



ENERGY TRANSITION THROUGH CIRATA FLOATING SOLAR POWER PLANT PROJECT: A CASE STUDY OF JOINT INVESTMENT COLLABORATION AND BILATERAL PARTNERSHIPS

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ABSTRACT

The process of developing and energy innovation is rapidly increasing within the environmental sustainability aspect based on SDGs such as the Cirata power plant. Nourishing partnership is indispensable in order to achieve a transformation until completely amended alongwith variety of aspects. This project includes environment, economy, and social value according to 17 SDGs. As a global commitment contained in the Paris Agreement regarding climate change, the construction of the Cirata solar power plant is realized as a form of energy transition by decarbonizing alternative electrical energy which not only benefits the economic sector but also has a positive impact on the commitment to developing ecosystems and a sustainable green environment. Having a partner who has the ability to make solar power plants in Indonesia into reality is very important because it will accelerate the transition of clean energy as well as increasing the social welfare and economy of the local community. ESDM, BUMN, PR PLN Persero, and Masdar from UAE are involved in the development of Citara Solar Power Plant. Their collaborative effort exemplifies the importance of strategic partnerships in fostering sustainable development and combating climate change. This partnership also contributes to improving the welfare of local communities. Through job creation, technology transfer and local capacity development, the project supports inclusive and sustainable economic growth. With support from various parties, PLTS Cirata stands as a model for other renewable energy projects and shows how strategic partnerships can drive sustainable development and positive change on a global scale.

Keywords: *Transformation, Energy, Environmental, Partnership, Sustainable*

INTRODUCTION

The effort to preserve and enhance environmental sustainability is something the government is striving to accomplish with the goals of implementing SDGs (Sustainable Development Goals) related to the environment. However, environmental sustainability today can be said to be deteriorating due to the impact of energy procurement activities that rely on non-renewable resources. Essentially, humans need energy resources, especially electricity, which is a vital necessity in life (Shyu, 2014). However, it is important to note that the electricity produced in Indonesia is predominantly sourced from non-renewable energy (fossil fuels) such as coal, oil, and natural gas. Over time, the use of fossil energy sources has had a negative impact on the environment and is also limited in nature, making it necessary to innovate and develop environmentally friendly and renewable energy sources. One alternative effort highlighted by the author and chosen as a case study is the energy transition at the Cirata Solar Power Plant (*PLTS*



Cirata), which utilizes solar panels as an innovative implementation and involves strengthening partnership among parties in order to support sustainable development (Nugraha, 2023). By means of strengthening partnership through joint investment is expected to aim at some objectives which are settled to be applicable and beneficial in the future.

The Cirata Solar Power Plant (PLTS Cirata) is the largest national energy generation service in West Java, with a capacity of up to 145 megawatts. It is located on the border of three districts: West Bandung, Purwakarta, and Cianjur. This concept is the outcome of an energy transition innovation that integrates the Cirata Reservoir with floating solar panels to supply an environmentally beneficial and sustainable energy source. Through this project, the government has effectively engaged international investors in its management, resulting in a USD \$129 million valuation (Hidayat, 2023). The ventures involved represent a form of green investment with the goal of committing to environmental preservation. Legally, this solar power plant (PLTS) is managed by PT. PJBI (Pembangkitan Jawa Bali Investasi), a state-owned enterprise with a 51% shareholding, while the remaining shares are owned by foreign investors. PT. PJBI, a subsidiary of PLN, collaborates with a company from the UAE (Masdar) in joint investment and management (Puspapertiwi & Nugroho, 2023).

This research will investigate the association among state-owned enterprises and foreign investment as a form of green investment in Indonesia. According to the author's research, various studies have been published on the Cirata Solar Power Plant (PLTS Cirata), however earlier study has focused on the technical aspects of the Cirata power plant, such as infrastructure development, output, and environmental impact. However, when compared to existing research, the author discovered a previously unexplored gap in understanding how the collaboration process between parties involved in the funding and management of the Cirata PLTS strengthens relationships. This study is meant to assign the following research question on how the intertwined partnership between involved parties happen, peculiarly highlighting joint investment and bilateral partnership. In accordance with the research question, the authors aim for several purposes, as follows: (1) analyzing the flow of cooperation activity; (2) discover the result of entwined collective work; (3) and explore how it is related to sustainable development.

