alone); growing GCF and green bond finance	Increasing green sukuk issuance; lower RE project realization	Egypt leads in project-scale investment; Indonesia leads in financial instruments.
Energy Mix Dependence	Natural gas dominant; coal marginal	Coal-dominant (>60% of power generation)	Indonesia's coal reliance significantly weakens mitigation outcomes.
Private Sector Participation	Enabled but constrained by subsidies and grid limitations	Stronger green finance frameworks: bureaucratic barriers persist	Indonesia is institutionally ahead; Egypt is operationally ahead.
Urban & Transport Mitigation	LRT, BRT, metro expansion; projected CO_2 reduction ~9 Mt by 2030	Pilot electric buses and car-free zones	Egypt demonstrates clearer mitigation impacts in urban transport.

Despite these differences, emissions data indicate that neither country has achieved absolute emission reductions over the past decade. Egypt has recorded modest improvements in emission intensity due to renewable energy expansion and transport electrification, while Indonesia's gains from renewable deployment have been largely offset by continued coal dependence. This demonstrates that policy ambition alone is insufficient without enforcement, pricing reform, and systemic energy transition measures.
Renewable Energy Deployment and Investment

Egypt has outperformed Indonesia in terms of large-scale renewable energy deployment, exemplified by the Benban Solar Park, supported by clear feed-in tariff mechanisms and international finance. Indonesia, despite possessing greater renewable resource potential, has attracted lower levels of renewable energy investment relative to its economy size due to regulatory uncertainty and institutional fragmentation. Conversely, Indonesia leads in green finance innovation, particularly through sovereign green sukuk, which has strengthened private sector participation more effectively than in Egypt.

The comparison reveals that policy structure directly affects outcomes. Egypt's centralized and project-driven model delivers visible infrastructure results but lacks systemic market reform. Indonesia's integrated planning and financial innovation create long-term transition potential, yet weak implementation and coal dependence undermine emission reductions. These findings suggest that combining Egypt's implementation capacity with Indonesia's market and governance instruments would significantly enhance mitigation effectiveness in both contexts.

CONCLUSION

The comparative study reveals that both Egypt and Indonesia have made significant strides in formulating policies to reduce carbon emissions. Egypt's approach is characterized by sector-specific legislative instruments and large-scale renewable energy projects, while Indonesia's strategy is rooted in integrated national planning and innovative financial tools like green sukuk. Despite these efforts, both countries face substantial implementation challenges, such as weak interagency coordination, infrastructural deficiencies, and limited community involvement.

To enhance the effectiveness of carbon mitigation strategies, Egypt can benefit from Indonesia's long-term planning frameworks and decentralized governance, whereas Indonesia could adopt Egypt's structured legal systems and successful public-private partnerships. A hybrid policy model that merges the strengths of both systems may serve as a blueprint for other developing countries aiming to meet their climate targets.

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