ANGIN INTRA NEW ENERGY NEXUS

Deep Dive Report

INVESTORS' DRIVES FOR CLEAN ENERGY AND IMPACT INVESTMENT AS PART OF CLIMATE SOLUTIONS

JULY 2022

Produced by

ANGIN INTRA NEW ENERGY NEXUS

ACKNOWLEDGEMENTS

This report is a deep dive report product of INTRA (Impact Investment and Entrepreneurship Think Tank) by ANGIN, collaborating with New Energy Nexus, and some respondent stakeholders. This independent report is part of the effort in advancing impact investment and climate solutions development in Indonesia.

NEW ENERGY NEXUS TEAM

Researchers & Writers

- Arif Utomo
- Naufal Musri
- Kevin Felix
- Rainy Putri

Reviewers

- Diyanto Imam
- Yeni Tjiunardi

INTRA BY ANGIN TEAM

Advisors & Reviewers

- Saskia Tjokro
- Benedikta Atika
- Yohana Parida

Report Publication

- Adriani Putri Indriarto

Designer

- Imam Sugiarto

Published July 2022

EXECUTIVE SUMMARY

This paper aims to answer questions on the willingness of investors (i.e., impact investors and venture capitalists) to invest in Indonesia's clean energy sector, what motivates them, and the most promising areas to invest in. Clean energy term is preferred over renewable energy for the focus of the paper as it encompasses all zero-carbon energy sources and is deemed more relevant to Indonesia's net-zero strategy.

This paper utilized a systematic literature review with the support of primary data collected through in-depth interviews with five different investors with distinguishable categories and areas of interest to acquire a broader perspective on the clean energy investment sector in Indonesia. Additional insights were gathered from Fireside Chat event held by New Energy Nexus Indonesia. The timeframe of the data collection was between April to May 2022.

The results of the conducted interview indicated that all five correspondents agree that Indonesia is currently experiencing an uprising trend on impact investment. However, specifically on clean energy investment, four of them stated it is still less developed in terms of the market and implementation.

Three main drivers to invest in the sector are concluded in this paper, namely:

(i) to support communities' livelihood and avoid the impacts of climate change.

(ii) the clean energy sector showed an encouraging trend in economic value.

(iii) the sector is promising to invest in, viewed from the country's abundant resources and energy demand

This paper would also argue that the unmatched government's ambition with supporting regulations and incentives led investors to invest in early-stage startups instead of big utility projects. The reasoning for this is to diversify the allocated budget and spread out the risk to multiple enterprises instead of one big utility project.

Based on the conducted assessment, two are selected as the most promising areas to invest in. The first is solar PV technology, due to its versatility and high installed capacity planned; and the second is electric mobility (especially two-wheeler fleet) as Indonesia provides a promising future as the current largest automotive market.

01 OVERVIEW

1.1. CLEAN ENERGY DEVELOPMENT

Energy has long become a part of basic human needs, as they play a vital role in our lives. Dating back, energy was first developed from the modest invention of fire. Today, production has advanced drastically from utilizing natural resources to nuclear power. The rapid advancement presses a continuing issue of energy security, which has shaped the way modern society exists. Heavy reliance on fossil fuel-based energy has led to its scarcity and other issues of multiple spectrums from global warming, geopolitical problems, economic instabilities, and unequal distribution of resources (Keleş, 2011; Olson & Lenzmann, 2016; Thompson, 2022). These issues have steered society to lean towards clean energy as a measure of obtaining energy security and achieving sustainability.

1.2. TRANSITIONAL EFFORT TOWARDS CLEAN ENERGY

Indonesia, as the second-biggest coal producer in the world has a powerful domestic coal mining industry - with over 60% of electricity in the country powered by fossil energy (Lo, 2022). The ongoing transition toward a more responsible and sustainable energy generation has involved trillions of dollars in economic activity and is currently expanding at an unprecedented pace (Hendriwardani & Geddes, 2022; UNEP, 2019). At a regional level, Asia-Pacific countries are leading the clean energy development with the highest renewable power generation, accounting for approximately 3,600 Terawatt-hour (TWh) in 2019 (Trihill Capital & JP Morgan, 2020). In 2020, the region accounted for 33% of total energy capacity. Despite these appealing figures, there is still plenty of room for improvements to ramp up energy capacity and diminish the impacts of climate change as Asia Pacific regions still log the highest share of global carbon emissions at 52% (UNESCAP & UNEP, 2020)

In the case of Indonesia, the latest figures for 2020 showed the renewable energy portion was a mere 11.2% of the total energy mix, that is equivalent to a 10.5 GW installed capacity (Hendriwardani & Geddes, 2022). The growth rate in the sector has shown slow progress with only an additional 1.7 GW capacity installed compared to the total capacity installed of 8.8 GW in 2016, indicating an overall growth of just 19.3% (MEMR, 2021a; Warta, 2017). The slow-paced trend further continued up to Q3 of 2021 when data pointed out that Indonesia has only installed a total capacity of 386 MW (IESR, 2022). Given the fact that in the same year, prior to the 2021 United Nations Climate Change Conference (COP26), the Indonesian government had just announced its commitment to reach net-zero by 2060.

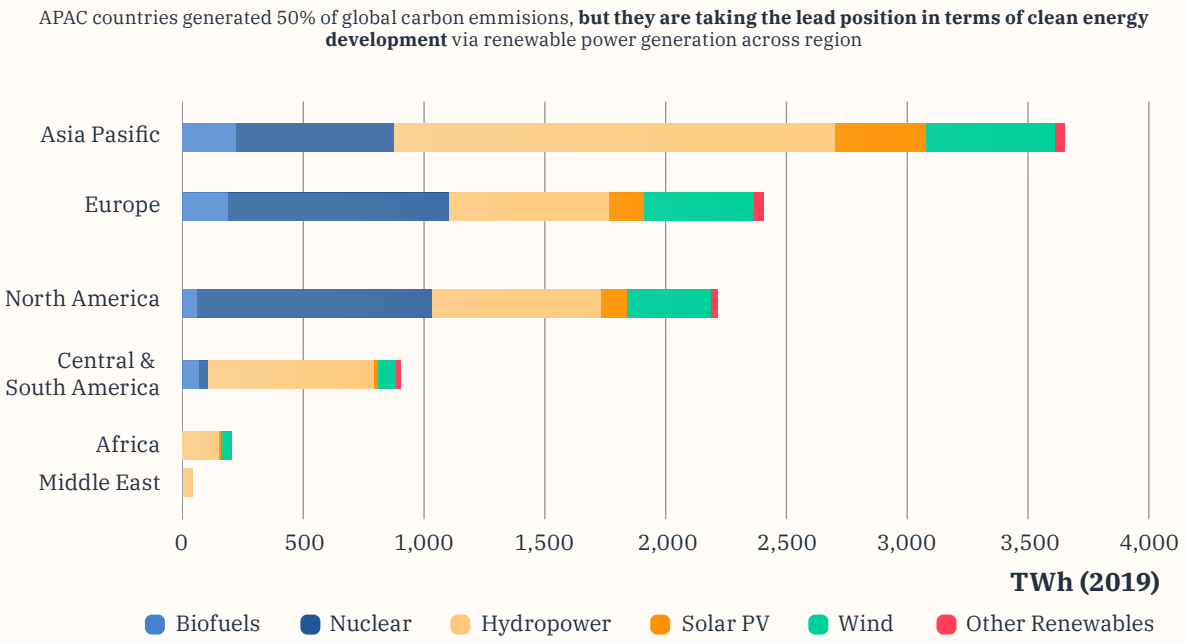


Figure 1. ***APAC countries' clean energy development***
Source: Trihill Capital., JP Morgan. (2020). *Renewable Energy and Climate Tech Landscape.*

Transitional efforts in the renewable energy sector have shown significant potential in contributing to Indonesia's post-pandemic economic recovery (OECD, 2021). Aligning with the country's commitments that have been communicated at the Presidency G20 2022 on prioritizing sustainable energy transition - clean energy investment, in particular, could be a strong driving force behind Indonesia's economic recovery.