The authors argue that while the Indonesian government is striving to achieve environmental sustainability through the implementation of Sustainable Development Goals (SDGs), the continued reliance on non-renewable energy sources, such as fossil fuels, undermines these efforts. The author highlights the need for innovation and the development of renewable energy sources to mitigate the environmental damage caused by fossil fuels. The case of the Cirata Solar Power Plant (PLTS Cirata) is presented as a model for this energy transition. As the largest solar power initiative in West Java, Cirata integrates floating solar panels with the Cirata Reservoir, showcasing a significant step toward sustainable energy production. The project's success is attributed not only to technological innovation but also to the strategic partnerships between state-owned PT. PJBI and foreign investors, particularly the UAE-based company Masdar. This collaboration exemplifies how joint investments in green energy can bolster environmental preservation while also attracting significant international funding. The author concludes that



such partnerships are crucial for achieving long-term sustainability and addressing the limitations of current energy practices.

METHODS

As a matter of fact, sustainable development these days is profoundly concerning to certain parties and regulations. Therefore, this research intends to delve deeper into the joint investment that occurs in this project by using qualitative research methods, leveraging literature studies from reliable journal sources and text analysis. Data collection in the preparation of this article is also based on a literature review obtained from gathering data sources, which are then examined in-depth based on the case study that has been selected as the theme of this research article. In addition, the data analysis technique used is content analysis, which analyzes sources in the form of texts with the aim of finding implicit information related to the research topic.

THEORY

Joint Investment Theory

The floating solar power plant project in Cirata, Indonesia, is a strategic step in this energy transition. This project not only relies on innovative technology but also emphasizes the importance of collaboration among various stakeholders through the Joint Investment Theory. Joint Investment Theory focuses on collaboration among different entities to reduce investment risks and maximize profits. In the context of the Cirata project, collaboration between the government, private companies, and international institutions has created a strong synergy. By sharing resources, expertise, and responsibilities, all parties can contribute to the success of this project. Through the Joint Investment Theory approach, the Cirata project offers various benefits. First, this project contributes to the reduction of carbon emissions and dependence on fossil fuels. Second, this project creates local jobs and enhances domestic technological capacity. Thirdly, this collaboration also leads to an increased awareness among the public about the importance of renewable energy and sustainability. The Cirata Floating Solar Power Plant project is a concrete example of how Joint Investment Theory can be implemented in the energy transition. The collaboration between the government, the private sector, and international institutions not only optimizes resources but also creates a model that can be adopted in similar projects in the future. With this approach, Indonesia has the potential to become a leader in renewable energy in Southeast Asia, as well as make a significant contribution to global efforts in addressing the challenges of climate change. The success of this project could inspire other countries to adopt a joint investment model as a solution to the existing energy challenges.

Strategic Partnership Theory

The energy transition towards renewable energy sources is a key focus in efforts to reduce dependence on fossil fuels and mitigate climate change. The Floating Solar Power Plant (PLTS Apung) project in Cirata, West Java, is an innovative example that combines renewable energy technology with strategic collaboration between the government, private sector and international partners. This research uses Strategic Partnership Theory to analyze how this



collaboration can accelerate Indonesia's energy transition. Strategic Partnership Theory explains how organizations or entities can collaborate to achieve common goals through complementary resources, knowledge and technology. These partnerships not only benefit the parties involved, but can also have a positive impact on the wider community and the environment. Strategic partnerships are based on aligned goals. In the Cirata Floating Solar Power Plant project, the main objectives are to increase the use of renewable energy, reduce carbon emissions, and support national energy policy.

Cirata Floating Solar Power Plant is located in Cirata Reservoir, West Java, with an installed capacity of 145 MW. The project is expected to generate significant clean energy and reduce carbon emissions. By utilizing water land, the Floating Solar Power Plant reduces negative impacts on agricultural land and terrestrial ecosystems. Research shows that this technology can reduce water evaporation from reservoirs by up to 80%. The project involves various entities, such as the local government, PLN (State Electricity Company), and private companies, as well as international institutions such as the Asian Development Bank, reflecting a strategic partnership.

