

Lessons From Vietnam's Solar Power Plant Growth Development for Indonesia to Reach Net Zero Emission

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ABSTRAK

Peningkatan emisi gas CO₂ semakin masif yang ditimbulkan salah satunya dari penggunaan energi fosil di berbagai negara sehingga menimbulkan ancaman perubahan iklim. Dunia global telah menandatangani Perjanjian Paris di tahun 2015 untuk menurunkan emisi karbon di tahun 2050. Negara-negara di ASEAN juga turut melakukan langkah nyata khususnya di bidang ketenagalistrikan dengan mengupayakan sumber energi terbarukan. Saat ini Vietnam yang berhasil menjadi negara paling depan di ASEAN dalam sektor pengembangan PLTS dalam rangka memenuhi kebutuhan listriknya dan juga dalam rangka mengurangi emisi karbon. Indonesia termasuk negara yang meratifikasi perjanjian Paris, telah membuat suatu “*grand strategy*” untuk pengembangan PLTS yang bertujuan untuk menurunkan penggunaan energi fosil serta emisi karbon nasional hingga tahun 2060. Tulisan ini bertujuan untuk memberikan studi komparasi antara Vietnam dan Indonesia dari segi kebijakan dan implementasi pengembangan PLTS hingga saat ini. Metodologi yang penulis gunakan dalam penelitian ini merupakan riset kualitatif dengan pendekatan deskriptif untuk memberikan gambaran holistik. Penelitian ini melalui dua tahapan, yaitu peninjauan literatur secara sistemik dan observasi komparatif antara Vietnam dengan Indonesia. Data yang diperoleh juga ditinjau dari dokumen negara, literatur akademik, hingga media daring yang relevan dengan penelitian ini. Secara konklusif, penulis berhasil meninjau bahwa Vietnam jauh lebih sukses dengan beberapa keunggulannya yang dapat ditiru oleh Indonesia yang masih terhambat untuk pengembangan PLTS dalam periode dekat ini.

Kata kunci: PLTS, Vietnam, Indonesia, Emisi Karbon, Energi Fosil

ABSTRACT

CO₂ gas emissions are increasingly massive, one of which is caused by the generation of energy from fossils in many countries that pose a threat to climate change. The global world has agreed on the Paris Agreement in 2016 to reduce carbon emissions in 2050. ASEAN countries are also taking concrete steps, especially in electricity, by seeking renewable energy sources. At present, Vietnam has succeeded in becoming the leading country in ASEAN in the solar power development sector in order to meet its electricity needs and also in order to reduce carbon emissions. Indonesia is one of the countries that has ratified the agreement has made a “grand strategy” for the development of solar power plant, which aims to reduce the use of fossil energy and national carbon emissions by 2060. This paper aims to provide a comparative study between Vietnam and Indonesia in terms of policy and implementation of solar power plant development to date. The methodology that the authors use in this study is a qualitative research with a descriptive approach to provide a holistic picture. The method of this study applied two steps, i.e., systemic literature review and comparative observation between Vietnam and Indonesia. The data obtained were also reviewed from state documents, academic literature, to media bold relevant to this research. Conclusively, the author managed to review that Vietnam is far more successful with several advantages that Indonesia can emulate, which is still hampered from developing solar power plant in the near future.

Keywords: Solar power, Vietnam, Indonesia, Carbon Emissions, Fossil Energy

INTRODUCTION

Erickson and Lazarus (2013) quoted the 2012 World Energy Outlook, where there was a high surge in the aspects of population, income, and economic output, which had implications for increasing demand for fossil energy which had an impact on greenhouse gas emissions and global climate change. However, the demand for infrastructure with fossil power such as coal, gas, and oil continues to increase to support national and international needs, both government and private (Erickson & Lazarus, 2013). Climate change is one of the threats to challenges the global solidarity in today's contemporary era. CO₂ emission is one of the main causes of the result of burning fossil energy which is spread in the air. From a policy perspective, a number of countries have paid great attention to this threat, but only a few have associated it with aspects of the economic consumption of goods and services (Davis & Caldeira, 2010).