1.2. INVESTMENTS IN THE CLEAN ENERGY SECTOR

The Indonesian government is currently prioritizing and promoting clean energy investments in the country, under the National Energy Policy and Long-Term Development Plan from 2015 to 2025 (ADB, 2020). The clean energy investment data included private investments in projects across five renewable energy technologies, specifically ocean energy, bioenergy, wind power, hydropower, and solar power.

The problem is, the actual narrative of the allocated investment to the sector is different. Data in 2020 revealed that Indonesia has made investments in renewable energy development totaling a value of USD 1.4 Billion, which only represented 7.8% of the total investment in the energy sector. This is far less in amount compared to the fossil fuel industry at 65% valued at USD 16.5 Billion (Hendriwardani & Geddes, 2022).

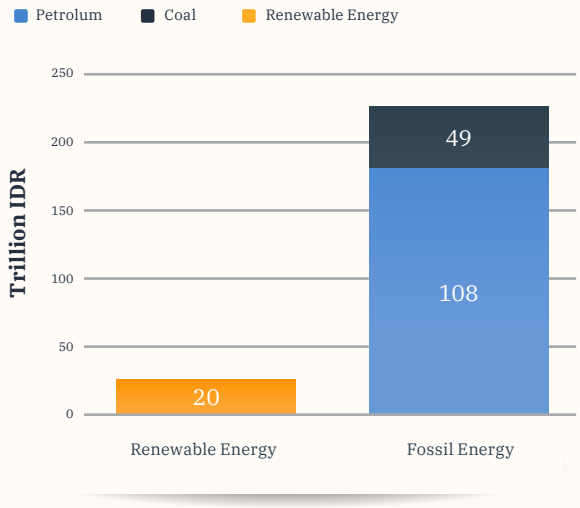


Figure 2. ***Investment in renewable power and fossil fuels in Indonesia, 2020***
Source: Hendriwardani, M., Geddes, A., Sumarno, T. B., & Hohenberger, L. (2022). Using Public Funding to Attract Private Investment in Renewable Energy in Indonesia Executive Summary. https://www.iisd.org/projects/fossil-free-recovery.

The latest estimate also disclosed that the current level of investment in the sector is still below the targeted value (Hendriwardani & Geddes, 2022), confirming that more investments are required to double the renewable energy portion from 11.2% to 23% by 2025 to meet Indonesia's Nationally Determined Contribution (NDC) target. The Ministry of Energy and Mineral Resources (MEMR) has currently set an average annual investment target at USD 2.1 Billion, yet the Indonesian government has only invested on average USD 1.6 Billion annually (MEMR, 2015, 2016, 2017, 2018, 2019, 2020, 2021b). In the third quarter of 2021, the renewable energy sector had only received an investment of USD 1.1 Billion (IESR, 2022). By the end of 2021, the amount concluded up to a mere USD 1.44 Billion (Uly, 2021). This was far less than the government's annual average.

These data indicated the presence of a financial gap that calls for an additional investment outside of the current pipeline established by the Indonesian government, where private sectors can play a critical role by filling up the gap needed to accelerate clean energy development. They are often discouraged due to several factors.

The rate of return and risk factor on clean energy investment are crucial comparison points with fossil fuel investment (Hesary & Yoshino, 2020). Technologies used in clean energy are often earlier in the development stage and are less commercially viable than technologies in the fossil fuel field - many of which date back to 100 years ago. This causes it to be costly and riskier (Hesary & Yoshino, 2020). In addition, a lack of access to conventional financing sources will increase the debt cost (borrowing interest rate). Therefore, longstanding subsidies for conventional energy sources, combined with the lack of a price for carbon emissions, have favored fossil fuels, like oil and coal, rather than renewable energy (Hesary & Yoshino, 2020).

According to the International Monetary Fund (IMF), global fossil fuel subsidies were valued at $5.9 trillion in 2020 or about 6.8% of global GDP. Figures are expected to rise to 7.4% of global GDP in 2025. Targeting these subsidies and reallocating them to the clean energy sector will increase the rate of return of green projects, making them an attractive option to private investors.

Through this paper, we aim to provide a concise review and analysis of Indonesia's clean energy development status, its financial gap, opportunities, and barriers to investment. This paper will combine both desk research and direct interview with five different venture capitals and/or investor institutions with a focus on impact and gender, financial technology, technology/agnostic, clean energy focused, and energy access.

By combining both secondary and primary research, we hope to bring a unique perspective and some clarity in answering the following three questions, namely:

- **Do investors want to invest in Indonesia's clean energy sector?**
- **What motivates them to invest? and**
- **What is or are the most promising sectors in Indonesia's clean energy sector?**

02 RESEARCH METHODOLOGY

This paper utilizes a systematic literature review supported with primary data that were collected through in-depth interviews involving five different correspondences. The combined method is chosen to provide both primary and secondary data to further understand investors' motives when investing in the climate and clean energy sector.

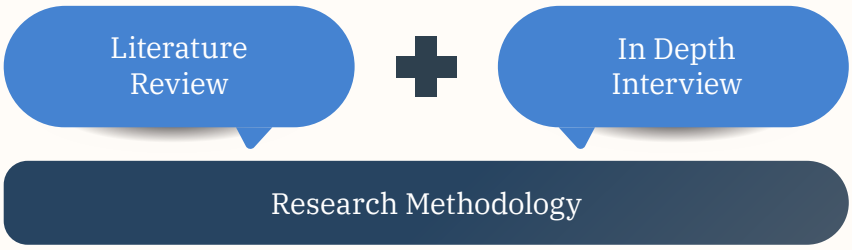


Figure 3. *Research Methodology*

2.1. LITERATURE REVIEW

This section outlines the data and empirical framework which will further be discussed throughout the paper to assess the determinants of clean energy investment in Indonesia. Dependent and independent variables are commonly chosen to illustrate a cause-and-effect relationship. In this case, the relationship is between clean energy impact investment and the investors themselves.

The chosen dependent variable is the current opportunities for clean energy investment in Indonesia; which will provide the effects of investing in the sector. Whereas the independent variables included clean energy-specific factors such as government and policy instruments promoting investments in clean energy, as well as country-specific factors such as the macroeconomic and financial factors - which will provide the causing factors for investors to fund the sector.

Four dependent variables measuring clean energy investment are used, namely: asset finance, corporate research & development, public market development, and venture capital. Venture capital and private equity include venture capital funding for the purpose of expansion by companies in the clean energy industry. All dependent variables are converted from current prices in national currency to US Dollars.

Data are gathered through a combination of desk research from government regulations, international organizations, and other relevant stakeholders' documents, such as Coordinating Minister for Economic Affairs, Ministry of Energy and Mineral Resources of Indonesia (ESDM), Ministry of National Development Planning / National Development Planning Agency (Bappenas), Institute for Essential Services Reform (IESR), IEA/IRENA Global Renewable Energy Policies, World Bank World Development Indicators, and the International Monetary Fund's International Financial Statistics.

Additional documents were taken from previous research on the Indonesian startup ecosystem and an event held by New Energy Nexus Indonesia on Fireside Chat. Pandu Patria Sjahrir as the Vice President Director of PT TBS Energy Utama Tbk, and Devin Wirawan as the Investment Director of PT Saratoga Investama Sedaya Tbk, appeared as speakers on the Fireside Chat, as a part of NEX Indonesia's effort to inform, excite, and energize stakeholders on matters related to the development and investment in clean energy and climate solutions start-ups.

