Kalamizu : Jurnal Sains, Sosial, dan Studi Agama
Volume 2 Number 4, April (2026), 749-760

Green FDI and Energy Transition in Indonesia: Masdar's Role in Reducing Greenhouse Gas Emissions

Muhammad Zidnal Arzaq[1], Mohamad Latief[2]

[1,2]University of Darussalam Gontor, Ponorogo
Email Correspondence : zidnalarzaq@gmail.com

Kata Kunci :

Green FDI, Energi Terbarukan, Masdar, Indonesia

Abstrak

Pengembangan energi terbarukan merupakan agenda strategis Indonesia dalam menurunkan ketergantungan pada energi fosil dan mendukung pembangunan berkelanjutan. Keterbatasan kapasitas pendanaan dan teknologi domestik menjadikan investasi asing hijau sebagai salah satu instrumen penting dalam transisi energi nasional. Artikel ini bertujuan untuk menganalisis peran Green Foreign Direct Investment (Green FDI) melalui kontribusi Abu Dhabi Future Energy Company (Masdar) dalam pengembangan sektor energi terbarukan di Indonesia pada periode 2020–2025. Penelitian ini menggunakan metode kualitatif dengan pendekatan studi kasus, melalui analisis dokumen kebijakan, laporan perusahaan, serta literatur akademik. Hasil penelitian menunjukkan bahwa Masdar berkontribusi secara signifikan melalui investasi proyek Pembangkit Listrik Tenaga Surya Terapung Cirata, transfer teknologi, serta penguatan kerja sama kelembagaan dengan aktor domestik. Meskipun demikian, tantangan regulasi dan aspek pemerataan manfaat sosial masih menjadi isu yang perlu diperkuat. Artikel ini menyimpulkan bahwa peran Masdar bersifat strategis dalam mendorong transisi energi Indonesia, namun membutuhkan dukungan kebijakan yang lebih inklusif dan berkelanjutan.

Keywords :

Green FDI, Renewable Energy, Masdar, Indonesia

Abstract

Renewable energy development has become a strategic agenda for Indonesia in reducing dependence on fossil fuels and promoting sustainable development. Limited domestic financial and technological capacity has positioned green foreign direct investment as a crucial instrument in the national energy transition. This article aims to analyze the role of Green Foreign Direct Investment through the contribution of Abu Dhabi Future Energy Company (Masdar) in Indonesia's renewable energy sector from 2020 to 2025. Employing a qualitative method with a case study approach, this research draws on policy documents, company

reports, and relevant academic literature. The findings reveal that Masdar has played a significant role through investment in the Cirata Floating Solar Power Plant project, technology transfer, and institutional cooperation with domestic actors. However, regulatory challenges and social equity issues remain. This study concludes that Masdar's contribution is strategic for Indonesia's energy transition, yet requires stronger policy support to ensure long-term sustainability.

INTRODUCTION

The global energy transition has become a strategic issue in international relations as awareness of the impacts of climate change and dependence on fossil fuels increases. Renewable energy is seen as the main solution for achieving sustainable development while maintaining national energy security. For developing countries such as Indonesia, the energy transition is not only related to environmental issues, but also concerns economic interests, development stability, and the country's position in global dynamics.

Indonesia has enormous renewable energy potential, particularly solar energy, but its utilization remains relatively limited. The main obstacles include limited funding, technology, and domestic institutional capacity. The involvement of international actors through Foreign Direct Investment (FDI) is an important instrument for promoting the development of the renewable energy sector. Recent developments show that FDI is no longer solely oriented towards economic profits, but also integrates environmental objectives known as Green Foreign Direct Investment (Green FDI).(Famanta et al., 2024)

In international relations studies, Green FDI is understood as part of the dynamics of international political economy that reflects the shift in global interests towards sustainability issues. Green investment not only functions as a flow of capital, but also as a means of technology transfer, institutional capacity building, and a mechanism for international cooperation between states and non-state actors. Therefore, the analysis of Green FDI is relevant to understanding how the energy transition agenda is carried out through interactions between countries and global actors.(Barboza et al., 2025)

One of the international actors playing an important role in the development of renewable energy in Indonesia is Abu Dhabi Future Energy Company (Masdar). Masdar's involvement in renewable energy projects in Indonesia demonstrates the role of non-state actors in supporting the national energy transition agenda. Masdar's presence not only brings investment, but also technology and strategic partnership patterns with domestic actors, which has broader implications for Indonesia's international cooperation.