The global commitment to fight the threat of carbon gas emissions and sustainable climate change has been carried out with the signing

of the Paris Agreement in 2015, providing a commitment for countries that are members of the 2015 United Nations Framework Climate Change Conference. The Paris Agreement targets to reduce the effects of climate change and withstand global temperature levels (UNFCCC, 2021). In addition, CO₂ emissions must be reduced slowly to reach net-zero levels in the middle of the 21st century, with the main target in 2030 so that the contribution of countries that agree must meet the minimum aggregate (UNFCCC 2021). Indonesia is also moved to commit to the Paris Agreement so that it starts its efforts to achieve an aggregate net-zero emission in 2060 or sooner, especially in the energy sector through, one of which is the development of Solar Power Plants as a transition towards implementing renewable energy.

Indonesia also has a national climate commitment to reduce greenhouse gas (GHG) emissions by up to 29% in 2030 and reductions of up to 41% through international cooperation (Waste4Change, 2022). One of Indonesia's efforts to achieve net-zero emission in 2060 is in the energy sector by developing Solar Power Plant in various

regions so that they can be separated from fossil energy dependencies. However, there is pessimism in Indonesia at the level of developing Solar Power Plant nationally in various government or private sectors. Tumiwa and Citraningrum (2021) analyze that there is a futile prospect that is being carried out by Indonesia due to regulations that hinder the development of Solar Power Plant in Indonesia. Even though it has committed and has a “grand strategy”, Indonesia is still hampered by dependence on fossil energy and regulations that support it, so that efforts to develop sustainable Solar Power Plant cannot be realized in the short term (Tumiwa & Citraningrum, 2021). On the other hand, one of the ASEAN countries, Vietnam, has succeeded in developing a massive and significant Solar Power Plant which previously depended on coal. Tumiwa and Citraningrum (2021) noted that at the end of 2020, Vietnam has succeeded in increasing up to 2400% of PLTS installations and producing 16.5 GW of electricity from Solar Power Plant. Without a doubt, this raises the question of how Vietnam can be faster than Indonesia. This paper will provide a comparative picture regarding the development of Solar Power Plant in the two countries.

RESEARCH METHOD

The research method used for this research is a literature review and continuing with a comparative study between the construction of Solar Power Plant in Vietnam and Indonesia from the perspective of national public policy as well as statistical data on its development so far. This research method uses a qualitative descriptive research approach by exploring various scientific literature such as academic journals, research reports, online articles, and other media. In collecting the data, the author also correlates the stated resources with the topic of discussion in this paper, namely a comparative study of Solar Power Plant development in Vietnam and Indonesia to achieve net-zero emissions in 2060. Each collection of literature data or figures that the author encounters will be explained by the economic perceptions of the government and academics and technical especially in comparing the two countries. The author analyzed Vietnam,

which has succeeded in developing many Solar Power Plant in its country, by reviewing the data through reviewed state documents and academic literatures. Then, the study compared it with Indonesia in terms of commitment and its implementation from the national government level to implementation in various sectors through the data presented. The analysis carried out is illustrated by qualitative data interpretation and synthesized to construct conclusions about how Indonesia can learn from what Vietnam did to develop its Solar Power Plant.

RESULTS AND DISCUSSION

A. Vietnam and Its Success on Becoming a Pioneer in the Implementation of Solar Power Plant in ASEAN

Ever since 2011, Vietnam has confirmed that they will utilize four main sources of renewable energy on a national scale: Hydropower, Wind Power Plants, Solar Power Plants, and Biomass Energy. By 2018, the share of renewables covered about 24% in power generation, but the electricity production from solar and wind energy have remained low, less than 6% (Sanseverino et al., 2020). Bulloch et al. (2022) in his research entitled “Vietnam’s Renewable Energy Policies and Opportunities for the Private Sector” argued that Vietnam has a strategy and outlook for national energy development which is sheltered in Politburo Resolution 55 in 2020. The contents show Vietnam to put forward a vision from 2030 to 2045 with a focus on: (1) Maintaining national energy security as a solid foundation for socio-economic development while developing the energy sector quickly and sustainably; (2) Based on the market mechanism, quickly develop a competitive and transparent energy market, diversify forms of ownership (especially the private sector) and business models, and eliminate monopolies or unfair competition; (3) Develop and diversify forms of energy; (4) Accelerating digital transformation and research and development to become more technologically independent; and (5) Emphasize energy efficiency and environmental protection.

