

Analysis of Sustainable Environmental Policy: Implementation of the Clean Energy Transition and the Green Economy

Devina Arifani¹⁾ & Firdo Lingga²⁾

¹⁾Faculty of Law, Universitas Islam Sultan Agung (UNISSULA), Semarang, Indonesia, E-mail: rifanidevina@gmail.com

²⁾Faculty of Law, Universitas PGRI Semarang, Semarang, Indonesia, E-mail: virdolingga@gmail.com

Abstract. *Sustainable environmental policy has become an essential instrument for addressing climate change, reducing environmental degradation, and promoting inclusive economic development. The transition toward clean energy and the development of a green economy represent interconnected strategies for achieving long-term environmental sustainability while maintaining economic growth and social welfare. This study aims to analyze the conceptual and legal framework of sustainable environmental policy, examine the implementation of the clean energy transition and its implications for sustainable development, and identify the challenges and strategies for strengthening the green economy. This research employs a normative juridical approach, supported by conceptual and statutory approaches, to examine relevant international agreements and Indonesian legal instruments governing environmental protection, energy development, and climate change mitigation. The analysis considers the United Nations Framework Convention on Climate Change, the Paris Agreement, the 2030 Agenda for Sustainable Development, Law No. 32 of 2009 concerning Environmental Protection and Management, Law No. 30 of 2007 concerning Energy, Law No. 16 of 2016 concerning the Ratification of the Paris Agreement, and Presidential Regulation No. 112 of 2022 concerning the Acceleration of Renewable Energy Development for Electricity Supply. The study focuses on renewable energy development, energy efficiency, regulatory effectiveness, investment mechanisms, environmental safeguards, and the socioeconomic implications of transitioning away from fossil fuels. The analysis highlights that the effectiveness of sustainable environmental policy depends on regulatory consistency, institutional coordination, technological innovation, financial accessibility, and meaningful public participation. Although renewable energy development and green economic activities offer opportunities to reduce greenhouse gas emissions, improve resource efficiency, and generate employment, their implementation may be constrained by high investment costs, infrastructure limitations, regulatory uncertainty, and continued dependence on carbon-intensive industries. Furthermore, the transition may create socioeconomic inequalities when workers and communities affected by industrial transformation do not receive*

adequate protection and alternative economic opportunities. Strengthening sustainable environmental policy therefore requires coherent regulatory frameworks, accessible green financing, transparent environmental assessments, investment in renewable energy infrastructure, and just transition mechanisms. Improved monitoring and evaluation systems are also necessary to measure emissions reductions, renewable energy utilization, resource efficiency, and socioeconomic outcomes. This study concludes that integrating clean energy transition policies with green economy strategies is essential for achieving sustainable development. Effective implementation requires coordinated institutional action, accountable governance, technological advancement, and inclusive policies that balance environmental protection, economic competitiveness, and social justice.

Keywords: Clean; Energy; Green-Economy; Renewable; Sustainable.

1. Introduction

Environmental sustainability has become one of the most significant challenges in contemporary global governance, particularly in response to climate change, environmental degradation, natural resource depletion, and the increasing demand for energy. Conventional economic development models that rely heavily on fossil fuels have contributed to greenhouse gas emissions and ecological damage, highlighting the urgent need for sustainable environmental policies. In this context, the clean energy transition and the development of a green economy have emerged as essential strategies for achieving sustainable development. These approaches seek to balance economic growth, environmental protection, and social welfare through the adoption of renewable energy, resource efficiency, low-carbon technologies, and environmentally responsible economic activities. Therefore, analyzing sustainable environmental policy is necessary to understand how legal frameworks and government strategies can facilitate the transition toward a more sustainable future. (Haidar, Fikri Abdurrahman, and Wilmar Salim; 2026).

