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Assessing the Challenges and Opportunities for Implementing New and Renewable Energy Policy in Indonesia: A Qualitative Study

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ABSTRACT

The purposes of the study are to examine the challenges and opportunities for Implementing New and Renewable Energy Policy in Indonesia. In this qualitative study, the data were analyze by using Regulatory Impact Assessment (RIA) and SWOT analysis to assess the challenges and opportunities of NRE policy and technology in Indonesia. Our findings suggest that despite the abundance of NRE resources, the country needs to reform its policies to support NRE development better and increase investment in NRE infrastructure. Furthermore, inadequate technological research and development significantly challenge NRE adoption. While the Government should be more active in fostering NRE development, we advise universities to play a critical role in developing NRE technology. Furthermore, solar energy is the most appropriate choice to be implemented in Indonesia because of its position at the equator where solar energy is abundant. This study provides valuable insights into energy policy in Indonesia and contributes to the global efforts towards achieving a sustainable future.

***Keywords**: Energy policy, renewable energy, Regulatory Impact Assessment (RIA), Indonesia*

ABSTRAK

Tujuan dari studi ini adalah untuk mengkaji tantangan dan peluang Penerapan Kebijakan Energi Baru dan Terbarukan di Indonesia. Dalam studi kualitatif ini, data dianalisis dengan menggunakan Regulatory Impact Assessment (RIA) dan analisis SWOT untuk menilai tantangan dan peluang kebijakan dan teknologi EBT di Indonesia. Temuan kami menunjukkan bahwa meskipun sumber daya EBT berlimpah, negara ini perlu mereformasi kebijakannya untuk mendukung pengembangan EBT dengan lebih baik dan meningkatkan investasi pada infrastruktur EBT. Selain itu, kurangnya penelitian dan pengembangan teknologi menjadi tantangan besar dalam penerapan EBT. Meskipun Pemerintah harus lebih aktif dalam mendorong pengembangan EBT, kami menyarankan perguruan tinggi untuk memainkan peran penting dalam pengembangan teknologi EBT. Lebih lanjut, energi surya menjadi pilihan yang paling tepat untuk diterapkan di Indonesia karena posisinya yang berada di garis khatulistiwa dimana energi surya melimpah. Studi ini memberikan wawasan berharga mengenai kebijakan energi di Indonesia dan berkontribusi terhadap upaya global untuk mencapai masa depan yang berkelanjutan.

Kata Kunci: Kebijakan energi, energi terbarukan, Regulatory Impact Assessment (RIA), Indonesia

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INTRODUCTION

The Indonesian government has created various incentives and subsidies to motivate investors in the NRE sector, but not enough to drive large-scale investment (Legamo, Šèasný, & Tasew, 2021; Maradin, 2021; Tiep et al., 2021; Zezelj, Maksimovic, Todorovic, & Djatkov, 2020). This little investment impacts the slow rate of development of NRE sources, thereby limiting the potential for renewable energy, which is an essential part of Indonesia's energy mix. Furthermore, the implementation of energy policy in Indonesia has also encountered problems such as regulatory uncertainty, lack of women's participation, and paying more attention to economic growth than to the green environment (Plutshack, Sengupta, Sahay, & Viñuales, 2019; Rigo et al., 2020; Setyowati, 2020; Soedarwo, 2014; Suparjo et al., 2021). his regulatory uncertainty has an impact on increasing project developer costs and slowing down the use of NRE sources (Kazak, Kamiñska, Madej, & Bochenkiewicz, 2020; Kurnia et al., 2021; Tomczyk & Wiatkowski, 2020). Another critical obstacle that restricts the diversity of viewpoints and abilities in the energy sector is the minimal participation of women. Finally, authorities do not place a high priority on the creation of "renewable energy" since economic growth takes precedence over environmental concerns. The analysis of NRE sources and the implementation of the country's energy policy in this research highlight the potential for "renewable energy" to play a substantial part in Indonesia's energy mix. The analysis demonstrates that although Indonesia has a variety of NRE sources to tap, there are several barriers to the execution of energy policies.