In 2021, Solar Power Plant has generated Vietnam’s electricity reserves up to 11% on a

national scale. Vietnam has become a country with increased implementation of Solar Power Plant for national electricity needs to become the 10th country producing solar electricity. This is in accordance with Vietnam’s policy principles to stop using coal-fired electricity to achieve Zero Emissions by 2050 (The Economist, 2022). The Vietnamese government also targets that by 2030 the use of coal will be reduced and replaced with solar electricity (one of them). This is evidenced by since 2020, the combined capacity of electricity generated from Solar Power Plant and Wind Power Plant has reached 17 GW (Do et al., 2021). Since 2021, Vietnam has a total capacity of 25% of electricity from renewable energy (air, solar, and other EBT). Vietnam is now leading the implementation of Solar Power Plant and Wind Power Plant in ASEAN in terms of cumulative installation capacity, annual increase in energy installations, and per-capita energy installation capacity (Do et al., 2021).

Why does Vietnam prioritize Solar Power Plant development in the future? Research from Nguyen Duc Duong with the title “State Management of Solar Energy: A Case Study in Vietnam” answers from a geographical perspective. Vietnam is geographically located at latitude 23023’ North to 8027’ North, so that it is located exactly in geographical conditions with high solar radiation intensity, especially in Ho Chi Minh City, North West Region of Vietnam, and North Central Vietnam (Duong, 2022)), it can be seen in Table 1, solar radiation intensity in South Central and Central Highlands have the highest range between 4.9 – 5.7 (kWh/m².day) and also in great number of hours of sunshine in a year on range between 2000 – 2600 (hours/year). In addition, Duong (2022) has mapped several Solar Power Plant in Vietnam that are developing and have contributed a lot to national energy security. Through the Table 2:

Table 1. Solar radiation Data in Vietnam Territories

No	Territory	Solar radiation intensity (kWh/m ² .day)	Number of hours of sunshine in a year (hours/year)
1	northeast	3.3 – 4.1	1600-1750
2	northwest	4.1 – 4.9	1750-1800
3	North Central	4.6 – 5.2	1700-2000
4	South Central and Central Highlands	4.9 – 5.7	2000-2600
5	Southern	4.3 – 4.9	2200-2500
6	National average	4.6	1700-2500

(Source: Duong, 2022)

No	Factory Name	Conscious	Capacity (MWp)	Land area (ha)	Land occupation rate (ha/MWp)
1	Trung Nam Ninh Thuan Solar energy Plant	Ninh Thuan	258	264	1.02
2	CMX Renewable Vietnam Solar energy Plant	Ninh Thuan	168	186	1.11
3	Trung Nam Tra Vinh Solar energy Plant	Tra Vinh	156	171.17	1.10
4	My Son Solar energy Plant - Hoan Loc Viet	Ninh Thuan	50	64.57	1.29
5	Adani Phuoc Minh Solar energy Plant	Ninh Thuan	49.8	59.86	1.20
6	BP Solar 1. Solar energy Plant	Ninh	forty six	62.26	1.35

(Source: Duong, 2022)

Do et al (2021) in his research entitled “Vietnam’s Solar and Wind Power Success: Policy Implications for the Other ASEAN Countries” succeeded in explaining why Vietnam was able to succeed in becoming the driving force or number one in ASEAN. There are several explanations, such as: (i) Underlying Drivers: There is a commitment by the Vietnamese government that motivates Vietnam to prioritize the development and implementation of solar energy policies. There are also public opinion factors that are fundamental to the government’s motivation to suppress the development of Solar Power Plant because awareness of renewable energy is increasingly widespread. The Solar Power Plant industry is growing in countries such as Singapore, Thailand, and others, so that Vietnam is trying to keep up with the development of Solar Power Plant at the national level. In addition, there is a government commitment to an international climate change charter so that Vietnam designs a national strategy to contribute to the international agreement. (ii) Feed-in-tariffs (FITs): FITs are becoming a cornerstone of the increasingly widespread adoption of solar PV in Vietnam. The first was launched in 2017 through Ministerial Decree 11/2017/QD-TTg. FITs in Vietnam aim to provide subsidies for investment in the development of PLTS, especially for business units, based on criteria determined by the government. FITs in Vietnam in 2020 through Prime Ministerial Decree 13/2020/QD-TTG regulate subsidies of US\$83.8/MWh for rooftop solar projects, US\$70.9/MWh for ground-mounted solar PV, and US\$76.9/MWh for floating diesel. This policy is considered by the public as a generous policy. (iii) Tax and land lease incentives: There are corporate income tax exemptions and incentives for companies that develop and implement Solar Power Plant. Income