The conceptual and legal framework of sustainable environmental policy provides the foundation for integrating environmental protection into economic and energy governance. At the international level, the United Nations Framework Convention on Climate Change, the Paris Agreement, and the Sustainable Development Goals establish important principles and commitments concerning climate action, clean energy access, and sustainable economic development. In Indonesia, environmental protection and energy transition are supported by

Law No. 32 of 2009 on Environmental Protection and Management, Law No. 30 of 2007 on Energy, and Law No. 16 of 2016 ratifying the Paris Agreement. These legal instruments demonstrate the importance of regulatory frameworks in promoting renewable energy development, reducing emissions, and encouraging environmentally sustainable economic activities. However, the effectiveness of these frameworks depends on consistent implementation, institutional coordination, and adequate enforcement mechanisms. (Hermawan, Luky Tri, and Adhiningasih Prabhawati; 2024).

The implementation of the clean energy transition has significant implications for sustainable development. Expanding renewable energy sources, improving energy efficiency, and encouraging low-carbon industries can reduce environmental pressures while creating new employment opportunities and stimulating technological innovation. Nevertheless, the transition also presents challenges, including substantial investment requirements, technological limitations, dependence on fossil fuels, and disparities in access to clean energy. These challenges may undermine policy effectiveness if environmental objectives are not accompanied by inclusive economic and social measures. (Keumala, Dinda, Ahmad Sabirin, Setiyono Setiyono, M. Fariduddin Az, and Jimi Rambo Arranchado; 2025).

Furthermore, strengthening the green economy requires integrated policy approaches that connect environmental regulation, investment incentives, technological innovation, public participation, and institutional accountability. Governments must ensure that the benefits of the energy transition are distributed equitably while minimizing adverse effects on vulnerable communities and workers in carbon-intensive sectors. (Kurniawan, Okta Dwi Andika, Diah Permata Sari, Christine Wulandari, Samsul Bakri, and Indra Gumay Febriyano; 2025).

2. Research Method

This research employs a normative juridical approach, supported by conceptual and statutory approaches, to examine relevant international agreements and Indonesian legal instruments governing environmental protection, energy development, and climate change mitigation. (Negara, Tunggul Ansari Setia; 2023).

3. Result and Discussion

3.1. Conceptual and Legal Framework of Sustainable Environmental Policy for Clean Energy Transition and Green Economy

Sustainable environmental policy constitutes a fundamental framework for integrating environmental protection, economic development, and social welfare into public governance.

In the context of the clean energy transition and the green economy, sustainable environmental policy refers to a set of legal principles, regulatory instruments, institutional arrangements, and strategic measures designed to reduce environmental degradation while promoting economic activities that remain within ecological limits.

The increasing severity of climate change, biodiversity loss, air pollution, and natural resource depletion demonstrates the limitations of conventional development models that prioritize short-term economic growth without adequately considering environmental consequences. Consequently, governments are required to establish policies that encourage low-carbon development, improve resource efficiency, expand renewable energy production, and ensure that economic progress does not compromise the ability of future generations to meet their needs. This approach reflects the principle of sustainable development, which recognizes the interdependence of environmental integrity, economic prosperity, and social justice. (Lubis, Arief Fahmi, M. Reza Saputra, and Rizqi Shohibul Khotami; 2025).

The conceptual foundation of sustainable environmental policy is closely associated with the principles of sustainable development, precaution, prevention, polluter pays, public participation, and intergenerational equity. Sustainable development requires governments to balance present economic and social needs with the long-term preservation of environmental resources. The precautionary principle supports preventive action when activities may cause serious or irreversible environmental damage, even where scientific certainty remains incomplete.

The prevention principle emphasizes the importance of addressing environmental risks before they produce significant harm, while the polluter-pays principle requires those responsible for pollution to bear the costs of preventing, controlling, and remedying environmental damage. Public participation is equally important because environmental decisions affect communities, workers, businesses, and future generations. These principles provide a normative basis for evaluating whether clean energy and green economy policies are environmentally responsible, economically feasible, socially inclusive, and legally accountable.

The clean energy transition represents a central component of sustainable environmental policy because the energy sector is a major source of greenhouse gas emissions. This transition involves gradually reducing dependence on fossil fuels and increasing the use of renewable energy sources, including solar, wind, hydropower, geothermal energy, and sustainable bioenergy. It also encompasses energy efficiency improvements, electrification, modernization of electricity networks, and the development of technologies that support lower-emission economic activities.