2.2. IN-DEPTH INTERVIEW

To complement the collected secondary data from the literature review, this paper added primary data gathered from the in-depth interviews with five venture capital/investor companies, focusing on impact, energy access, technology, financial technology, and clean energy financing as follow:

Table 1. Interviewee List and Profile Background

INSTITUTION*	CATEGORY AND AREA OF INTEREST	REASONS WHY THE INSTITUTION IS CHOSEN	TYPICAL TICKET SIZE
Moonshot Ventures	Impact-Focused, Gender-Lens Investing	To add perspective on the paper content from impact and women empowerment driven investor	$ 30K - 200K
Schneider Electric Energy Access	Clean Energy and Energy Access	To add perspective on the paper content from clean energy and energy access focused investor	$ 500K - 1M
Insignia Ventures Partners	Technology Venture Capital	To add perspective on the paper content from technology venture capital	Prefer not to disclose
Mandiri Capital Indonesia	Innovation and Finance Technology (Fintech)	To add perspective on the paper content from fintech focused investor	$ 500K - 1M
Nexus for Development	Clean Energy and Productive Use of Energy Financing	To add perspective on the paper content from clean energy and productive use of energy driven investor	**The KIVA Loan:** $ 10K - 50K **Pioneer Facility Loan:** $ 100K - 500K

**Link to each investors: Moonshot Ventures - https://www.moonshotventures.org/ ; Schneider Electric Energy Access Asia - https://www.se.com/ww/en/about-us/sustainability/; Insignia Ventures Partners - https://www.insignia.vc/ ; Mandiri Capital Indonesia - https://mandiri-capital.co.id/en/ ; Nexus for Development - https://nexusfordevelopment.org/*

Five interviews were conducted with distinguishable categories and areas of interest to acquire a broad perspective on clean energy investments in Indonesia. Taking into consideration that the finance-technology investment sector has shown rapid development in Indonesia over the past five years, this sector specifically was highlighted in the interviews conducted as they have framed a general understanding of investment opportunities in Indonesia. Another additional factor to emphasize is the role of pioneering companies in demonstrating their knowledge and awareness of the investment challenges and opportunities in Indonesia (ADB, 2020).

03 INVESTOR'S PERSPECTIVES AND THEIR DRIVE TO INVEST IN THE CLEAN ENERGY SECTOR

With regards to the methodology stated in chapter 2, data collected from the literature review and in-depth stakeholders' interviews will be presented and analyzed in an integrated manner as a discussion on the topic of their motivation to invest in a forthcoming sector, clean energy.

3.1. LITERATURE REVIEW

Direct in-depth interviews with five selected stakeholders were conducted with the purpose of acquiring primary information on their standpoint and driving factors towards funding businesses in the clean energy sector.

Four focused inquiries were on climate and impact-related investments and its trend in Indonesia, the country's clean energy sector development, and the preferred startup size of each stakeholder. The following points were summarized in table 2 below.

Table 2. Summarized Findings on Stakeholders' Interview

	Nexus for Development	Schneider Electric Energy Access	Moonshot Ventures	Insignia Ventures Partners	Mandiri Capital Indonesia
Climate and Impact-related Investment	All correspondents **have invested in climate and impact-related investment.** Nexus for Development and Schneider Electric Energy Access Asia have specifically invested in clean energy enterprises.				
	(i) Have given a 9 months bridge loan (USD $100.000) to **GREEN Energy** for the **development of biogas energy** and **water treatment** in Lampung, Indonesia. **(ii)** Provided funds to 3S, a company providing **household solar energy** and supported local **bamboo production facilities in** Sumba island, Indonesia. **(iii)** Clean energy investments made in **Myanmar: Okra** (mini-grids), **Techno-Hill** (solar mini-grids), and **Agrosolar** (solar water pumps)	**(i)** Indonesia - invested in Xurya Daya Indonesia, a startup company focusing on solar panels products and services. **(ii)** India - Farming-as-a-service (FaaS) company providing solar-powered services (solar pumping, cold-storage and milling) to clusters of farmers **(iii)** Cambodia - Company offering biodigesters and e-cook stoves under a PAYGO model.	Have invested in TransTrack, a fleet management system that optimizes the operation of transportation resulting in fuel consumption savings.	Still actively taking a close look at clean energy and its software derivatives, in addition to e-mobility, and novel technology in both tracking and managing carbon reduction and sequestration. Partnered with two plant-based alternative protein companies.	Recently closed an investment deal with a company producing resins to convert plastic to biodegradable materials (climate innovation)
Impact Investment	All correspondences agree that Indonesia is currently experiencing an uprising trend where investors are putting their attention into and some are even chasing these projects.				
Trend in Indonesia	Elaborated on how climate impact investing in Indonesia is still not progressive enough in terms of application compared to western countries. It is still an emerging market, and arguably more attractive compared to other SEA countries. Indonesia is in a good position to move capital for ESG or SDG-related goals.			Highlighted ESG investment trend shows an overlap with other sectors of climate tech and agriculture.	Highlighted the increased demand for ESG and impact-related compliance as the driver behind the trend.
Clean Energy Development in Indonesia	Defined the development as delicate - the market is dominated with incumbents, and yet clean energy startups have yet to shift their research mindset to entrepreneurial objectives.	Four agreed that clean energy development has yet to mature compared to the upward trend from the impact of ESG investment.			
		Highlighted how Indonesia's high level of ambition needs to be matched with the adoption rate. It is an aggressive development, but slow adaptation.			Elaborated further on its rawness as most enterprises have their eyes focused solely on the social and/or research aspect. This alone demonstrates the need for a mindset shift towards more entrepreneurial objectives, considering the general VC timeframe for an expected fund life in clean energy is around 10-15 years with a 30-35% return on investment.
Preferred Start-Up Size	All prefer to invest in early-stage startups starting from the pilot stage to series A.				

3.2. DRIVING FACTORS TOWARDS INVESTING IN CLEAN ENERGY

Based on the collected information, a series of driving factors to invest in the clean energy sector were concluded, namely to support communities' livelihood from impacts of climate change, the sector showed an encouraging economic growth, and Indonesia as a country has plenty of resources with the support of enough demand and high governments' ambitions.

3.2.1. TO SUPPORT COMMUNITIES' LIVELIHOOD AND AVOID THE IMPACTS OF CLIMATE CHANGE

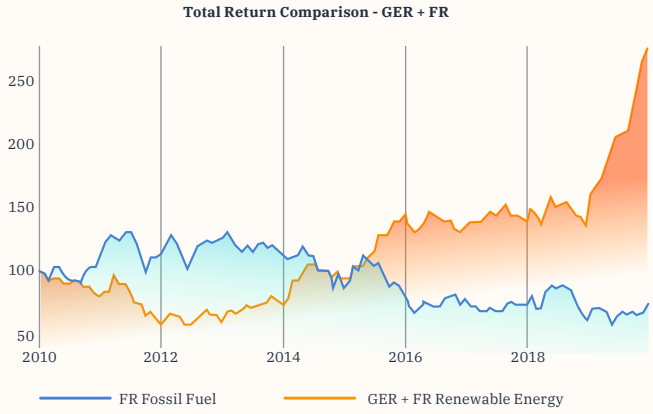
Climate change has undoubtedly increased its significance as a pressing issue, which has now been considered an ongoing disaster putting humans, infrastructures, ecosystem stability, and the biodiversity of the planet to be at substantial risk (NBC, 2022 and IPCC, 2022). The World Meteorological Organization has calculated that around 115 people are killed and USD 202 million were lost on a daily average over the past 50 years regarding climate-related disasters (WMO, 2021). Furthermore, from 2016 to 2018 alone, climate change-related disasters caused an average annual loss of USD 210 billion in economic damage worldwide (Morgan Stanley, 2019; Munich RE, 2019). In Southeast Asia alone, climate change is expected to cause 17-37% GDP loss by 2050 (Bangkok Post, 2021).