Based on this, this study aims to analyze Masdar's role through its contributions to the development of renewable energy in Indonesia. Using a qualitative approach and case studies, this article seeks to explain the form of Masdar's contributions and their implications for Indonesia's energy transition and international relations. This analysis is expected to provide empirical and conceptual contributions to the study of international relations, particularly regarding the role of green investment and non-state actors in the sustainable development agenda.

METHODS

This study uses the perspective of international political economy (IPE) to analyze the role of Green Foreign Direct Investment (Green FDI) in supporting energy transition in developing countries. In international relations studies, Green FDI is understood as cross-border investment that is not only oriented towards economic profit, but also integrates environmental sustainability goals and the strategic interests of international actors.

Green FDI is a form of Foreign Direct Investment (FDI) that emphasizes long-term investment with an environmental dimension. In the context of energy transition, Green FDI serves as an important instrument to overcome the limitations of funding, technology, and institutional capacity in developing countries, while also being part of international cooperation mechanisms in responding to global issues such as climate change (Oliveira & Santos, 2024)

This conceptual framework also positions non-state actors as important elements in the dynamics of contemporary international relations. Multinational companies in the renewable energy sector not only play a role as economic actors but also as actors that influence the patterns of cooperation and implementation of the sustainable development agenda. In this study, Abu Dhabi Future Energy Company (Masdar) is positioned as a non-state actor that channels Green FDI to Indonesia through renewable energy projects.

The relationship between Green FDI and energy transition is analyzed through three main dimensions, namely the economic dimension (investment and financing), the technological dimension (technology transfer and capacity building), and the environmental dimension. Through this framework, Masdar's contribution is understood as the result of interactions between the interests of international actors, Indonesia's domestic needs, and the global energy transition agenda.

RESULT AND DISCUSSION

Green FDI In Energy Transition

The energy transition in developing countries such as Indonesia is taking place amid structural constraints, particularly in terms of financing, technology, and institutional capacity. Dependence on fossil fuels remains relatively high, while energy demand continues to rise in line with economic and population growth. In this context,

Green Foreign Direct Investment (Green FDI) has become an important mechanism for accelerating the development of renewable energy through the involvement of international actors.

Green FDI is understood as a form of cross-border investment that integrates economic and environmental sustainability objectives. Unlike conventional FDI, which focuses on financial returns, Green FDI also carries an environmental agenda that is in line with global commitments to climate change mitigation. Therefore, Green FDI not only functions as a flow of capital, but also as an instrument of international cooperation in promoting energy transition in developing countries.

For developing countries such as Indonesia, the main contribution of Green FDI lies in its ability to bridge the financing and technology gap. Foreign investment in the renewable energy sector enables the development of large-scale projects that would be difficult to realize through domestic resources alone. In addition, Green FDI has the potential to encourage technology transfer and technical capacity building, which contributes to strengthening national capabilities in managing and developing clean energy in a sustainable manner.(Herindrasti, 2022)

However, the role of Green FDI in energy transition also presents a number of challenges. Dependence on foreign investment can create an imbalance of power between the host country and investors, particularly in terms of technology control and strategic decision-making. Furthermore, the effectiveness of Green FDI is highly dependent on the regulatory framework and institutional capacity of the host country. Without clear policies and strong governance, the benefits of Green FDI risk not being optimally distributed.

Green FDI in energy transition must be understood as a political and institutional process, not merely a technical or economic one. The success of Green FDI is determined not only by the size of the investment, but also by the recipient country's ability to manage international cooperation, align national interests with the global agenda, and ensure that renewable energy investments contribute to long-term sustainable development.

Green FDI in energy transition must be understood as a political and institutional process, not merely a technical or economic one. The success of Green FDI is determined not only by the size of the investment, but also by the recipient country's ability to manage international cooperation, align national interests with the global agenda, and ensure that renewable energy investments contribute to long-term sustainable development.

Masdar as a Non-State Actor in Renewable Energy Investment

The development of global energy transition is marked by the increasing role of non-state actors in international relations, particularly multinational companies in the renewable energy sector. In this context, Abu Dhabi Future Energy Company (Masdar) occupies a strategic position as a non-state actor operating across countries with a clean energy investment agenda. Masdar's presence reflects a shift in the dynamics of

international relations, where companies function not only as economic actors but also as part of international cooperation mechanisms in addressing global issues such as climate change.