However, the country still relies heavily on non-renewable energy, and some regulatory barriers and uncertainties impede the uptake of NRE sources (Endri, Rinaldi, Ian, Saing, & Aminudin, 2021; Laila et al., 2021; Prayitno, Hakim, & Meidiana, 2021; Srinita & Effendi, 2021). The main aim of this paper is to analyze NRE sources and energy policy implementation in Indonesia without focusing on any particular type of renewable energy. The energy policy is a procedure to address challenges related to energy production, distribution, utilization, and environmental issues (Al-Tal & Al-Tarawneh, 2021; Bridle et al., 2018; Suparjo et al., 2021; Tiep, Huan, & Hong, 2021; Zhakupova, Aigerim, Elmira, Dinara, & Azamat, 2021). Despite extensive research on energy policy, the literature shows that policy failure is a main problem in meeting energy needs from renewable sources. Whereas, the Global warming has led to criticism of using coal and petroleum as non-renewable sources, such as, due to their limited quantity and harmful impact on "climate change" (Zafar et al., 2019). As a result, Indonesia has implemented new and renewable energy (NRE) sources to address energy problems (Irena, 2019; Kurnia et al., 2021).

The Government acknowledges that its target of generating 35,000 MW by 2019 will be challenging to achieve, given that only around 13,000 MW was generated in 2017 (McNeil, Karali, & Letschert, 2019; Srinita & Effendi, 2021), concerning it needs to catch up to the planned target. The delay resulted from the Government's publication of crucial rules about expanding the use of "new and renewable energy" in 2017 (Noor, 2012). Therefore, effective and efficient strategic steps are required to achieve this ambitious target. The Government should prioritize new "renewable energy" regulations, such as focusing on geothermal or nuclear energy to pursue the 35,000 MW target, as both technologies have the most significant capacity to meet the target in a relatively short time and can fulfill industry needs (Noor, 2012; P. et al., 2017). Meanwhile, solar energy can be prioritized to provide lighting to areas not yet reached by electricity, with the Government offering incentives and facilities for its use to residents living in islands and remote areas. This policy priority is crucial in meeting the Government's commitment and leveraging the resources at its disposal. This may also draw outside investors who focus on particular energy sources. Furthermore, Indonesian government policies should encourage large-scale research and development for "renewable energy" sources.

LITERATURE REVIEWS

Renewable energy is integral to sustainable development (Permana, Rochaida, Mire, & Suharto, 2021; Quirapas & Taeihagh, 2021), and Indonesia has a vast potential to develop this sector (Mikkal, 2020; Permana et al., 2021). Renewable energy sources can provide long-term benefits such as energy security, environmental protection, and economic growth (Prayitno et al., 2021). Indonesia has set ambitious renewable energy targets, but policy implementation has been fragmented due to a lack of political commitment. Currently, Indonesia depends heavily on nonrenewable natural resources like coal and oil, which are scarce and accelerate "climate change."

To cut greenhouse gas emissions and lessen the consequences of "climate change," the percentage of "renewable energy" in the mix of energy sources must reach 23% by 2025. (ASEAN Centre for Energy, 2016; Boulton, 2018), as part of ASEAN's energy cooperation action plan, which was created to address these issues. A key element in reaching this objective may be Indonesia's "renewable energy" advancement. However, more than implementing the guidelines alone is required. Stakeholder cooperation is required to support the development of "renewable energy." Such efforts may include research and development, investment, education, and information campaigns (Suparjo et al., 2021). Promoting energy efficiency and savings to reduce energy demand is also essential. With cooperation, Indonesia can achieve its goal of 23 percent of its energy blend from "renewable energy" by 2025, a significant contribution to the global challenge

of "climate change" (Amir & Amir, 2020; ASEAN Centre for Energy, 2016; Setyowati, 2020).