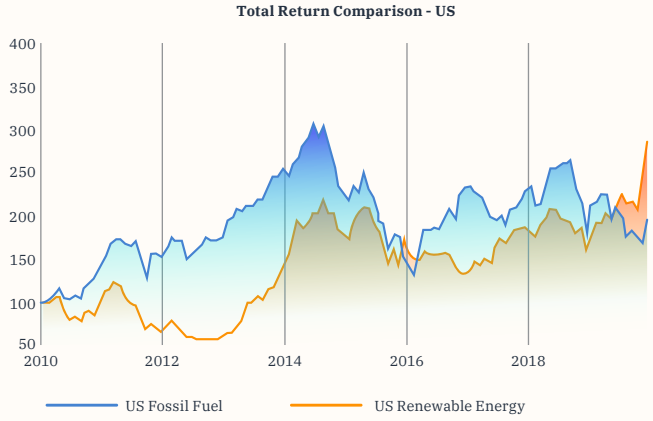
These risks have driven investors to invest in impact and clean energy investments, or at least to incorporate climate urgency into their portfolio and investment strategies (GIC, 2020; Morgan Stanley, 2019). This is supported by a survey done by Morgan Stanley's Institute, communicating that 78% of the surveyed U.S. individual investors said that they wanted to address climate change through investments (Morgan Stanley, 2019), the same concern addressed by our investor correspondents - All mentioned how the climate urgency is within their attention.

The correspondent from Nexus for Development stated that their mandate is to support companies that provide access to clean energy, water and sanitation for low-income or underserved communities, therefore, the idea is to provide early stage social enterprises with working capital to scale their impact and early success. Additionally, productive access and use of energy in rural communities has grown to become a concern for another correspondent (Schneider Electric Energy Access Asia) and motivated them to invest in the adoption of clean energy in areas in need, though it must be realistically implementable.

3.2.2. THE CLEAN ENERGY SECTOR SHOWED AN ENCOURAGING TREND IN ECONOMIC VALUE

A study on energy investing published by the IEA and Imperial College showed a key finding from renewable energy companies in the United States displaying that their portfolios generated a higher total return with slightly higher annual volatility compared to the fossil fuel portfolios over the past ten years. However, when a five-year time frame is applied, the trend changes with renewable energy portfolios delivering a significantly higher total return with less annual volatility (Source: IEA and IC, 2020). Similar findings were also found in other developed countries such as Germany, France, and the United Kingdom.





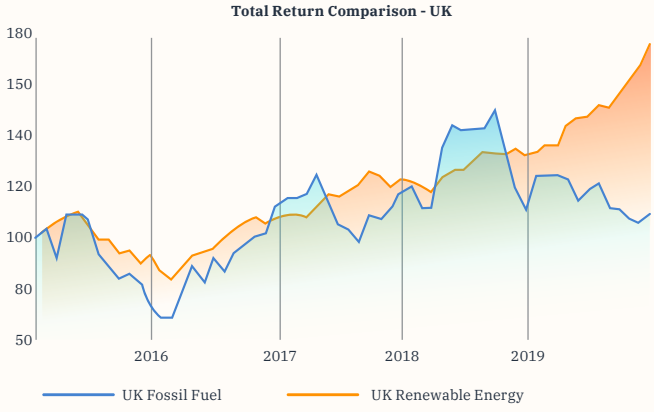


Figure 4. ***Total Return Profile for the (a) Germany + France, (b) the US, and (c) the UK***
Source: Data adapted from International Energy Agency, & Imperial College Business School. (2020). Energy Investing: Exploring Risk and Return in the Capital Markets A Joint Report by the International Energy Agency and the Centre for Climate Finance & Investment 2nd Edition.

Disruption from the falling cost of renewable energy over the past years has made the clean energy sector cost-competitive against conventional power plants (IESR, 2019). The competitiveness of solar and wind power technologies increased dramatically from the year 2010 to 2020 as the cost of electricity from utility-scale solar photovoltaics, onshore wind, and offshore wind decreased by 85%, 56%, and 58% respectively (IRENA, 2021). Data from the IRENA Renewable Cost Database also indicates the year-on-year decline trend in the cost of electricity from utility-scale photovoltaics, offshore wind, and onshore wind is by -7%, -9%, and -13% up to 2020.

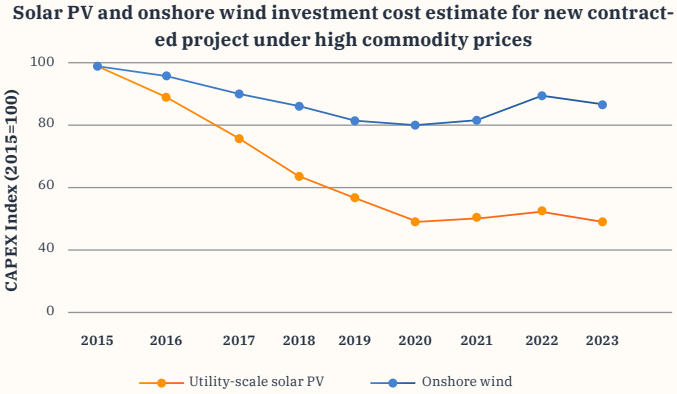


Figure 5. ***Solar PV and Onshore Wind Investment Cost Estimate***
Source: IRENA. (2021). Renewable Power Generation Costs 2020. International Renewable Energy Agency.

The performance of the indicated renewable energy portfolio in different developed countries above portrayed signals to investors for the predicted outcome from renewable energy investment in developing countries, such as Indonesia. A correspondent from Mandiri Capital Indonesia believes Indonesia will undergo a positive trend in impact investing economic value going forward. The statement is supported by the ability of businesses to scale their products, which motivates venture capitals to track their footprints and have an ESG-compliant portfolio. Nexus for Development is aware of several impact investors seeking to make investments into companies in the country. With more promising capital in South East Asia, the question remains matching the process from the available capital to the startups in terms of investment readiness.

3.2.3. INDONESIA'S CLEAN ENERGY SECTOR IS A PROMISING SECTOR TO INVEST IN, VIEWED FROM THE COUNTRY'S RESOURCES AND ENERGY DEMAND

Indonesia as a country is filled with an abundance of renewable energy resources. Which, according to a study done by the Ministry of Energy and Mineral Resources, has a total potential capacity of up to 417.8 Gigawatt (GW). These are sourced diversely, such as ocean at 17.9 GW, geothermal at 23.9 GW, bioenergy at 32.6 GW, wind power at 60.6 GW, hydropower at 75 GW, and solar power at 207.8 GW (Bappenas, 2021). Despite the lack of economic viability in some of the mentioned technical potential, it still shows a significant portion of the supply. As an example, the Indonesian technical hydropower potential is estimated at 75 GW, but only 8 GW is economically viable to be developed (IHA, 2016). This 8 GW potential could translate to approximately 33 TWh of electricity per year, which can fulfill 12.6% of Indonesia's electricity demand in 2018 (RUPTL, 2019; Climatescorecard, 2021). Moreover, the estimated technical potential for residential solar is only around 194 to 655 GWp, which is equivalent to around 296.8 to 1002.2 TWh per year; More than enough to fulfill the whole electricity demand in 2018 (IESR, 2019).

Mandiri Capital Indonesia has recently invested in resins that are able to make regular plastics biodegrade safely in the environment within 2 years. The interviewed correspondent mentioned, "Indonesia's rich resources in agricultural sectors have enabled the fulfillment of our pledge through developing biodegradable and environmentally friendly materials that reduce the effects of climate change."

On the other hand, Indonesia is also known to have a high energy demand as much as around 40% of the energy consumption in Southeast Asia (Statista, 2022). The highest total energy consumption level was in 2019 which was calculated to be 241,044 ktoe or equivalent to 2,803 TWh with a growth rate at the pre-covid era of 3.4% per year (Enerdata, 2021). In Q3 2021, the final energy consumption was seen to increase by 3.4% year on year which reflects the overall economic recovery (IESR, 2022).