RESULT AND DISCUSSION

Along with the development of human activities, this has an impact on increasing the need for electricity as the most important component in daily life. The use of energy sources in Indonesia is still dominated by fossil fuel power plants such as oil and coal, which if these energy sources are used continuously in the long term will experience scarcity because these energy sources are natural resources that cannot be renewed. Therefore, an effort is needed to address energy scarcity, namely by transitioning from non-renewable energy to renewable energy. Fortunately, Indonesia is a region with a tropical climate, where sunlight is very abundant throughout the year, making the sun a potential source of renewable energy to be developed. Indonesia also contributes 2.3% of total greenhouse gas emissions, this is based on the European Commission, which is the highest figure among developing countries, but this is balanced with Indonesia's ambition to reduce carbon emissions with its own efforts and with international assistance as stated in the Paris Agreement, this is proven by carbon emissions in Indonesia experiencing a gradual decline

The policy on licensing for the construction of solar power plants was launched by the Indonesian government in 2018, this is a form of government realization in an effort to increase renewable energy consumption by 23% by 2025 (Setyawati, 2020). Even though it has a lot of potential in various renewable energy sources such as solar, wind, water and geothermal, Indonesia has not been able to utilize them properly due to the high cost of producing electrical energy from renewable resources, and the price cannot even compete with fossil fuel energy sources such as gas, coal and oil, example, the high cost of building a solar power plant compared to building a conventional power plant, this is because of the many components and devices needed to convert sunlight into electrical energy, even so the resulting impact is very minimal compared to electricity from fossil fuel power plants.

The Cirata Floating Solar Power Plant was developed through a jointly owned company called PT Pembangkitan Jawa Bali Masdar Solar Energy (PMSE), in which Masdar retains the majority stake



of 51%, with the remaining 49% owned by PLN. Masdar, being a global leader in renewable energy development, provides the financial backing and advanced technological capabilities required for the construction of a large-scale floating solar power plant (Kibtiah, Dewi, Bainus, & Abdurrahman, 2024). Indonesia, on the other hand, supplies the local expertise, regulatory support, and access to land and water resources, such as the Cirata Reservoir, to facilitate the project. Without this partnership, it would be difficult for either party to develop such a massive project individually. Indonesia’s financial constraints and technological gaps in renewable energy infrastructure could have delayed the project, but Masdar’s financial input helped overcome these challenges. It gives an opportunity for this joint venture model to distribute the financial risks and benefits while taking advantage of Masdar’s technical capabilities in solar energy, complemented with profound knowledge of the Indonesian energy market by PLN. Access to international capital markets is easier with the backing of a strong international partner, it can lead to having such a partner reduces concerns related to political and financial risk, which are often associated with large infrastructure projects in emerging markets.

By partnering with Masdar, Indonesia gaining some benefits from the transfer of cutting-edge solar technology and the best practices for floating solar installations. This knowledge transfer equips Indonesia with the skills and technical expertise needed to maintain and expand renewable energy projects in the future. In addition, Masdar’s involvement ensures that the latest and most efficient solar technologies are utilized in the project, leading to better performance and higher energy output.

Furthermore, the bilateral partnership between Indonesia and the UAE is strengthened through government-level agreements. These diplomatic relations have paved the way for smoother regulatory processes and have created a conducive environment for foreign direct investment (FDI) in Indonesia’s renewable energy sector. The support of both governments has been critical in overcoming bureaucratic hurdles, accelerating licensing, and ensuring the project's smooth progress.

Cirata Solar Power was one of the results at the role of technological innovation in facilitating transition to renewable energy. Also, PLTS Cirata not only the first of its kind in Indonesia but also one of the largest floating solar power plants in Southeast Asia (Kulsum, Rochman, & Nasrudin, 2017). The floating solar technology that have been used in PLTS Cirata project has several advantages over an traditional land-based solar installations. Because floating solar panels are more efficient due to the cooling effect of the water itself and prevents them from overheating that could possibly enhances their energy conversion rates.

According to the World Resources Institute (WRI) in 2014, Indonesia ranked sixth in the world as a carbon emitter, producing 1.981 billion tons of emissions annually. This has prompted the government to initiate efforts to reduce the emission levels. In addition to being the sixth-largest emitter globally, Indonesia also holds the top position as the largest carbon emitter in Southeast Asia. Due to its high carbon emissions, Indonesia ratified the international agreement aimed at reducing Greenhouse Gas (GHG) emissions, known as the Kyoto Protocol (Madyan, 2024).