However, the transition cannot be understood solely as a technological transformation. It also requires legal certainty, effective public administration, appropriate financing mechanisms, and institutional coordination. Governments must establish clear renewable energy targets, remove unnecessary regulatory barriers, encourage responsible private investment, and ensure that energy infrastructure is developed in accordance with environmental and social safeguards. Without these measures, the expansion of clean energy may be constrained by inconsistent regulations, inadequate infrastructure, financial limitations, and conflicts over land and natural resources.

At the international level, several legal instruments establish the foundation for sustainable environmental governance and climate action. The United Nations Framework Convention on Climate Change provides a framework for international cooperation in addressing climate change, while the Paris Agreement establishes commitments aimed at limiting global temperature increases and strengthening adaptation and climate resilience. The Paris Agreement also emphasizes nationally determined contributions, through which states communicate and periodically strengthen their climate objectives. (Maidasari, Tika, Lukman Yudho Prakoso, and Sri Murtiana; 2023).

Furthermore, the 2030 Agenda for Sustainable Development, particularly Sustainable Development Goal 7 on affordable and clean energy, Goal 12 on responsible consumption and production, and Goal 13 on climate action, connects energy transformation with broader environmental and socioeconomic objectives. Although these instruments differ in their legal character and implementation mechanisms, collectively they encourage states to integrate climate mitigation, sustainable energy development, and environmental protection into national planning. Their effectiveness depends on domestic implementation, international cooperation, institutional capacity, and the availability of financial and technological resources.

In Indonesia, the legal framework for sustainable environmental policy includes Law No. 32 of 2009 on Environmental Protection and Management, Law No. 30 of 2007 on Energy, and Law No. 16 of 2016 ratifying the Paris Agreement. Law No. 32 of 2009 establishes important principles and mechanisms for environmental management, including environmental impact assessment, environmental permits or approvals within the applicable regulatory framework, supervision, and enforcement. Law No. 30 of 2007 provides a legal foundation for national energy management, including the development of energy resources and the promotion of energy conservation. Law No. 16 of 2016 formalizes Indonesia's ratification of the Paris Agreement and supports national climate action. Presidential Regulation No. 112 of 2022 also addresses the acceleration of renewable energy development for electricity supply. Together, these instruments demonstrate the relationship between environmental governance, energy policy, and climate commitments. Nevertheless, their practical impact depends on regulatory

consistency, adequate implementation capacity, effective oversight, and coordination among national and regional institutions.

The green economy extends the objectives of the clean energy transition by promoting economic growth that reduces environmental risks and ecological scarcity. It emphasizes efficient resource use, low-carbon production, sustainable infrastructure, waste reduction, circular economic practices, and the conservation of natural ecosystems. Within this framework, environmental policy should encourage businesses to adopt cleaner production technologies, improve energy performance, and incorporate environmental considerations into investment and operational decisions.

Governments can support these changes through renewable energy incentives, green public procurement, environmental standards, research funding, and appropriate economic instruments. At the same time, incentives must be designed transparently to prevent inefficient spending, market distortions, and environmental claims that are not supported by measurable performance. A green economy should not simply replace fossil fuel consumption with other forms of resource exploitation; it must also ensure that renewable energy projects and low-carbon industries respect biodiversity, land rights, labor protections, and community interests.

Despite the development of international and national legal frameworks, significant challenges remain in translating policy commitments into measurable environmental outcomes. Regulatory fragmentation, limited investment, dependence on fossil fuel infrastructure, inadequate technological capacity, and competing economic priorities may weaken the implementation of sustainable environmental policy. In addition, the costs and benefits of the energy transition may be distributed unevenly across regions and social groups. (Permana, Teguh, and Andriani Puspitaningsih; 2026).

Workers in carbon-intensive industries may face employment uncertainty, while low-income households may encounter difficulties accessing affordable clean energy technologies. Therefore, the concept of a just transition is essential to ensure that decarbonization policies incorporate worker retraining, social protection, affordable energy access, and meaningful community participation. Stronger monitoring systems, transparent reporting, evidence-based policymaking, and consistent enforcement can further improve institutional accountability and policy effectiveness.