3.3. UNMATCHED GOVERNMENT'S AMBITION WITH SUPPORTING REGULATIONS AND INCENTIVES LED INVESTORS TO INVEST IN EARLY-STAGE STARTUPS

With this steady increase in energy demand, depleting fossil-based resources, and increasing awareness of climate change and its detrimental effects – we can argue that it is only logical to prioritize clean energy development as we build our civilization forward. This direction would only be possible with strong support from the country's policy, which coincidentally, the year 2021 has been the momentum in the energy transition. Starting in May 2021, the Government of Indonesia has announced the commitment to stop building new coal-fired power plants after the year 2023 with additional electricity capacity from renewable energy only (Mongabay, 2021). Later in August 2021, the government increased its climate ambition by submitting its new **Nationally Determined Contributions (NDC)** on achieving the net-zero target by 2060 at the latest (Jakarta Globe, 2021). This new target is a decade faster than what has been previously estimated in April 2021, highlighting the ambition level made.

Recently, Indonesia's commitment to the clean energy trend along with the international agenda that has been confirmed by Indonesia's Presidency unit in G20 2022 raises the priority issue of Sustainable Energy Transition. Diving from the domestic energy perspective, Indonesia has a different approach to achieving clean energy actualization, including:

Coordinating Ministry for Economic Affairs Regulation Number 7 2021 concerning Changes to the **List of National Strategic Projects** resulting in more projects from renewable energy power generation and better development for electricity grids.

The Ministry of National Development Planning / National Development Planning Agency (Bappenas) by **Low Carbon Development Indonesia (LCDI)** aims to support a green investment climate, strengthen cross-sectoral integration in decision-making and bring forth Indonesia as a leader in low-carbon development.

Perusahaan Listrik Negara (PLN) or Indonesian Government-Owned Electric Corporation has planned more electricity generation from renewable energy sources in **Rencana Usaha Penyediaan Tenaga Listrik (RUPTL)** or Electricity Supply Business Plan by 2021 - 2030.

The Ministry of Energy and Mineral Resources of the Republic of Indonesia has provided a more contentious plan to implement a greater share of renewable energy in the drafted **Indonesia Energy Mix**.

Based on the conducted in-depth interviews, four correspondents (Moonshot Ventures, Schneider Electric Energy Access Asia, Insignia Ventures Partners, and Mandiri Capital Indonesia) highlighted the opportunities in Indonesia's resources, validating how the sector is appealing to invest in. One correspondent (Schneider Electric Energy Access Asia) further mentioned how the government's ambition in achieving the net-zero target added more confidence to invest in the sector. However, when asked about the investors' take on the expected government's role, all five correspondents mentioned the unmatched ambition and the implementation. Clean energy development in the country requires more robust regulation and more incentives to further accelerate the sector.

Evaluating the above finding, this paper argues that the lack of robust regulations and incentives could be the underlying reason why there is a presence of a financial gap in Indonesia's clean energy sector. Despite the driving factors stated above, the lack of regulations and incentives lowers the confidence level of investors to fund the sector. This possibly has driven all five correspondences, and perhaps other investors to an extent, to choose to invest in early-stage startups instead of big utility projects. The hypothesized reason behind this behavior is to diversify the allocated budget and spread out the risk. When it comes to allocating a similar amount of investment budget to just one big utility project, investors seem to prefer to spread out the investment to multiple enterprises. Should several selected early-stage startups succeed and show a growth in revenue, they will provide a more impactful return on investment as a result of the higher growth speed and higher equity offered as they are in the early stages.

04 PROMISING SECTORS TO INVEST

As a country, Indonesia will become the fourth largest economic power in the world by 2050 (Hawksworth et al., 2017). This will certainly increase the demand for electricity, which has already grown by 6% since 2000 (ESDM, 2020).

Indonesia, on the other hand, has relied on conventional sources of energy to cover its electricity demand to date. Regardless, this is bound to change following the target set for the development of electricity generation in Indonesia, which is to increase installed capacity by 65 gigawatts in 2018 to 443 gigawatts by 2050, of which 168 gigawatts will be sourced from renewable energy (Langer et al., 2021).

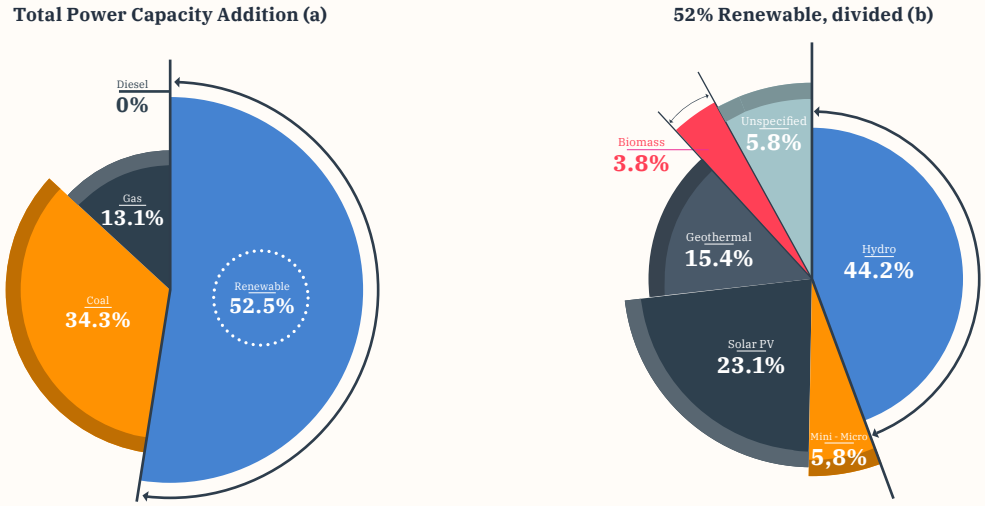


Figure 6. ***(Left) Indonesia's total energy capacity addition until 2030 according to RUPTL 2030, (Right) Renewable energy technologies mix to energy generation.***
Source: PT PLN (Persero). (2021). Rencana Usaha Penyediaan Tenaga Listrik (RUPTL) PT PLN (Persero). PT PLN (Persero).

Two of the most attractive sectors in the renewable energy and climate innovation space are Solar PV as renewable energy technology and Electric Mobility as an ecosystem.

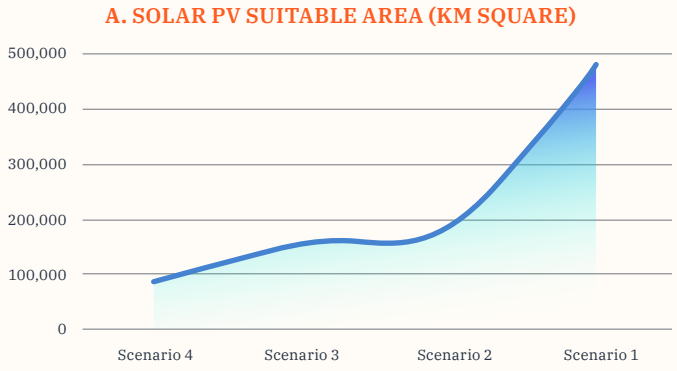
This is based on desk research on the high technological maturity factor, decreasing equipment investment cost, adequate regulation, and market demand created by the economic-social-political conditions of Indonesia. This argument is strengthened by our stakeholder engagement sector referral by five venture capital/investor companies, focusing on impact, energy access, technology, financial technology, and clean energy financing. The sectors included solar representing the biggest market, and electric mobility as the backbone industry (especially two-wheeler EVs). As supporting arguments, Insignia Ventures Partners, Moonshot Ventures, Nexus for Development, and Schneider Electric Energy Access Asia stated that the two sectors are supported by current high innovation states and abundant natural resources.