Indonesia faces a significant challenge to meet its growing energy needs by promoting sustainable and "renewable energy" sources. The Indonesian Energy Policy (KEN) projects that the country's total energy demand will reach 2.41 billion BOE in 2025, an 84 percent increase from the national energy demand in 2013 of 1.31 billion BOE (Bouazizi, Hadhek, Mrad, & Lafi, 2021; Ihsan et al., 2015; Kurnia et al., 2021). Although several alternative energy sources are available, Indonesia faces several obstacles in achieving its "renewable energy" goals, such as geographic challenges, coordination between central and regional governments, high renewable technology costs, lack of incentives, public perception, and institutional capacity. Despite the difficulties, Indonesia has established a clear roadmap for national energy development with the National Energy Policy stipulated in Government Regulation No. 79 of 2014 (Mikkal, 2020). The "renewable energy" blend should be 23 percent by 2025 and 31 percent by 2050. Indonesia is working hard to achieve this so that by 2021, the share of new and "renewable energy" in the national energy mix can exceed 11%. To address this problem, Indonesia has begun implementing various initiatives such as using solar energy in rural areas and islands, developing geothermal electricity (estimated potential of 29 GW), and building wind farms (PLTB) in Sidrap, South Sulawesi, with a capacity of 75 MW (ASEAN Centre for Energy, 2016; Setyowati, 2020).

As a comparation, 80% of energy consumption in ASEAN is derived from conventional sources, which are becoming increasingly scarce and costly. Renewable energy sources, like solar and wind, biomass, and hydropower, are being explored as alternative energy sources to sustain economic growth. Shifting to "renewable energy" sources will reduce dependence on nonrenewable resources like oil and reduce energy costs (Handayani and Ariyanti, 2012). However, the transition to "renewable energy" is not without challenges. For instance, global crude oil price volatility, such as the decline in oil prices in early 2020, can disrupt state revenues and make it difficult to implement policies aimed at promoting "renewable energy" sources (Setyowati, 2020). For example, the Indonesian government's plan to cap gas prices at US $6 per MMBTU to encourage "renewable energy" sources has been met with resistance because it would sacrifice state revenues in the upstream oil and gas sector. Moreover, the government's efforts to mitigate the impact of the COVID-19 pandemic have resulted in increased public, raising concerns that policies aimed at subsidizing industrial gas prices could further strain state finances.

It is essential to note that promoting "renewable energy" requires the cooperation of all stakeholders, including the government, the private sector, and society (Osius & Osius, 2020; Setyowati, 2020). As Indonesia faces challenges in achieving its "renewable energy" goals, it must continue its efforts towards a more sustainable energy future.

RESEARCH METHOD

The research methodology employed in this study combines data gathering and analytical methods to determine Indonesia's potential for "renewable energy" sources and the efficacy of current regulations. Indonesia was chosen due to its distinctive qualities as a developing nation with a diversified topography and substantial potential for "renewable energy." The information was gathered to ascertain the potential "renewable energy" capacity as assessed by the Indonesian government based on its geographic and geological characteristics from publicly accessible databases, government papers, and investment organizations. Using the Vosviewer app, peer-reviewed journal articles were scanned in order to find present and upcoming energy-saving technology.

Information about "renewable energy" in Indonesia was gathered for the FGD from a variety of stakeholders, including academics, researchers, and professional staff of the Indonesian Parliament. For analytical objectives, the author used the RIA method. The authors create an RIA-based analytical tool to evaluate the efficacy of present policies and decide whether regulatory action requires for new and "renewable energy" policies in Indonesia. Analytical approach policy formation and evaluation, focus group discussions also allow the analysis to consider different perspectives (Suska, 2012).

Field data, both primary data and secondary data, were then analyzed using the RIA and SWOT analysis methods. Analysis of the impact of policies is important so that policies do not receive rejection from society, including the feasibility of implementing them. Meanwhile, SWOT analysis provides a complete picture regarding the technical feasibility and possibilities in the field by considering the strengths, weaknesses, opportunities and threats of the policy issue if it is to be implemented. The reasons for using the RIA analysis method are first; RIA is an approach that reviews policies comprehensively. Second; RIA is currently a trend for reviewing policies because it involves aspects of policy impact which are very useful in implementing government policies so as not to receive rejection from the public. Therefore, using the RIA method is very useful for studying energy policy in Indonesia because the RIA-based analytical approach applied in this work is multi-step.