tax is reduced by 50% in the following nine years and then 10% through the 15th year of operation. Vietnam also waives import tariffs on equipment used for Solar Power Plant construction. Then, there is the utility scale of land lease exemption starting for Solar Power Plant development. Foreign funding is also allowed so that Solar Power Plant can develop further.

Quoting research by Bulloch et al (2021) representing the British Chamber of Commerce Vietnam with the title “Vietnam Renewable Energy Report,” there is a factor of foreign investment that plays an important role. Vietnam has high opportunities in the renewable energy industry, so that investor demand is also high with various potentials, especially in the field of Solar Power Plant. Vietnam has also adopted a flexible policy for investment development in the solar energy sector. Foreign investment is offered with several scheme options, mainly four, namely: (1) Build-Operate-Transfer (BOT); (2) 100% Foreign Invested Company; (3) Public-Private Partnerships; (4) Joint Ventures. Bulloch et al (2021) also explain the role of regulated government incentives in policy, which are referred to as four key proclamations as guidelines for the development of renewable energy: (1) MOIT Report No.2941 as a follow-up to the extension of FITs; (2) Resolution No. 55 as the orientation of Vietnam’s national energy development strategy; (3) MOIT Report No. 1931 as an affirmation of the development of wind power sources; (4) Decision No. 13 which focuses on the development of Solar Power Plant assisted by government incentives and foreign investment.

In their research entitled “Vietnam’s Solar Power Boom: Policy Implications for Other ASEAN Member States”, Do and Burke (2021) show that the advantages of Vietnam’s development in the Solar Power Plant field lie in FITs policies (main key to success), income tax policies, and land-lease payments. exemptions. In addition, the government’s commitment and public demand are also big drivers to improve Vietnam’s air quality and renewable energy supply amid global uncertainty. This research emphatically shows Vietnam to be a teacher for ASEAN countries,

including Indonesia, for the development of Solar Power Plant with its various potentials.

B. PLTS Indonesia and its Development to Achieve Net-Zero Emissions in 2060

Geographically, Indonesia is an archipelagic country consisting of various islands with a tropical climate. One characteristic of a tropical climate is the tendency for a hot climate and exposure to high-intensity sunlight, especially due to its position below the equator (Dang, 2017). Dang (2017) reviews that Indonesia is geographically very suitable for the development of renewable energy through specific Solar Power Plant and is supported by the high demand for renewable energy in line with the commitment of the Paris Agreement to achieve net-zero emissions in 2060. Indonesia’s average solar irradiance potential is around 4.8 kWh/m²/day, with a monthly variation of around 9% (Hardianto, 2019). Casson et al. (2015) explained that Indonesia has an energy mapping target in 2025, which is grouped into

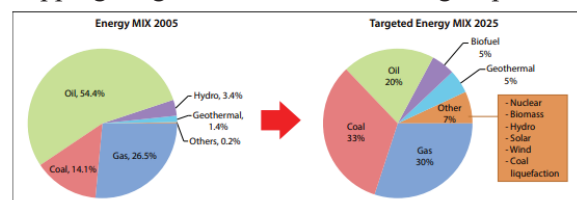


Figure 1. Indonesia’s Energy Mix 2025 (Source: Casson et al. 2015)

It can be analyzed that the percentage of solar energy is still small compared to other fossil energy such as oil, gas, and coal. In addition, biogas and geothermal energy have their own capacities, which are prioritized at 5% each. From the graph, it can be analyzed that Indonesia has great potential in developing Solar Power Plant, but the reality is that fossil energy is still used more in various ways even though Indonesia has set a target of net-zero emissions in 2060 (Casson et al., 2015)

There is research developed by Hertadi et al. (2022), who managed to review that there is still Indonesia’s dependence on fossil energy, the trend for Solar Power Plant development is still less attractive to industry and other sectors. From this study, Hertadi et al. succeeded in formulating a

table of research results as Table 3 as follows:

Table 3. Power Plant Type Capacity Proportion

Year	Power Plant Capacity by Energy Source	
	Fossil Fuel	Renewable
2018	87.86%	12.133%
2019	88.026%	11.974%
2020	87.721%	12.279%

Source: Hertadi et al. (2022)

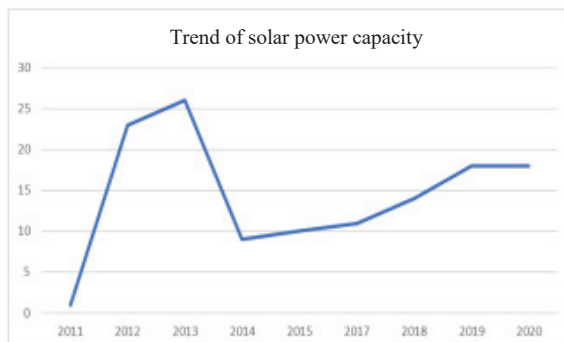


Figure 2. Capacity Trend of Solar Power (megawatts) (Source: Hertadi et al. 2022)

From Figure 2, it can be explained that the proportion of Solar Power Plant in Indonesia is still very small but has increased and also decreased in certain time periods. Even though Indonesia has signed the Paris Agreement in 2016, in terms of implementing commitments, especially in the Solar Power Plant development sector, there are still obstacles that can slowly threaten Indonesia’s commitment. However, the Indonesian government has anticipated by issuing a scenario to achieve net-zero emissions by 2060 in stages every decade (Hertadi et al., 2022).

At the online seminar entitled “Quality Low Carbon Growth and Indonesia’s Opportunities to Achieve Carbon Neutrality before 2070”, delivered by Dr. Medrilzam, MPE as Director of the Environment of Bappenas that low carbon development must be prioritized as a national instrument towards achieving the targets of the Sustainable Development Goals (SDGs) and Indonesia Gold 2045 (IESR, 2021). Dr. Medrilzam also explained that the sources and development of New and Renewable Energy (EBT) in Indonesia

had been planned early on to achieve net-zero emission in 2060. Through the figure below, the Indonesian government, through Bappenas, has described scenarios for the distribution of EBT development, including PLTS in Indonesia:

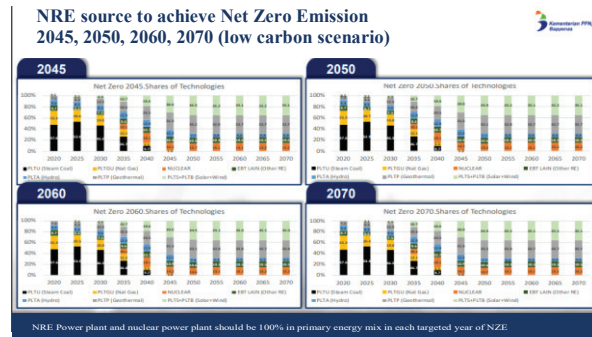


Figure 3. NRE Sources for NZE Achievement up to 2070 (Source: IESR, 2021)

In 2021, Bappenas also published a research report entitled “A Green Economy for a Net-Zero Future: How Indonesia can build back better after COVID-19 with the Low Carbon Development Initiative (LCDI)” which explains that LCDI development in Indonesia has decreased in intensity due to the Covid-19 pandemic, so a new breakthrough is needed in this transitional era to pursue Indonesia’s sustainable net-zero emissions target through LCDI (Bappenas, 2021). With Indonesia leading the G20 Presidency in 2022, the scenario of a commitment to net-zero emissions demonstrates Indonesia’s leadership strength internationally, especially in the aspect of resistance to climate threats. Bappenas (2021) also explains that the scenario of Indonesia’s net-zero emissions through the 2020-2024 RPJMN also has implications for increasing Gross Domestic Product (GDP) by up to 6% annually until 2045. With this in mind, other positive implications can be born, such as increasing the number of fields jobs, poverty reduction, and other economic and social benefits at the national level. Bappenas also provides a scenario for massive Solar Power Plant development up to 2070 with a significant level, as explained in Figure 4.;