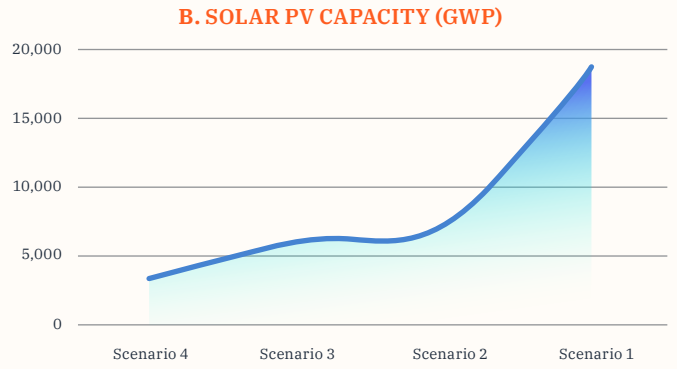
4.1. SOLAR PV

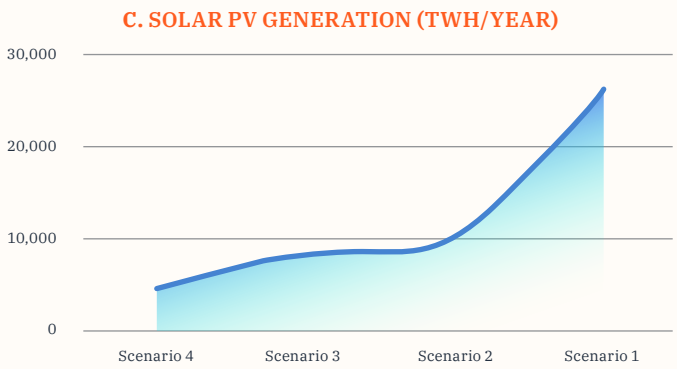
Solar PV is making its way to be a dominant technology in Indonesia - with a capacity of 45 GWp in 2050, this will contribute to 10.1% of total energy use and 26.8% of the total renewable energy mix. To achieve this target, as much as 30% of government buildings and 25% of housing developed will need to utilize solar PV (Maulidia et al., 2019). To date, solar PV has contributed significantly to the electrification of rural communities (Direktorat Jenderal Energi Baru Terbarukan dan Konversi Energi (EBTKE), 2020) (Sambodo & Novandra, 2019).

Scenario 1	Slope exclusion + natural forest, water bodies, wetland areas, airports, and seaports + protected area
Scenario 2	Scenario 1 + agricultural areas and plantation forest exclusions
Scenario 3	Scenario 2 + settlement areas exclusions (transmigration and settlements)
Scenario 4	Scenario 2 + dry shrub exclusion

Figure 7. ***Assessment of the technical potential of solar PV in Indonesia.***
Source: IESR. (2021). Beyond 207 Gigawatts: Unleashing Indonesia's Solar Potential. Institute for Essential Services Reform (IESR).







The data above illustrates the potential for solar PV in Indonesia at its maximum, reaching a percentage high of 24.43% of the total area of Indonesia, including solar PV floating units. As Indonesia is an archipelagic country, the potential for developing solar floating PV is relatively high. Currently, evidence of success can be seen with the implementation of the Cirata Floating PV project in West Java by PT PJB Investasi and Masdar, as well as the Batam 2.2 GWp floating PV project and battery energy storage, planned to be carried out by the Sunseap Group and BP Batam.

CIRATA FLOATING SOLAR PV PROJECT

The biggest floating PV project in South East Asia, the fourth biggest in the world.

Cirata, Indonesia's largest floating solar photovoltaic (PV) power plant, is currently under development. It has a unique concept that uses floating PV panels to generate electricity in conjunction with an existing hydropower facility in West Java.

This solar farm is projected to start construction in the first half of 2021, By the fourth quarter of 2022, the 145 MW floating PV installation on the Cirata Reservoir should be completed. The Cirata project, which will be the country's first floating solar power plant, will reduce CO2 emissions by 214,000 tons per year and create enough energy to power 50,000 homes.

The Cirata floating power plant program has received backing from a variety of parties, including international financial institutions, since the electricity sales and purchase contract was signed in January 2020. The project is being funded by three international banks: Sumitomo Mitsui Banking Corporation (SMBC), Societe Generale, and Standard Chartered Bank. The three banks are providing financial assistance in the amount of USD 140 million. The Cirata floating power plant is another joint venture between PT PLN and Masdar, an Arabic corporation.

Source: *Kumar, (2021) PT Pembangkitan Jawa-Bali (PJB), 2021)*

4.2. ELECTRIC VEHICLE

Electric vehicle (EV) market in Indonesia is showing an early growth stage, this occurs due to the barriers on high price vs options on conventional mobility, and the dependence on transport fossil fuel-based in the country (IESR, 2021).

4.2.1. MARKET POTENTIAL FOR EV

The market share for non-conventional motorized vehicles or electric vehicles in Indonesia is considered relatively small, due to its high prices. However, the construction of an electric battery factory, PT Industri Battery Indonesia or Indonesian Battery Corporation (IBC) together with LG Energy Solution (LGES) can potentially have a significant impact in reducing EV prices, therefore making them market competitive (GAIKINDO, 2021).

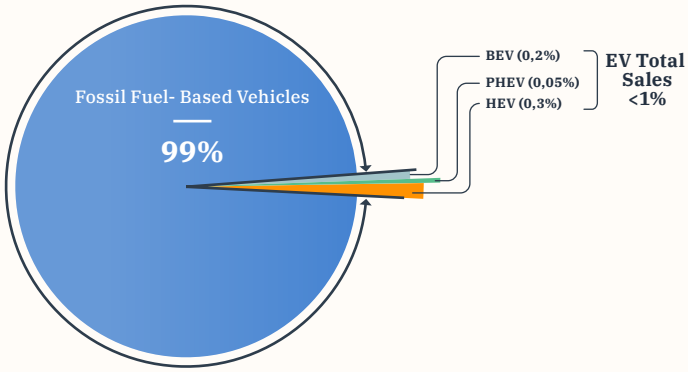


Figure 8. ***Percentage of fossil fuel-based vehicle & EV sales in Indonesia (2021).***
Source: Adapted from Maghfiroh, M. F. N., Pandyaswargo, A. H., & Onoda, H. (2021). Current readiness status of electric vehicles in indonesia: Multistakeholder perceptions. Sustainability (Switzerland),

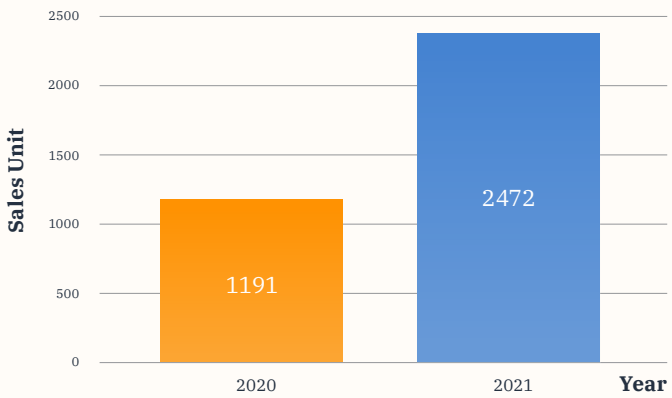


Figure 9. ***PEV total unit sales in Indonesia per year***
Source: Adapted from Maghfiroh, M. F. N., Pandyaswargo, A. H., & Onoda, H. (2021). Current readiness status of electric vehicles in indonesia: Multistakeholder perceptions. Sustainability (Switzerland),

In regards to the future of the electric vehicle market in Indonesia, there is certainly room and demand in the transportation sector for electric public transportation options, such as e-buses, which are comparable to the pilot run by TransJakarta, Southeast Asia's first BRT system. Furthermore, the local administration had expressed a strong desire to see local demand for electric vehicle solutions expand (Slavcheva et al., 2021; Ministry of Investment, 2021).