As a renewable energy company owned by the United Arab Emirates, Masdar operates within a framework of interrelated economic and environmental interests. Masdar's investment activities in various countries show that renewable energy has become a strategic instrument in energy diplomacy and sustainable development. Through investments in clean energy projects, Masdar is expanding its international network while supporting the global energy transition agenda, which is in line with international commitments to reduce carbon emissions.

Masdar's role can be understood through its interactions with host countries and domestic actors. Masdar not only brings investment capital, but also technology, technical expertise, and partnership models that influence the governance of the energy sector in recipient countries. Thus, Masdar acts as an intermediary between global interests and domestic needs, particularly in the development of renewable energy in developing countries.

However, as a non-state actor, Masdar's role also presents power dynamics that need to be considered. Masdar's position as a foreign investor has the potential to create technological and financial dependence for the host country if it is not balanced with strong national policies (Tan & Uprasen, 2022). Therefore, the relationship between Masdar and the recipient country is not neutral but is influenced by interests, negotiations, and the applicable regulatory framework.

Therefore, Masdar as a non-state actor in renewable energy investment can be understood not only as an economic actor but also as an actor that contributes to the formation of international cooperation patterns in the energy sector. Analysis of Masdar's role is important to understand how Green Foreign Direct Investment operates in practice and how interactions between non-state actors and states influence the direction of energy transition in developing countries, including Indonesia.

Masdar's Contribution to Renewable Energy Development in Indonesia

Masdar's role in renewable energy development in Indonesia reflects the application of Green FDI, which focuses not only on financial gains but also on energy transition and sustainable development. Masdar's contribution can be seen in three main dimensions, namely investment and financing, technology transfer, and reduction of greenhouse gas emissions. These three dimensions show that Masdar not only functions as a capital provider but also has a structural influence on the management of the national energy sector.

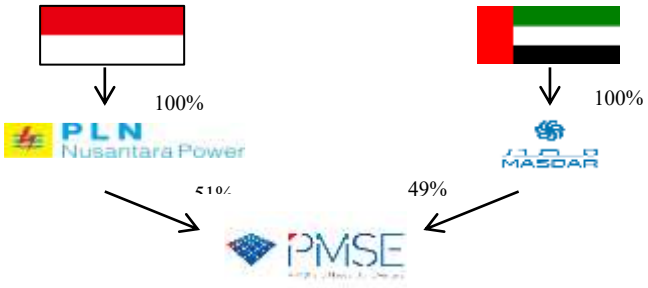
Total Investment and Capital Flows

In terms of investment and financing, Masdar contributes through direct participation in large renewable energy projects, particularly in the solar power sector. Masdar's presence as a foreign investor enables the realization of projects that require long-term financing and significant financial strength. This funding is crucial because

limited public budgets and high investment risks often hinder the development of renewable energy. Thus, Masdar's Green FDI acts as a catalyst for accelerating the development of clean energy infrastructure in Indonesia.

The Cirata Floating Solar Power Plant is a solar power generation project resulting from a collaboration between Masdar and PT PLN through PT PJBI. This project signed a power purchase agreement (PPA) in mid-January 2020 in Abu Dhabi with a total investment value of around USD 129-140 million or around IDR 2.2 trillion, according to the exchange rate at that time. The Cirata Floating Solar Power Plant project, developed by PT Pembangkitan Jawa Bali Masdar Solar Energy (PMSE), illustrates a collaborative investment structure between equity sponsors and bank financing (debt). The equity structure consists of a majority stake of 51% held by PLN Nusantara Power and 49% held by Masdar in the developer company (Hidayat et al., 2022)

Figure 1 Distribution of PT PMSE Shares



The UNCTAD approach to Green FDI views foreign investment as a strategic tool for sustainable development that combines economic, environmental, and social objectives. From a macroeconomic perspective, Green FDI is permanent and more consistent, and supports fiscal resilience by reducing dependence on energy imports. In addition, Green FDI contributes to the achievement of SDG 7 through the increase in clean energy and SDG 13 through the reduction of emissions. In the long term, this investment encourages structural changes from an economy dependent on fossil fuels to a low-carbon economy through the development of environmentally friendly industries and clean energy technologies.(on Trade & Development, 2022)

Technology Transfer and Human Resource Development

In addition to financial factors, Masdar also plays a role in technology transfer and technical capacity building. Masdar's investment in renewable energy has brought advanced solar power generation technology and international standards in project management practices. This technology transfer not only improves efficiency in clean energy production, but also helps increase the capacity of domestic actors in managing renewable energy projects. In the long term, this has the potential to reduce the technology gap and increase national capacity in supporting energy transition.