Finding the policy issue and defining the goals of the policy are the initial steps. The political concern in this situation is the low proportion of "renewable energy" sources in Indonesia's energy blend. The goal is to raise that proportion to meet the nation's energy needs. The political decision to accomplish the aim is the second step. Alternatives include the development of renewable energy technologies, improving the regulatory environment that supports "renewable energy" investment, and promoting "renewable energy" projects. The third stage is an analysis of the results of each possible course of action. The impact evaluation evaluates each option's prospective costs and advantages. The impact analysis shows the risk and uncertainty factors connected to each action. Based on the

impact analysis findings, the most crucial action alternatives chose in the fourth step. The best option is the one with the most significant net profit and the lowest cost. Preparing a plan for carrying out direct actions is the fifth step. The resources, spending strategy, and possible course of action are all included in the implementation plan. Monitoring and assessing the policy's efficacy over time is the final phase, which includes learning more about the impact and results of the policy and determining. Overall, RIA-based analytical techniques offer a methodical and thorough approach to policy.

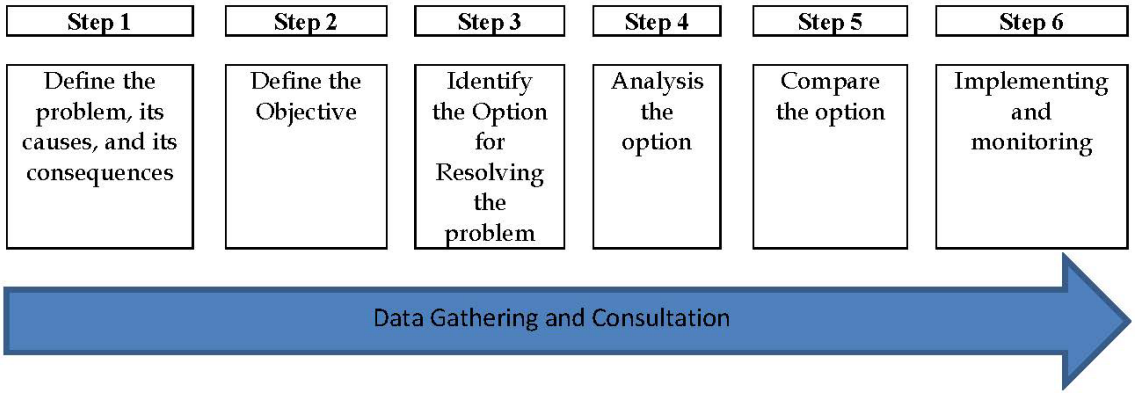


Figure 1. The RIA Process and Analytical Steps

The authors used the Regulatory Impact Assessment (RIA) method in this study. RIA is a method of policy development with an approach that accommodates all requirements in the regulatory process. "…RIA's most important contribution to the quality of decisions is not the precision of the calculations used, but the action of analyzing questioning, understanding real-world impacts and exploring assumptions" (Suska, 2012). Regulatory Impact Assessment (RIA) is a process of several steps that aims to analytically and systemically answer whether regulatory intervention is needed and, if so, which of the possible options is the best solution to the problem. RIA based on: (1). asking the right questions when considering the need for regulatory intervention and during regulation development; (2). gathering the necessary data; (3). organizing the analysis to follow logical steps and applying adequate methods; (4). They exchanged information between the regulator and the stakeholders (Marušiæ and Raduloviæ, 2011).

RESULTS

The Indonesian Government has recognized the significant role of NRE in enhancing energy security and facilitating the de-carbonization of the global economy. It has established a National Energy Policy (Kebijakan Energi Nasional, KEN) as stipulated in Government Regulation (PP) No. 79 of 2014. The PP targets the NRE blend to reach 23% by 2025 and 31% by 2050, equivalent to a "renewable energy" generation capacity of 45

GW from a total capacity of 135 GW in 2025 (see Figure 6). The Government has further operationalized KEN by issuing Presidential Regulation No. 22 of 2017 on the General Plan of National Energy (Rencana Umum Energi Nasional, RUEN) (Mikkal, 2020).