Ultimately, the conceptual and legal framework of sustainable environmental policy must connect international commitments with national legislation, institutional responsibilities, and practical economic transformation. The clean energy transition and green economy will achieve their intended objectives only when environmental protection is integrated into development planning and supported by enforceable regulations, reliable financing,

technological innovation, and inclusive governance. For Indonesia, strengthening coordination between environmental and energy policies is particularly important to ensure that renewable energy expansion contributes to emission reduction without creating additional ecological or social harm. By applying sustainable development principles, improving legal implementation, and promoting a just and accountable transition, governments can establish a stronger foundation for long-term environmental resilience, economic competitiveness, and intergenerational welfare.

3.2. Implementation of the Clean Energy Transition and Its Implications for Sustainable Development

The implementation of the clean energy transition has become an essential component of global efforts to achieve sustainable development, address climate change, and establish more resilient economic systems. The transition involves a gradual shift from energy systems dominated by fossil fuels toward cleaner and more sustainable sources, including solar, wind, hydropower, geothermal energy, and other renewable technologies. (Siagian, Abdhy Walid, Muhammad Syammakh Daffa Alghazali, and Rozin Falih Alify; 2023).

It also encompasses improvements in energy efficiency, electrification of transportation and industrial activities, modernization of electricity infrastructure, and the development of technologies that reduce greenhouse gas emissions. The significance of this transformation extends beyond the energy sector because energy production and consumption influence economic productivity, environmental quality, public health, employment, and social welfare. Consequently, implementing the clean energy transition requires comprehensive policies that integrate technological innovation, legal frameworks, economic incentives, institutional coordination, and public participation. When effectively designed and implemented, the transition can support sustainable development by reconciling economic growth with environmental protection and social inclusion.

One of the most important aspects of implementing the clean energy transition is the development and expansion of renewable energy infrastructure. Governments play a central role in establishing clear renewable energy targets, creating predictable regulatory environments, facilitating investment, and ensuring that electricity systems can accommodate increasing shares of renewable energy. Solar and wind power have become important alternatives to conventional electricity generation, while geothermal and hydropower resources can contribute significantly in regions with suitable natural conditions. In Indonesia, the availability of geothermal resources, solar radiation, hydropower potential, and other renewable energy sources provides opportunities to diversify the national energy mix.

However, the realization of this potential depends on investment availability, grid connectivity, technological capacity, land-use planning, and effective project management.

Renewable energy projects must also undergo appropriate environmental and social assessments to minimize ecological damage, protect local communities, and ensure that infrastructure development complies with applicable legislation. Therefore, successful implementation requires not only increasing installed renewable energy capacity but also strengthening the institutional and technical systems necessary to deliver reliable, affordable, and sustainable energy.

The clean energy transition also has important economic implications because it can stimulate investment, encourage innovation, and create new employment opportunities. The development of renewable energy facilities, energy storage systems, electric transportation, and energy-efficient buildings generates demand for skilled workers and specialized services. Furthermore, investment in clean technologies can encourage domestic industrial development, improve technological capabilities, and strengthen long-term economic competitiveness.

The emergence of green industries may provide opportunities for small and medium-sized enterprises to participate in sustainable supply chains through equipment manufacturing, installation, maintenance, recycling, and energy management services. Nevertheless, these benefits are not automatic. The transition requires substantial initial investment, access to affordable financing, workforce development, and consistent policies that reduce uncertainty for investors. Countries that depend heavily on fossil fuel revenues or employment may also experience economic disruption as conventional energy industries gradually decline. Consequently, economic planning must anticipate structural changes, support affected workers, and promote alternative sources of income to ensure that the transition contributes to inclusive and sustainable prosperity. (Ariyanto, Sudi, and Septina Is Heriyanti, eds; 2023).