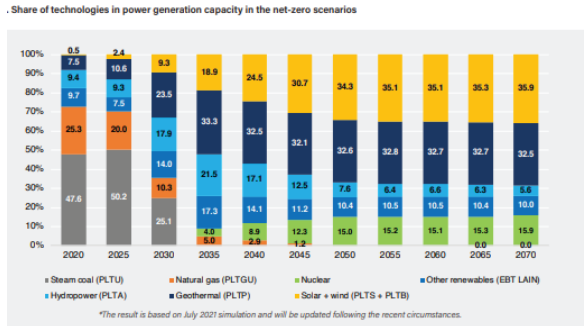


Figure 4. The Technology Portion of the Electricity Generation Capacity in the Net Zero Scenario (Source: Bappenas, 2021)

From Figure 4, it can be analyzed that the Indonesian government has big ambitions in developing Solar Power Plant on a national scale. Indeed, empirical data shows that now the use of Solar Power Plant in any sector is less visible, but several sectors are starting to use it for electricity generation needs. From 2020, with a projection of around 0.5%, the use and development of Solar Power Plant in Indonesia will begin to slowly reduce the use of fossil energy until 2070 of 35.9% of its use (Bappenas, 2021). From this scenario, it can also be seen that the Indonesian government has an optimistic target for the development of Solar Power Plant in various sectors so that it is projected to be the highest level compared to other electricity generators in the future.

The author also takes statistical data from Statista, which provides empirical data on the energy capacity produced by Solar Power Plant in Indonesia. As follows:

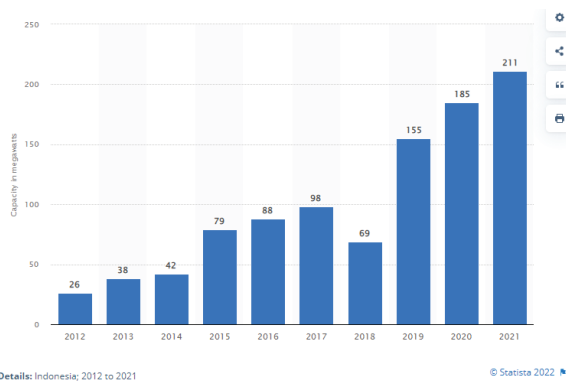


Figure 5. PLTS Capacity in Indonesia (Source: Statista, 2022)

From the stated data above, it can be concluded that although Indonesia still has a dependency on fossil energy, it has started to develop massive Solar Power Plant every year. From the table above, it can be seen that the capacity figures in Megawatts produced by Solar Power Plant from 2018 have continued to experience a significant increase in energy capacity (Statista, 2022). The author sees it as a follow-up from the Indonesian government to commit to the Paris Agreement and achieve net-zero emissions through the development of Solar Power Plant in various sectors.

C. Recommendations for Indonesia

Through reviewed research from Pranadi and Shani (2019), Do et al. (2021), and Vakulchuk et al. (2022), the author would like to provide some input regarding policy recommendations for ASEAN countries, including Indonesia, from the significant development of solar energy from Vietnam. The following are some policy recommendations:

- 1. Drivers of solar PV:** Government motivation to follow public opinion regarding the development of Solar Power Plant for greener post-pandemic recovery. Solar Power Plant offers the opportunity to benefit from social, economic, and environmental sectors so that it can be profitable from an investment perspective.
- 2. Strong Political and Social Support:** The government and the public (society) must have the same interest in developing renewable energy, including Solar Power Plant, and the policy framework must be unified from the government's political interests and public wishes.
- 3. FITs for New Projects:** Vietnam has implemented FITs optimally so that it becomes a key driver for more optimal PLTS development. With fully regulated FITs, it is possible to expand sustainable electricity through investment and subsidies.
- 4. Gross Metering:** the measurement of this indicator is used as corporate governance that develops Solar Power Plant for the government to measure taxation through

the company's gross income and must be flexible with policies and relevant to the development of the PLTS industry.

5. **Land Lease Exemptions:** Exemption from land leases can provide more room for movement and lower operational costs to develop new Solar Power Plant.
6. **Low Fossil Fuel Subsidies:** Provide subsidies for companies that implement renewable energy and government elements.
7. **Room for Improvement:** Providing space for innovation and flexibility in the scope of government politics, social society, and the company's economy, which is protected by national policies that are coherent and profitable for these elements.