Technology transfer in the context of Green FDI is understood as the introduction of clean energy technologies, operational methods, and more modern technical

standards brought by foreign investors into the renewable energy sector, thereby improving the efficiency and sustainability of the national energy system. From a Green FDI perspective, technology transfer involves not only infrastructure development but also the process of learning, mastering, and adapting technology by local parties.

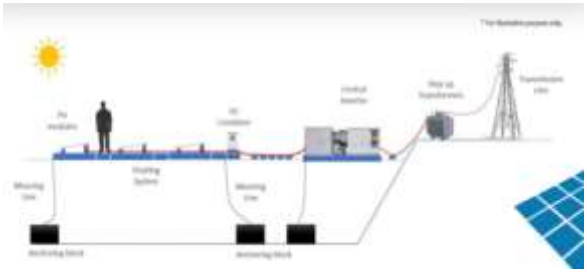
In line with the OECD's view that Green FDI should bring clean technology and knowledge to the destination country, Masdar's technology transfer in Indonesia is realized through the application of new Floating Solar PV technology and the use of an Internet of Things (IoT)-based digital monitoring system.

The implementation of renewable energy technology through the Cirata Floating Solar Power Plant project is a concrete step in supporting the transition of Indonesia's energy sector towards a cleaner and more sustainable future. This project is not merely a symbol of energy transition, but also an element of the national strategy to achieve the Net Zero Emissions (NZE) target by 2060. The Cirata Floating Solar Power Plant, a collaboration between PT PLN Nusantara Power and the Masdar energy company from the United Arab Emirates, was built at the Cirata Reservoir in West Java, with a capacity of 192 MWp and capable of generating up to 245 GWh of energy per year, as well as reducing carbon emissions by around 214,000 tons of CO^2 annually.(Luthfianingsih et al., 2025)

The Cirata project utilizes the latest technology in solar modules specifically designed for the more extreme environmental conditions of floating solar power plants. There are approximately 340,000 modules installed in this project, with all floating elements held in place by 2,100 anchors made of concrete blocks manufactured on-site.

The advantage of floating solar is that it can utilize a larger area on the water surface compared to land acquisition on land. Water space for large-scale PV can reduce land use for more beneficial purposes, reduce water evaporation, and support power plant operations. The Cirata Floating Solar Power Plant project adopts a 1:1 modular floating system made from recycled HDPE, which is environmentally friendly, fire-resistant, and UV-resistant to support solar panels.(Rudolph et al., 2025)

Figure 2 illustration of a PV system (PMSE, 2022)



Green FDI al source development as one of the long-term impacts of investment. Human resource development is carried out by involving local workers in the planning, construction, and operation phases of

renewable energy projects. In Green FDI's view, this process plays a role in improving the technical skills, operational knowledge, and professional capacity of local workers, which ultimately strengthens the national capacity to manage the green energy sector.

The Cirata Solar Power Plant has obtained ISO 45001 certification, signifying full compliance with international Health, Safety, and Environment (HSE) standards. Every employee must undergo occupational safety training and wear personal protective equipment. Throughout the project period, there were no fatal accidents, and less than five minor incidents were recorded each year.(Organization, 2013)

Masdar implements a mentoring and On the Job Training (OJT) program with a gradual learning approach, which demonstrates knowledge spillover in Indonesia's renewable energy ecosystem. The second program is technical skills training for local communities who play a crucial role in human resource capacity building. This training was designed to encourage the transition from conventional jobs to the more stable and sustainable construction and renewable energy sectors. Masdar involved fishermen around the Cirata Reservoir in solar panel installation training. After completing the exam, they received competency certification to work professionally in renewable energy projects.

In implementing Green FDI at the Cirata Floating Solar Power Plant, Masdar not only brought technology, but also carried out training programs for the local workforce. During the construction phase, local fishermen underwent training in solar panel installation and obtained national competency certificates (BNSP), as well as participating in technical workshops for local suppliers. The documentation and results of this guidance created a knowledge base that strengthened the standardization of the project and the long-term operation and maintenance of the Cirata PLTS, while increasing national capacity in the renewable energy sector.(Yogatama & Ritonga, 2024)

Reduction of Greenhouse Gas Emissions

The third dimension of Masdar's contribution, which is no less important, is the reduction of greenhouse gas (GHG) emissions through the development and utilization of renewable energy. Masdar's investment in clean energy contributes to the substitution of fossil fuels with low-carbon energy sources, thereby potentially reducing GHG emissions from the electricity sector.