New and "Renewable Energy": Sources and Technologies

1. NRE Sources

Indonesia has a significant potential for "renewable energy" Sources (RES), including mini/micro hydro amounting to 450 MW, biomass amounting to 50 GW, solar energy of 4.80 kWh/m2/day, wind energy of 3-6 m/s, and nuclear energy of 3 GW. The latest data on RES potential was presented by the Director of "New and Renewable Energy' and Energy Conservation in a Focus Group Discussion on National Energy Resilience, in collaboration with the Council's expert staff (Table 1).

Table 1. Potential and Installed Capacity of Indonesia's New and Renewable Energy

Type of Renewable Energy	Resources Power	Reserve	Installed capacity
Panas Bumi /Geothermal	12.386 MW	16.524 MW	1.643 MW*) -
Hydro	75.000 MW		4.010 MW**)
Mini-Microhydro			212 MW
Biomassa /Biomass	32.654 MW	-	1.656 MW (Off Grid)
			131,4 MW (On Grid)
Energi Surya / Solar energy	4,8 – kWh/m2/hari	-	70 MW***)
Energi Angin/ Wind Energy	970 MW (4-6 m/s)	-	196 MW
Uranium/ Uranium	3.000 MW	-	30 MW
Gas Methana Batubara / Coal bed Methana	456,7 TSCF	-	-
Shale Gas	574 TSCF	-	-
Gelombang Air Laut /Ocean Wave	1.995,2 MW (Potensi Praktis /practical potential)	-	-
Energi Panas Laut (OTEC) / Ocean Thermal Energy Conservation	41.012 MW (Potensi Praktis / practical potential)	-	-
Energi Pasang Surut (Arus)/ tide and tidal power	4.800 MW (Potensi Praktis /practical potential)	-	-

Sources: BPPT Indonesian Outlook Energy 2016
Performance Report NREKE 2016*)

The installed capacity of biomass is 1,656 MW off-grid and 131.4 MW in on-grid applications. This shows that biomass has the potential as a renewable energy source in Indonesia, especially in rural areas that are not yet connected to the national electricity grid (Lev, Mcvey, & Mcvey, 2020). The installed capacity of solar energy is 70 MW, still relatively small compared to the potential of solar energy in Indonesia because the country receives an average of 4.8 kWh/m2/day of solar radiation. The installed wind power capacity is 196 MW, and the potential capacity is 970 MW with a wind speed of 4-6 m/s. This shows that Indonesia has the potential to develop wind energy further. Uranus has a reserve capacity of 3000 MW, but the installed capacity is only 30 MW. However, Indonesia does not have a nuclear power plant, and the Government has not announced any plans to build one.

Natural gas, CBM, and shale gas have significant reserve capacity, but there is no information on installed capacity or development opportunities. Ocean waves have a practical potential of 1,995.2 MW while Ocean Thermal Energy Conservation has a practical potential of 41,012 MW. The practical tidal power potential is 4,800 MW (Lev et al., 2020). However, there is no information about the installed capabilities or development opportunities of these sources. Overall, the data shows that Indonesia has great potential to develop "renewable energy" sources, particularly geothermal, hydropower, and wind energy. However, there is a need for further investment and policy support to realize this potential and increase the share of "renewable energy" in Indonesia's energy blend (Lev et al., 2020).

2. NRE Technology

Indonesia has set a target of 23% "renewable energy" generation (NRE) by 2025, which requires an investment of $36.95 billion (Lev et al., 2020). The anticipated investment for 2020 was USD 2 billion, however, the trend for this year indicates that the risk of missing the investment goal exists owing to Indonesia's lack of interest in NRE investments and the Covid-19 pandemic, which makes it challenging to develop new ones. Finding investors shouldn't be difficult because they will invest once they can see that the industry will turn a profit. In actuality, the NRE industry is still quite new in comparison to other industries, including fossil fuels. It should be emphasized that various investor categories have their considerations while making investments. However, one thing that has a significant impact on this is the nature of NRE financing (Ihsan et al., 2015; Prayitno et al., 2021).