Environmental improvement represents another fundamental implication of clean energy implementation. Replacing fossil fuel-based energy with lower-emission alternatives can reduce greenhouse gas emissions and contribute to international climate objectives. It may also improve air quality by reducing emissions of pollutants associated with conventional power generation and transportation. These improvements can generate public health benefits, including reduced exposure to harmful air pollution and lower environmental pressures in densely populated areas. In addition, energy efficiency measures can reduce overall energy demand, minimize resource consumption, and decrease the environmental footprint of industrial production and household activities.

Nevertheless, renewable energy technologies are not entirely free from environmental impacts. Large hydropower facilities may affect river ecosystems, while solar and wind installations can create land-use conflicts, biodiversity concerns, and waste management challenges. The extraction of minerals required for batteries, electrical equipment, and renewable energy infrastructure can also generate environmental and social risks. Therefore,

the sustainability of the energy transition must be evaluated across the entire life cycle of energy technologies, from resource extraction and manufacturing to operation, decommissioning, and recycling.

The relationship between clean energy and sustainable development is also reflected in improvements in energy access and social welfare. Affordable and reliable energy is essential for education, healthcare, communication, sanitation, and productive economic activities. In remote and underserved areas, decentralized renewable energy systems, including solar-powered mini-grids and household installations, may help expand electricity access where conventional infrastructure is expensive or difficult to establish. Reliable electricity can support schools, health facilities, agricultural processing, small businesses, and digital connectivity, thereby improving local development opportunities.

However, access to clean energy must be accompanied by affordability and reliability. High installation costs, unequal financing opportunities, limited technical services, and inadequate electricity networks can prevent low-income households from benefiting fully from renewable technologies. Public policy should therefore prioritize equitable energy distribution, targeted financial assistance, community participation, and appropriate infrastructure investment. Such measures can help ensure that the transition reduces rather than reinforces existing social and regional inequalities. (Bank Indonesia Institute; 2025).

The implementation of clean energy policies also requires strong legal and institutional governance. International instruments such as the Paris Agreement provide a framework for climate action, while Sustainable Development Goal 7 promotes access to affordable, reliable, sustainable, and modern energy. At the national level, governments must translate these objectives into enforceable regulations, measurable targets, implementation plans, and monitoring mechanisms.

In Indonesia, Law No. 30 of 2007 on Energy, Law No. 32 of 2009 on Environmental Protection and Management, Law No. 16 of 2016 ratifying the Paris Agreement, and Presidential Regulation No. 112 of 2022 concerning the acceleration of renewable energy development for electricity supply constitute important elements of the relevant policy framework. Effective implementation requires coordination among ministries, local governments, energy providers, financial institutions, and affected communities. Transparent procurement, consistent regulation, environmental oversight, and periodic policy evaluation are necessary to reduce corruption risks, improve accountability, and ensure that public resources support genuine sustainability outcomes.

Despite its considerable potential, the clean energy transition faces challenges that may limit its contribution to sustainable development. Intermittent renewable energy sources require appropriate storage systems, flexible electricity networks, and complementary generation capacity. Financing constraints, regulatory uncertainty, dependence on existing fossil fuel

infrastructure, and shortages of specialized workers can further slow progress. In addition, poorly planned projects may cause land conflicts, displace communities, or undermine biodiversity. Addressing these problems requires integrated planning, technological research, international cooperation, and meaningful public consultation. Governments should strengthen vocational training, support research and development, improve grid infrastructure, and establish safeguards for workers and communities affected by economic restructuring. Policy effectiveness should be measured not only by renewable energy capacity or emissions reductions but also by energy affordability, employment quality, environmental protection, and equitable access. (Harinowo, Cyrillus; 2020).

Ultimately, the clean energy transition should be understood as a comprehensive transformation of economic and social systems rather than a simple substitution of one energy source for another. Its contribution to sustainable development depends on the ability of governments and other stakeholders to align climate objectives with economic resilience, environmental integrity, and social justice. By expanding renewable energy, improving efficiency, strengthening legal implementation, mobilizing responsible investment, and ensuring a just transition, countries can reduce environmental pressures while creating new opportunities for sustainable prosperity. For Indonesia, an integrated and accountable approach can help translate its renewable energy potential into tangible development benefits while supporting national climate commitments and long-term environmental sustainability.