Greenhouse gas (GHG) emission reduction is one of the main pillars of the global energy transition agenda and an international commitment agreed upon through the Paris Agreement. Under this agreement, Indonesia is committed to reducing GHG emissions across various sectors, with the energy sector being one of the main contributors to national emissions. Therefore, the development of renewable energy plays a strategic role in supporting the achievement of national emission reduction targets.

In the energy sector, GHG emissions mainly come from the use of fossil fuels for power generation. Therefore, investment in renewable energy is strategically

significant because it directly contributes to reducing the carbon intensity of the national energy system (Aprirachman et al., 2025).Masdar's involvement in Indonesia can be understood as a form of Green FDI contribution oriented towards climate change mitigation.

Masdar's investment in the renewable energy sector, particularly solar energy, helps replace fossil-based power plants that have dominated the national energy mix. This transition conceptually influences the reduction of carbon intensity and GHG emissions, in line with the emission reduction targets outlined in Indonesia's climate commitments. Although this study does not quantitatively measure emissions, Masdar's contribution can be seen as part of a structural effort to reduce emissions by increasing the proportion of renewable energy.

GHG emissions reduction in renewable energy projects is achieved through the replacement of fossil fuel energy sources. Solar power plants generate electricity without combustion, thereby producing no carbon dioxide (CO2) emissions during the operational phase. From a Green FDI perspective, this replacement has a structural impact because it reduces dependence on coal-based power plants, which have been the main cause of GHG emissions in the energy sector.

In its Nationally Determined Contribution (NDC) document, Indonesia targets a 31.89% reduction in GHG emissions independently and up to 43.2% with international assistance, with the energy sector contributing around 39% of the total emission reduction target of 915 million tons of CO2. If the Cirata Floating Solar Power Plant is not built, electricity demand in the Java-Bali region will continue to be met by existing power plants, most of which are coal-fired steam power plants (UNFCCC, 2015)

Since this solar power plant does not produce direct emissions during operation, the operational emissions of the solar power plant = 0 kg CO2/kWh. Through the calculation of avoided emissions = 203,184,000 kWh x 0.855 kg CO2/kWh = 173,700 tons of CO2 per year. However, this amount is less than the project's official statement of 214,000 tons of CO2 per year. This difference occurs because the project's calculations use a pure coal-fired power plant baseline, not a mix from the existing grid.(Mondol & Hillenbrand, 2014)

Masdar's role in reducing GHG emissions reflects the link between the global climate change mitigation agenda and its implementation at the national level. Through the Green FDI mechanism, this global agenda is translated into concrete projects that support Indonesia's energy transition. This shows that non-state actors play an important role in bridging the gap between international normative commitments and the domestic capacity of developing countries to reduce GHG emissions (IRENA, 2020)

By placing GHG emission reduction at the core of Green FDI, Masdar's case in Indonesia shows that renewable energy investment cannot be understood solely as an economic development strategy. Green FDI serves as an instrument that integrates economic interests, the global environmental agenda, and domestic needs through concrete investment in the energy sector. Therefore, Masdar's contribution to GHG

emission reduction confirms the strategic role of non-state actors in Indonesia's energy transition and international relations dynamics.

CONCLUSION

This paper explores the role of Green Foreign Direct Investment (Green FDI) in supporting energy transition in Indonesia, focusing on the contribution of Abu Dhabi Future Energy Company (Masdar) as the main subject of study. The analysis shows that Green FDI plays a role not only as a cross-border capital flow, but also as a strategic tool that integrates economic interests, global environmental agendas, and the domestic needs of developing countries. In the context of Indonesia, Green FDI is important due to limitations in domestic financing and technological capacity to develop renewable energy.

Masdar's contribution to renewable energy development in Indonesia can be seen in three main aspects, namely investment and financing, technology transfer and capacity building, and greenhouse gas (GHG) emission reduction. Through its involvement in the Cirata Floating Solar Power Plant project, Masdar is contributing to the realization of a large-scale solar energy project that supports an increase in the proportion of national renewable energy. This investment not only strengthens clean energy infrastructure, but also encourages the application of low-carbon power generation technology and increases the capacity of local human resources.

The dimension of GHG emission reduction is the main focus of Masdar's Green FDI contribution. The construction of solar power plants directly replaces fossil fuel-based power plants with high carbon intensity, thereby supporting emission reduction in the electricity sector. In the context of international relations, this contribution reflects the relationship between Indonesia's global commitment to the Paris Agreement and its implementation at the national level through the role of non-state actors. Therefore, Green FDI serves as a means of bridging the gap between normative international commitments and domestic capacity to address climate change.