CONCLUSION

It can be concluded that the two countries each have the same goal, namely to achieve net-zero emissions or carbon in 2050 and 2060. Both of them have formed a "grand strategy" in the field of energy and renewable resources with high projections for the next few decades. However, after further investigation, it can be seen that Vietnam is far superior to Indonesia. Even though they have the same geographic potential, the same commitment, and the same vision, both have different ways of execution in terms of implementation and policy. From Vietnam, Indonesia can implement several elements such as a coherent underlying driver vision so that cooperation between the government and the community is created, FITs policies to encourage subsidies for Solar Power Plant development, as well as tax and land lease incentives policies to facilitate Solar Power Plant development. The author has also presented policy recommendations that can be considered by the Indonesian government, especially for Bappenas and the Indonesian Ministry of Energy and Mineral Resources, to optimally develop Solar Power Plant like Vietnam did.

BIBLIOGRAPHY

- Bappenas. (2021). *A Green Economy for a Net-Zero Future: How Indonesia can build back better after COVID-19 with the Low Carbon Development Initiative (LCDI)*. Jakarta: Ministry of National Development Planning/National Development Planning Agency.
- Bulloch, B., Doan, A., Dean, T., Pham, M., Thieu, T., & Nguyen, N. (2021). *Vietnam Renewable Energy Report*. Hanoi: British Chambers of Commerce
- Casson, A., Muliastira, Y. I. K. D., & Obidzinski, K. (2015). *Green Development Initiatives in Indonesia*. In *Land-based Investment and Green Development in Indonesia; Lessons from Berau District, East Kalimantan*. Center for International Forestry Research.
- Dan, N. L. (2022). *Vietnam's Renewable Energy Policies and Opportunities for the Private Sector*. The National Bureau of Asian Research, 1-8.
- Dang, M.Q. (2017) *Potential of Solar Energy in Indonesia*. Researchgate Technical Report. Available at: https://www.researchgate.net/profile/Minh-Quan-Dang/publication/324840611_Potential_of_Solar_Energy_in_Indonesia/links/5ae7229a0f7e9b9793c82cea/Potential-of-Solar-Energy-in-Indonesia.pdf.
- Davis, S. J., & Caldeira, K. (2010). *Consumption-based Accounting of CO2 Emissions*. *National Academy of Sciences of the United States of America*, 107 (12), 5687-5692.
- Do, T. N., Burke, P. J., Nguyen, H. N., Overland, I., Suryandi, B., Swndaru, A., & Yurnaidi, Z. (2021). *Vietnam's Solar and Wind Power Success: Policy Implications for the Other ASEAN Countries*. *Energy for Sustainable Development*, 65 (2021), 1-11.
- Do, T. N., & Burke, P. J. (2021). *Vietnam's Solar Power Boom: Policy Implications for Other ASEAN Member States*. *ISEAS Perspective*, 28 (2021), 1-10.
- Duong, N. D. (2022). *State Management of Solar Energy: A Case Study in Vietnam*. *Journal of Positive School Psychology*, 6 (6), 2072-2085.
- Erickson, P., & Lazarus, M. (2013). *Assessing the Greenhouse Gas Emissions Impact of New Fossil Fuel Infrastructure*. Stockholm: Stockholm Environment Institute.
- Hadrian, H. (2019). 'Utilization of Solar Power Plant in Indonesia: A Review', *International*

Journal of Environment, Engineering and Education, 1(3), pp. 1–8. Available at: <https://doi.org/10.55151/ijeedu.v1i3.21>.

Hertadi, C.D.P., Sulaiman, M. and Anwar, P.G.P. (2022) ‘Kajian Industri Energi Terbarukan Tenaga Listrik di Indonesia Berdasarkan Arah Kebijakan dan Potensi Alam’, G-Tech, 6(2), pp. 276-283.

Available at: <https://doi.org/10.33379/gtech.v6i2.1690>

IESR. (2021). Pembangunan Rendah Karbon Indonesia & Net-Zero Emission Menuju Ekonomi Hijau. IESR. Available at: https://iesr.or.id/wp-content/uploads/2021/05/Final-Dir-LH-IESR-Net-Zero-Emission_V1.pdf

Pranadi, A. D., Shani, N. (2019). Indonesian Solar Lessons from Vietnam. Sun-Connect.