3.3. Challenges, Policy Effectiveness, and Strategies for Strengthening the Green Economy

The development of a green economy has become an increasingly important strategy for addressing environmental degradation, climate change, resource depletion, and the unequal distribution of economic opportunities. A green economy seeks to promote economic growth while reducing environmental risks, improving resource efficiency, protecting ecosystems, and enhancing social welfare. Unlike conventional economic models that frequently prioritize short-term production and consumption, the green economy emphasizes sustainable investment, low-carbon technologies, renewable energy, circular production systems, and responsible natural resource management. (Joni; 2025).

Nevertheless, transforming these principles into effective policies requires governments to overcome structural, financial, technological, institutional, and social challenges. The effectiveness of green economy policies depends not only on the existence of environmental regulations but also on their implementation, enforcement, coordination, and ability to generate measurable economic and environmental outcomes. Therefore, strengthening the green economy requires an integrated policy framework that connects environmental protection with economic development, social inclusion, and long-term institutional accountability.

One of the most significant challenges in developing a green economy is the continued dependence of many national economies on fossil fuels and environmentally intensive industries. Conventional energy systems, manufacturing activities, transportation networks, and agricultural practices have often been designed around relatively inexpensive fossil fuel consumption and resource-intensive production. Transitioning away from these systems requires substantial investment in renewable energy, energy-efficient infrastructure, cleaner industrial processes, and alternative transportation technologies. However, existing infrastructure, established business interests, employment patterns, and public revenue dependence can create resistance to structural change. In countries where coal, oil, and natural gas remain important sources of employment or government revenue, rapid decarbonization may generate economic uncertainty if alternative industries are not developed simultaneously. Consequently, governments must adopt gradual but credible transition strategies that establish clear long-term objectives while providing practical support for affected workers, businesses, and communities. Diversifying economic activities and encouraging investment in sustainable industries can reduce dependence on environmentally damaging sectors and strengthen economic resilience. (Purwanto, Edi; 2024).

Financial limitations constitute another major obstacle to strengthening the green economy. Renewable energy infrastructure, sustainable transportation systems, wastewater treatment facilities, green buildings, and circular manufacturing processes frequently require substantial initial investment. Although these investments may generate long-term environmental and economic benefits, their implementation can be constrained by high financing costs, limited access to credit, uncertain investment returns, and insufficient public budgets. Small and medium-sized enterprises may experience particular difficulties because they often lack the financial resources required to adopt cleaner technologies or comply with increasingly demanding environmental standards.

Governments can address these challenges by developing green financing mechanisms, providing carefully designed tax incentives, facilitating access to affordable loans, and encouraging public-private partnerships. Green bonds, sustainability-linked financing, concessional lending, and blended finance can also help mobilize investment when supported by transparent criteria and credible monitoring. However, financial incentives must be evaluated regularly to ensure that public funds support genuine environmental improvements rather than activities that merely present themselves as sustainable.

Regulatory inconsistency and institutional fragmentation can further undermine the effectiveness of green economy policies. Environmental protection, energy development, industrial regulation, transportation, agriculture, and investment are frequently administered by different institutions with distinct priorities and administrative procedures. When these institutions operate without effective coordination, policies may conflict, implementation

responsibilities may become unclear, and businesses may face uncertainty concerning regulatory requirements. Inconsistent enforcement can also encourage noncompliance and disadvantage enterprises that invest in environmentally responsible practices. Strengthening the green economy therefore requires coherent legislation, clearly defined institutional responsibilities, transparent administrative procedures, and coordination between national and regional governments. Environmental objectives should be incorporated into broader economic planning, infrastructure development, public procurement, and industrial policy. Governments should also establish measurable targets, accessible reporting systems, and periodic evaluations that allow policymakers to identify implementation gaps and adjust strategies according to reliable evidence.