Major market players in the electric vehicle industry include GESITS (a local electric motorcycle start-up), Mitsubishi (a leader in the electric passenger vehicle), and BYD (a leader in both electric public buses and electric public taxis) (BKPM, 2020). Officially launched in 2019, GESITS is the first domestic company in Indonesia to produce a fully battery-based electric motorcycle with target sales approximating 60.000 motorcycles.

Table 3. Indonesia EV Market Overview

VEHICLE TYPE	/E-MOTORBIKES	/E-BUSSES	/E-SCOOTER
Current Market	In 2019, Indonesia had a total of 107 million motorcycles. The e-motorbike market was worth $364 million in 2019, with 7 million units sold.	No electric buses are currently produced in Indonesia. Several e-bus pilots are underway, including two in Jakarta and one in Bali.	Scooters represent up to 87% of the motorcycle market, which had annual sales of 7 million units in 2019.
Future Market	The Indonesian government wants 16 percent of the total motorcycles to be electric by 2035. The market value in 2025 is expected to reach $816 million, representing a 20.96% annual growth rate.	TransJakarta (the largest BRT in the world) is aiming to have 50% of its fleet electric by 2025 and 10,000 e-buses (83% of its fleet) by 2030.	The scooter market is expected to grow alongside the motorcycle market and lead in export growth.

Source: Slavcheva, R., Cockburn, A., Joyce, M., Khoo, K., Hochadel, D. A., & Burgoyne, B. (2021). Guide to E-mobility in Indonesia for UK. Catapult & Department for Business, Energy and Industrial Strategy of the United Kingdom.

4.2.2. THE GOVERNMENT'S ROLE IN EV IMPLEMENTATION

Aligning with the country's momentum to develop electric mobility (Climate Transparency, 2020), the development of EV has been covered in the Acceleration of Battery Electric Vehicle (BEV) Program of Road Transportation on Presidential Regulation Number 55 2019.

This regulation sets out five main directives to accelerate BEV Program in Indonesia, namely:

1. Accelerating the development of the domestic BEV industry.
2. The provision of incentives (Fiscal incentives along 12 sub-sector and other non-fiscal sectors).
3. The provision of charging stations and regulating electricity tariffs for charging stations and regulating electricity tariffs for charging electric vehicles.
4. Satisfaction with the technical requirements of EV.
5. Environmental protection.

The government has provided incentive opportunities for incoming investors in the sector from tax allowance and tax holiday to super deductible tax, especially for the low-cost green car (LCGC), the 4-wheeled motor vehicle that uses full and/or mild-hybrid technology, the four-wheeled motor vehicle that uses flexy engine technology (Biofuel 100), and the 4-wheeled motor vehicle that uses plug-in hybrid electric, electric battery, or fuel cell EV Technology (BKPM, 2020).

05 KEY TAKEAWAYS AND CONCLUSION

- Among five investors that have invested in climate and impact-related investment, 100% agree on the uprising trend on impact investment in Indonesia but 80% stated that the country's clean energy development is less developed.

- The three propelling points identified to affect investors' motivation to invest in the clean energy sector are: (i) to support communities' livelihood and avoid the impacts of climate change, (ii) the clean energy sector showed an encouraging trend in economic value, and (iii) the sector is promising to invest in, viewed from the country's abundant resources and energy demand.

- The investors' tendencies to choose early-stage startups rather than big utility projects indicated a low level of confidence as a result of insufficient support for regulation and policies. Investors chose to diversify the allocated investment budget and spread out the risk to several early-stage enterprises instead of one big utility project.

- Solar PV Technology was identified as the first promising area to invest in given its versatile application on both small and large production scales, high installed capacity planned in 2050 of 45 GWp (equivalent to 10.1% of the total energy use), and allocated building to install it which include 30% of the government buildings and 25% of housing developed.

- Electric mobility is the second promising area to invest in given the country's potential as the largest automotive market and the second-largest automotive production base in Southeast Asia. Moreover, the indicated immediate future market potential of having 16% of two-wheeler electrified by 2035 and 50% of the TransJakarta bus fleet to be electric by 2025 indicates the room to grow and develop.

REFERENCES

Asian Development Bank. (2020). *Indonesia Energy Sector Assessment.* Asian Development Bank Report Series

Asian Development Bank. (2020) *Innovate Indonesia Unlocking Growth Through Technological Transformation.* Asian Development Bank Report Series

AHK Indonesien. (2021). *Indonesian Electric Vehicles Industry Development Gains Momentum.* https://indonesien.ahk.de/infothek/news/news-details/indonesian-electric-vehicles-industry-development-gains-momentum

Anenberg, S., Miller, J., Henze, D., & Minjares, R. (2019, February 26). *A global snapshot of the air pollution-related health impacts of transportation sector emissions in 2010 and 2015.* International Council on Clean Transportation. Retrieved May 10, 2022, from https://theicct.org/publication/a-global-snapshot-of-the-air-pollution-related-health-impacts-of-transportation-sector-emissions-in-2010-and-2015/

Bangkok Post. (2021, October 11). *Time to speed up the journey to Net Zero.* Bangkok Post. Asia Focus. Retrieved June 6, 2022, from https://www.bangkokpost.com/business/2195779/time-to-speed-up-the-journey-to-net-zero

BKPM. (2019). *Report BRIEF ON EV Investment Opportunity in Indonesia.* BKPM. Retrieved May 18, 2022, from https://www.asean.or.jp/ja/wp-content/uploads/sites/2/IIPC-EV-in-English.pdf

BKPM. (2020). *Electric Vehicle Brochure.* https://www.bkpm.go.id/images/uploads/printing/Electric_Vehicle_Brochure_2020.pdf

Coady, D., Parry, I., Sears, L., & Shang, B. (2015). *How Large Are Global Energy Subsidies?* IMF Fiscal Affairs Department.

Chow, D. (2022, February 22). *Urgent action on climate change needed 'to secure a liveable future,' U.N. report warns.* NBC News. Retrieved May 15, 2022, from https://www.nbcnews.com/science/environment/urgent-action-climate-change-needed-secure-liveable-future-un-report-w-rcna17764

Cekindo. (2021, July 2). *Indonesia EV Market: A Broad Opportunity for Foreign Investors.* Cekindo Indonesia. Retrieved May 10, 2022, from https://www.cekindo.com/blog/investing-indonesia-battery-electric-vehicle

Damayanti, H., Tumiwa, F., & Citraningrum, M. (2019). *Residential Rooftop Solar Technical and Market Potential in 34 Provinces in Indonesia.* Institute for Essential Services Reform.

Dewan Energi Nasional. (2020). *BAURAN ENERGI NASIONAL 2020.* Dewan Energi Nasional - Sekretariat Jenderal.

Direktorat Jenderal Energi Baru Terbarukan dan Konversi Energi (EBTKE). (2020). *Rencana Strategis 2020-2024.* EBTKE.

Enerdata. (2020). *Indonesia Energy Information.* Enerdata. Retrieved May 11, 2022, from https://www.enerdata.net/estore/energy-market/indonesia/

ESDM. (2020). *Handbook of Energy & Economic Statistic of Indonesia 2019.* ESDM.

Fernandez, Manuel., Almaazmi, Mariam., Joseph, Robinson. (2020) *Foreign Direct Investment in Indonesia: An Analysis from Investors Perspective.* International Journal of Economics and Financial Issues

Fitch Solutions. (2020). *Manufacturing Indonesia: Opportunities in Kendal Industrial Park.* Fitch Solutions. Retrieved 19 May, 2022, from https://www.incorp.asia/indonesia/learn/manufacturing-opportunities-kendal-industrial-park/

GAIKINDO. (2019). *Indonesian Automobile Industry Data.* GAIKINDO. Retrieved 19 May, 2022, from https://www.gaikindo.or.id/indonesian-automobile-industry-data/

Hendriwardani, M., Geddes, A., Sumarno, T., Hohenberger, L. (2022). *Using Public Funding to Attract Private Investment in Renewable Energy in Indonesia Executive Summary.* International Institute for Sustainable Development

Hesary, T., Yoshino, Y. (2020). *Sustainable Solutions for Green Financing and Investment in Renewable Energy Projects.* MDPI Energies

Hawksworth, J., Audino, H., & Clarry, R. (2017). *The Long View: How Will the Global Economic Order change by 2050?* Price Waterhouse and Cooper (PWC).