In contributing to carbon emissions, many sectors play a role, including transportation, households, industry, agriculture, and electricity. In Indonesia, emissions have become an issue that cannot be ignored, as the country's emissions have shown a significant increase since 1990, reaching a peak of 581 MtCO₂ in 2019. This number is expected to continue rising over time unless the government takes action to reduce emissions. The industrial sector is the largest contributor, accounting for 37% of emissions, followed by transportation at 27%, and electricity and heat generation at 27% (Madyan, 2024).

Indonesia is a tropical country, meaning it receives ample sunlight throughout the year. This advantage gives Indonesia high potential to develop solar power plants (PLTS) to address emissions from conventional power plants and reduce the use of non-renewable fossil fuels that harm the environment during extraction. Indonesia already has several solar power plants, one of which is the Cirata Solar Power Plant (PLTS Cirata). This plant is expected to reduce greenhouse gas emissions by 214,000 tons per year (PLN, “Profile dan Progress PLTS Terapung Cirata” Deklarasi Financial Close Proyek PLTS Terapung, 2021). The Cirata Solar Power Plant can also help reduce water evaporation at the Cirata Reservoir, which is highly valuable for farmers around the reservoir and for the Cirata Hydroelectric Power Plant (PLTA). The electricity generated by PLTS Cirata will be directly fed into the Cirata substation system, which serves the Java-Madura-Bali grid (Iqbal, 2023).

One of the advantages of the Cirata Solar Power Plant is that its system is connected to the Cirata Hydroelectric Power Plant, which has a capacity of 1,008 megawatts, facilitating energy storage and distribution throughout Java, Madura, and Bali (Iqbal, 2023). In addition to the challenge of building power plants that do not rely on fossil fuels, Indonesia faces another challenge: the purchase price of renewable energy. As a developing country, Indonesians tend to prefer cheaper electricity, without considering the environmental damage caused by conventional power plants. The energy produced by the Cirata Solar Power Plant is purchased by PLN at a price of 5.8 cents, or approximately Rp880 per kWh. Although this price is relatively affordable, it is still higher compared to other countries, where renewable energy can be purchased for 3 cents less from Indonesian price (Iqbal, 2023).

The construction of the Cirata Solar Power Plant (PLTS Cirata) also has an economic impact on the development of the areas surrounding Cirata. The PLTS Cirata is able to absorb 1,400 local workers from three regencies: Purwakarta, Cianjur, and West Bandung (Puspapertiwi & Nugroho, 2023). The creation of these job opportunities is expected to boost the local economy. In addition to the opening of new jobs, the PLTS Cirata also holds potential for local economic development, such as profits from the Cirata Solar Power Plant company, net income earned by Cirata Solar Power Plant employees, and increased tax revenue due to a rise in the standard of living in the area (Jenniches & Worrell, 2019).

CONCLUSION



Electricity demand in Indonesia has grown drastically with the growth of human activities, but most of its energy resources are still based on oil and coal, which are not sustainable and lead to higher levels of carbon emission. Curiously enough, Indonesia still cannot avoid an essential need to switch its usage from non-renewable into renewable sources of power-particularly, solar energy-on account of its geographical parameters: the tropical climate actually offers it an excessive amount of sun. The Cirata Floating Solar Power Plant represents a key move in that direction, with the facility being Southeast Asia's largest and leveraging advanced floating solar technology to provide benefits not available from land-based installations, such as improved efficiency due to water cooling. The Cirata project was facilitated by a strategic partnership between Indonesia's PLN and Masdar from the UAE, with the combination of Indonesia's local expertise and regulatory support along with Masdar's financial backing and technological expertise. The partnership balanced Indonesia's financial and technological problems in renewable energy infrastructure. The project thus became a model for appropriate balancing of financial risks and benefits among local and international stakeholders. In addition to the aforementioned benefits, the Cirata Solar Power Plant is seen as a venture with the potential to reap considerable economic dividends for the surrounding regions through employment and boosting local economies. It would also support Indonesia's ambitious plan to raise renewable energy consumption to 23% by 2025 in its broader efforts toward cutting greenhouse gas emissions in accordance with international agreements such as the Paris Agreement. Although renewable energy production is highly expensive in the beginning, Cirata shows long-term environmental and economic benefits from shifting to sustainable energy, therefore being one of the important projects against both energy needs and climate change in Indonesia.

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