The effectiveness of green economy policies must also be assessed in relation to their environmental integrity. The adoption of renewable energy, electric vehicles, sustainable materials, and energy-efficient technologies does not automatically guarantee that economic activities are environmentally sustainable. Renewable energy projects may create land-use conflicts, affect biodiversity, or generate waste when their environmental impacts are inadequately managed. Similarly, electric vehicle production depends on mineral extraction, manufacturing processes, electricity sources, and battery disposal systems that may produce significant environmental pressures. Consequently, green economy policies should adopt a life-cycle perspective that evaluates environmental impacts from raw material extraction and production through transportation, consumption, reuse, and disposal. Environmental impact assessments, pollution monitoring, sustainable supply-chain standards, and effective waste management are important mechanisms for preventing environmental burdens from being transferred between sectors or geographical regions. Governments should also establish reliable environmental performance indicators to distinguish measurable improvements from unsubstantiated sustainability claims. (Seftiani, Sari; 2024).

Another important challenge concerns social inequality and the distribution of the costs and benefits associated with economic transformation. Although green industries can create employment and improve environmental quality, their benefits may not be distributed equally among regions, income groups, or occupational sectors. Workers employed in fossil fuel industries may face job losses, while low-income households may struggle to afford energy-efficient appliances, electric vehicles, or renewable energy installations. Communities dependent on natural resources may also experience economic disruption when new environmental restrictions are introduced without adequate consultation or alternative livelihood opportunities. These concerns demonstrate the importance of a just transition, which seeks to ensure that environmental transformation does not disproportionately burden vulnerable populations. Governments should provide vocational education, retraining programs, social protection, employment assistance, and targeted financial support for households and businesses affected by the transition. Public participation should be

incorporated into policymaking so that communities can contribute to decisions concerning infrastructure development, resource management, and local economic priorities.

In Indonesia, strengthening the green economy requires policies that reflect the country's economic structure, natural resource potential, regional diversity, and development priorities. Law No. 32 of 2009 on Environmental Protection and Management provides an important foundation for environmental governance, while Law No. 30 of 2007 on Energy establishes a framework for national energy management. Law No. 16 of 2016 ratifying the Paris Agreement supports Indonesia's international climate commitments, and Presidential Regulation No. 112 of 2022 addresses the acceleration of renewable energy development for electricity supply. These instruments can support the transition toward lower-carbon development when implemented consistently and integrated with industrial, investment, and regional development policies. Nevertheless, regulatory frameworks must be accompanied by adequate institutional capacity, transparent enforcement, reliable environmental information, and effective coordination among government agencies. Particular attention should be given to renewable energy infrastructure, sustainable land management, waste reduction, forest protection, and the development of industries that create economic value without causing excessive ecological damage.

Strengthening the green economy also requires technological innovation, research, and human resource development. Universities, research institutions, private enterprises, and government agencies can collaborate to develop technologies that improve energy efficiency, reduce industrial emissions, increase material recovery, and support sustainable agricultural production. Investment in research and development can help reduce the cost of clean technologies while improving their suitability for local conditions. Digital technologies may further strengthen environmental monitoring, energy management, supply-chain transparency, and the measurement of resource consumption. However, technological progress must be accompanied by appropriate technical education and workforce training. Without sufficient human capital, countries may remain dependent on imported technologies and experience difficulties maintaining complex infrastructure. Policies that support domestic innovation, technology transfer, professional certification, and cooperation between educational institutions and industries can therefore improve the long-term competitiveness of the green economy.

Circular economy principles offer another important strategy for reducing environmental pressures while strengthening economic productivity. Traditional linear production systems generally follow a pattern of extraction, production, consumption, and disposal, resulting in substantial material waste and resource depletion. In contrast, circular economic approaches emphasize product durability, repair, reuse, remanufacturing, recycling, and responsible material recovery. Governments can encourage these practices through extended producer responsibility, sustainable product standards, waste separation systems, green public

procurement, and incentives for resource-efficient production. Businesses can benefit from reduced material costs, improved operational efficiency, and new markets for recycled products and environmental services. Nevertheless, circular economy policies require adequate collection infrastructure, reliable recycling technologies, consumer awareness, and enforcement against illegal waste disposal. Informal waste workers should also be included in transition strategies to improve working conditions and ensure that the benefits of material recovery are distributed more equitably.