However, this article also emphasizes that the success of Green FDI is greatly influenced by the national policy and management framework. Regulatory challenges and issues of social benefit distribution show that Green FDI does not automatically create equitable sustainable development impacts. Therefore, more flexible and coordinated policies are needed to maximize the contribution of environmentally friendly investment, especially in ensuring long-term sustainability and national capacity building.

REFERENCES

Aprirachman, R., Purnama, Y., & Saputra, A. (2025). The Impact Of Renewable Energy, Carbon Emissions And Labor Force On Economic Growth Of Developing Countries In Asia. *Prosiding Dan Call Paper Widya Wiwaha*, *4*(1 SE-Articles), 260–275. https://doi.org/10.32477/semnas.v4i1.1305

Barboza, G., Braga, A., Duchier, A., Chacon, A., Calderón, K., & Lang, G. (2025).

Technology transfer, knowledge spillover and foreign direct investment. *The Journal of Technology Transfer*. https://doi.org/10.1007/s10961-025-10226-6

Famanta, M., Randhawa, A. A., & Yajing, J. (2024). The Impact of Green FDI on Environmental Quality in Less Developed Countries: A Case Study of Load Capacity Factor Based on PCSE and FGLS Techniques. *Heliyon*, *10*(7), e29041. https://doi.org/10.1016/j.heliyon.2024.e29041

Herindrasti, V. L. S. (2022). Positioning Indonesia in the International World Through Energy Transformation. *Journal of Social Political Sciences JSPS*, *3*(2), 166–187. https://doi.org/10.52166/JSPS.V3I2.109

Hidayat, A., Ramdhani, S. A., & Romadhoni, S. L. (2022). Pembangunan Pembangkit Listrik Tenaga Surya Di Waduk Cirata, Kabupaten Purwakarta. *Jurnal Inovasi Penelitian*, *3*(6), 6701–6706.

IRENA. (2020). Global Renewables Outlook: Energy transformation 2050. In *International Renewable Energy Agency*. Global Electricity Review 2020. https://irena.org/publications/2020/Apr/Global-Renewables-Outlook-2020

Luthfianingsih, F., Novia Asyari, S., Sidabutar, T. Y., Fitri, M. A., & Kamal, U. (2025). Strategi dan Implementasi Net Zero Emission melalui PLTS Terapung Cirata Menuju Target Indonesia 2060 Strategy and Implementation of Net Zero Emission through Cirata Floating Solar Power Plant Towards Indonesia's 2060 Target. *JIIC: Jurnal Intelek Insan Cendikia*, *2*(6), 11699–11708. https://jicnusantara.com/index.php/jiic

Mondol, J. D., & Hillenbrand, S. K. (2014). Grid parity analysis of solar photovoltaic systems in Europe. *International Journal of Ambient Energy*, *35*(4), 200–210. https://doi.org/10.1080/01430750.2013.820141

Oliveira, C., & Santos, R. (2024). Examining the Role of Foreign Direct Investment (FDI) in Sustainable Development. *International Journal of Economics, Commerce, and Management*, *1*(1), 7.

on Trade, U. N. C., & Development. (2022). *World Investment Report 2022: International Tax Reforms and Sustainable Investment*. https://unctad.org/publication/world-investment-report-2022

Organization, I. L. (2013). *Decent Work Indicators: Guidelines for Producers and Users of Statistical and Legal Framework Indicators* (2nd ed.). ILO.

Rudolph, D., Maulidia, M., & Busyrah, H. (2025). Solar–water nexus: on local implications of the procurement and deployment of the first floating solar photovoltaics project in Indonesia. *Sustainability Science*, *20*(4), 1393–1406. https://doi.org/10.1007/s11625-025-01637-3

Tan, Y., & Uprasen, U. (2022). The effect of foreign direct investment on renewable energy consumption subject to the moderating effect of environmental regulation: Evidence from the BRICS countries. *Renewable Energy*, *201*, 135–149. https://doi.org/10.1016/j.renene.2022.11.066

UNFCCC. (2015). Updated Nationally Determined Contribution Republic of Indonesia. In *United Nations Frameork Convention on Climate Change*.

Yogatama, B. K., & Ritonga, W. M. (2024). *Fishermen "Throw Their Nets" to Become Solar Power Plant Installation Workers*. https://www.kompas.id/artikel/en-nelayan-banting-jaring-jadi-tenaga-pemasangan-plts.