IESR. (2021). *Beyond 207 Gigawatts: Unleashing Indonesia's Solar Potential* . Institute for Essential Services Reform. IESR. (2022). Indonesia Energy Transition Outlook 2022. Institute for Essential Services Reform.

Imperial College Business School .,& International Energy Agency. (2020). *Energy Investing: Exploring Risk and Return in the Capital Markets A Joint Report by the International Energy Agency and the Centre for Climate Finance & Investment 2nd Edition.* International Energy Agency

Indonesia Green Growth Program. (2021). *5 Facts on Financing Renewable Energy Mix target by 2025.* Global Green Growth Institute & BAPPENAS. Retrieved 18 May, 2022, from http://greengrowth.bappenas.go.id/en/5-facts-on-financing-renewable-energy-mix-target-by-2025/

International Agency of Renewable Energy. (2022). *Renewable Electricity. International Agency of Renewable Energy.* Retrieved 14 May, 2022, from https://www.iea.org/reports/renewable-energy-market-update-may-2022/renewable-electricity

International Agency of Renewable Energy. (2021). *Renewable Power Generation Costs 2020. I*nternational Agency of Renewable Energy

Institute for Sustainable Investing. (2019). *Climate Change Investment Megatrend. Institute for Sustainable Investing.* Retrieved 15 May, 2022, from https://www.morganstanley.com/ideas/climate-change-investment-megatrend

Jong, H. (2021, May 12). *Indonesia says no new coal plants from 2023 (after the next 100 or so).* Mongabay. Retrieved 15 May, 2022, from 16 May, 2022, from https://news.mongabay.com/2021/05/indonesia-says-no-new-coal-plants-from-2023-after-the-next-100-or-so/

Keleş, S. (2011). *Fossil Energy Sources, Climate Change, and Alternative Solutions. Energy Sources, Part A: Recovery, Utilization, and Environmental Effects, 33(12), 1184–1195.* https://doi.org/10.1080/15567030903330660

Kumar, H. (2021, February 19). World's biggest floating solar farms: Top ten by capacity. Power Technology. Retrieved May 10, 2022, from https://www.power-technology.com/analysis/worlds-biggest-floating-solar-farms/

Langer, J., Quist, J., & Blok, K. (2021, October 27). *Review of Renewable Energy Potentials in Indonesia and Their Contribution to a 100% Renewable Electricity System. energies (MDPI).*

Lo, Joe. (2022, May 18). *Rich countries seek coal-to-clean energy deals with Indonesia and Vietnam.* Climate Home News. Retrieved June 6, 2022, from https://www.climatechangenews.com/2022/05/18/rich-countries-seek-coal-to-clean-energy-deals-with-indonesia-and-vietnam/#:~:text=Indonesia%20is%20the%20second%20biggest,general%20and%20coal%20mine%20owner

Marciano, Idoan. (2021). *The development of the electric vehicle ecosystem needs to be accelerated. Fiscal incentives for electric two-wheelers and restrictions on conventional vehicles are key to successful EV development in Indonesia.* Institute for Essential Services Reform. Retrieved May 29, 2022 from https://iesr.or.id/en/the-development-of-the-electric-vehicle-ecosystem-needs-to-be-accelerated-fiscal-incentives-for-electric-two-wheelers-and-restrictions-on-conventional-vehicles-are-key-to-successful-ev-development-in

Maulidia, M., Ashworth, P., Dargusch, P., & Ardiansyah, F. (2019, March).. *Rethinking renewable energy targets and electricity sector reform in Indonesia: A private sector perspective,* 101, 231 - 247.

Ministry of Investment. (2021). *Coursing the Future with Electric Cars.* https://www.bkpm.go.id/en/publication/detail/news/coursing-the-future-with-electric-cars

Munich RE. (2018). *Data on Natural Resources Since 1980. Munich RE.* Retrieved October 30, 2019, from https://public.wmo.int/en/media/press-release/weather-related-disasters-increase-over-past-50-years-causing-more-damage-fewer

Maghfiroh, M., Onoda, H., Padyaswargo, A. (2021, November 28). *Current Readiness Status of Electric Vehicles in Indonesia: Multi Stakeholder Perceptions. energies (MDPI).*

OECD. (2021) *Clean Energy Finance and Investment Policy Review of Indonesia.* OECD - Green Finance and Investment.t

Olson, C., & Lenzmann, F. (2016). *The social and economic consequences of the fossil fuel supply chain.* MRS Energy & Sustainability, 3(1). https://doi.org/10.1557/mre.2016.7

Orim, R. (2021, January 29). *Indonesia Still Sources the Majority of its Electricity from Fossil Fuels.* Climate Scoreboard. Retrieved May 12, 2022, from https://www.climatescorecard.org/2021/01/indonesia-still-sources-the-majority-of-its-electricity-from-fossil-fuels/

PT Pembangkitan Jawa-Bali (PJB). (2021, December 22). *Project Profile of Cirata Floating Solar PV - PT Pembangkitan Jawa-Bali. ptpjb.com.* Retrieved May 10, 2022, from https://www.ptpjb.com/portfolio/project-profile-of-cirata-floating-solar-pv/

PT PLN (Persero). (2021). *Rencana Usaha Penyediaan Tenaga Listrik (RUPTL) PT PLN (Persero).* PT PLN (Persero).

Sambodo, M. T., & Novandra, R. (2019, September). *The state of energy poverty in Indonesia and its impact on welfare.* Energy Policy, 132, 113-121.

Slavcheva, R., Cockburn, A., Joyce, M., Khoo, K., Hochadel, D. A., & Burgoyne, B. (2021). *Guide to E-mobility in Indonesia for UK.* Catapult & Department for Business, Energy and Industrial Strategy of United Kingdom.

Statista Research Department. (2022, May 5). *Electricity sector in Indonesia - Statistics & Facts. Statista.* Retrieved May 10, 2022, from https://www.statista.com/topics/5781/energy-in-indonesia/

Taylor, M. (2021). *Analysis-To benefit the climate, Indonesia's electric vehicle push needs greener power.* Reuters. https://www.reuters.com/article/us-indonesia-climate-electric-analysis-idUSKBN2G303Q

Thompson, H. (2022). *The geopolitics of fossil fuels and renewables reshape the world.* Retrieved from Nature News website: https://www.nature.com/articles/d41586-022-00713-3

Trihill Capital., JP Morgan. (2020). *Renewable Energy and Climate Tech Landscape.* Trihill Capital

UNESCAP. (2021). *Assessment of AP Climate Ambition.* UNESCAP. https://www.unescap.org/sites/default/d8-files/2021-11/Assessment%20of%20AP%20Climate%20Ambition_Synopsis_Final-update_1.pdf

Vakulchuk, R., Overland, I., & Scholten, D. (2020). *Renewable energy and geopolitics: A review. Renewable and Sustainable Energy Reviews, 122(October 2019),* 109547. https://doi.org/10.1016/j.rser.2019.109547

World Meteorological Organization (WMO). (2021, August 31). *Weather-related disasters increase over past 50 years, causing more damage but fewer deaths.* Retrieved May 15, 2022, from https://public.wmo.int/en/media/press-release/weather-related-disasters-increase-over-past-50-years-causing-more-damage-fewer

Published July 2022