Policy effectiveness ultimately depends on the establishment of transparent monitoring, evaluation, and accountability mechanisms. Governments should assess green economy initiatives through measurable indicators, including greenhouse gas emissions, renewable energy deployment, energy efficiency, material productivity, waste recovery, biodiversity protection, green employment, and access to affordable energy. These indicators should be supported by reliable data, consistent reporting methods, and independent verification where appropriate. Public disclosure enables communities, investors, researchers, and civil society organizations to evaluate whether government commitments are producing meaningful outcomes. Regular policy reviews can identify ineffective subsidies, implementation delays, unintended social consequences, and opportunities for improvement. International cooperation can further support progress through financing, technical assistance, research partnerships, and the exchange of effective regulatory practices. However, international standards and policy models should be adapted to national circumstances rather than applied without consideration of local economic and institutional conditions.

Ultimately, strengthening the green economy requires a comprehensive transformation in the way governments, businesses, and communities understand economic progress. Environmental sustainability must be incorporated into investment decisions, industrial development, energy planning, public expenditure, and social policy rather than treated as a separate objective. Effective regulation, responsible financing, technological innovation, circular production, and inclusive governance are mutually reinforcing elements of this transformation. For Indonesia, the principal challenge is to translate existing environmental and energy commitments into consistent implementation and measurable improvements in environmental quality and social welfare. By strengthening institutional coordination, enforcing environmental standards, supporting affected workers, expanding green investment, and promoting transparent accountability, the country can build a more resilient and competitive economy. A successful green economy should therefore be evaluated not merely by economic growth or the expansion of green industries, but by its ability to reduce environmental damage, improve resource efficiency, create decent employment, and ensure that present development does not undermine the well-being of future generations. (Sudarwati, Yuni, Lukman Adam, Hariyadi, T. Ade Surya, Izzaty, and Achmad Wirabrata; 2014).

4. Conclusion

Sustainable environmental policy plays a fundamental role in promoting the clean energy transition and strengthening the green economy as essential components of sustainable development. This study concludes that the integration of environmental protection, energy governance, and economic development requires a coherent conceptual and legal framework. International instruments, including the Paris Agreement and the Sustainable Development Goals, provide important foundations for reducing greenhouse gas emissions, expanding renewable energy, and encouraging sustainable economic activities. In Indonesia, national legislation concerning environmental protection, energy management, and climate change mitigation establishes a legal basis for implementing these objectives. Nevertheless, the existence of legal instruments alone is insufficient without effective implementation, consistent enforcement, and coordination among relevant institutions. The clean energy transition offers significant opportunities to reduce dependence on fossil fuels, improve energy efficiency, stimulate technological innovation, and create employment opportunities in renewable energy industries. These benefits demonstrate that environmental protection and economic growth can be mutually reinforcing. However, the transition also faces substantial challenges, including limited financial resources, technological constraints, infrastructure deficiencies, institutional fragmentation, and unequal access to clean energy. Without appropriate policy interventions, these obstacles may hinder progress and create additional burdens for vulnerable communities and workers in carbon-intensive industries. Strengthening the green economy therefore requires comprehensive and integrated strategies. Governments should improve regulatory consistency, expand investment in renewable energy infrastructure, provide incentives for environmentally sustainable businesses, strengthen environmental monitoring, and encourage cooperation between public institutions, private enterprises, academic institutions, and communities. Equally important is the implementation of a just energy transition that ensures the fair distribution of economic benefits and protects groups potentially disadvantaged by structural economic changes. Transparent governance, measurable performance indicators, and periodic policy evaluations are also necessary to assess progress and improve accountability. Ultimately, the effectiveness of sustainable environmental policy depends on the alignment between legal commitments, institutional capacity, financial support, and practical implementation. A successful clean energy transition must extend beyond technological change to encompass social inclusion, economic resilience, and environmental responsibility. By strengthening legal enforcement, promoting innovation, and integrating green economic principles into development planning, Indonesia can advance toward a low-carbon economy while supporting long-term environmental sustainability and inclusive prosperity.

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