The cost of establishing a coal-fired power plant is still lower, although the construction costs of an NRE power station have fallen. For instance, the price of producing electricity with coal is approximately 4-6 cents/kWh, while solar energy costs between 6 and 12 cents/kWh. This issue leads to political issues regarding the price of electricity generated

by NRE. As mentioned earlier, the cost of building "renewable energy" infrastructure is relatively high, although operating costs are generally lower once the infrastructure is ready for use. However, the construction time of such an infrastructure is relatively long. Although investing in "renewable energy" is more promising, investors choose to invest in the coal sector because they can reap the benefits relatively quickly.

Table 2. The Strength, Weakness, Opportunities, and Threat (SWOT) Analysis of NRE Technologies and Adoption in Indonesia

Strengths	Weakness
High potential for NREs, particularly solar energy, in Indonesia.	High expenses for investment.
Since the system is modular, it is suitable for remote locations.	Lack of engagement from the private section.
Reduction of environmental contamination.	Absence of stable, effective policies and good incentives.
Technologies that are competitive and affordable for use domestically.	The absence of crucial coordination between various government and corporate sectors.
Abundant well-equipped and powerful colleges and research centers in this field.	Universities and research organizations are not involved in the technological development processes.
Availability of oil export.	The nation's economic instability, particularly the fluctuation of foreign currencies.
Opportunities	**Threats**
Participation and growth of the private part	Low prices of fossil fuels.
Stepping toward economic and sustainable development.	Great fossil fuel reserves that are easily accessible, particularly in areas that are shared with nearby nations.
Creating a prospective market for the adoption and development of technology.	Personalized and impromptu decision-making by managers.
Reduction in reliance on fossil fuels.	Lack of understanding of the need for the development of this sector.
Export of energy to nearby nations is a possibility.	Shortage of social awareness.
Possibility of research institutes and universities developing in a practical and scientific manner in order to launch crucial innovations.	Political issues such as forced sanctions make investors lack of motivation to continue.

Sources: Adopted and Modified from Aien and Mahdavi (2020)

Based on the data provided, Indonesia has a high potential for developing "renewable energy", specifically in the areas of geothermal, hydro, mini/micro-hydro, biomass, the solar, wind, uranium, coal bed methane, ocean wave, ocean thermal energy conservation, and tide and tidal power. Among these, solar energy has the highest potential (Mikkal,

2020; Mohan, Bisley, & Richardson, 2020). The "renewable energy" system is also modular and suitable for remote locations, which is an advantage in a country with many islands like Indonesia. Additionally, "renewable energy" can reduce environmental contamination and promote sustainable development. However, several weaknesses and threats exist to developing "renewable energy" in Indonesia. One of the significant areas for improvement is the high expenses for investment, which can hinder the private sector's engagement. The absence of stable, effective policies and good incentives can make it difficult for investors to enter the "renewable energy" market (McNeil et al., 2019; Mikkal, 2020; Robison & Hadiz, 2017). Another area for improvement is the absence of academic institutions and research-focused industries in technological development processes.

The essential cooperation between various private and public agencies is another area of difficulty. Another area for improvement is the absence of academic institutions and scientific areas from technological development processes. Despite these shortcomings, there are still chances for "renewable energy" growth in Indonesia. These opportunities include private sector involvement and development, a drive towards economic and sustainability, and the formation of prospective markets for adopting and maturing technology. The nation can gain from a decrease in the usage of fossil fuels as well as the potential to export energy to its neighbors (Report, 2016). Threats include cheap fossil fuel costs, vast fossil fuel reserves, managers' impulsive and personal actions, and a need to understand the need to expand this business.

The Implementation of NRE Policy in Indonesia

Indonesia aims to produce 23 percent of its energy from renewable sources by 2025 (ASEAN Centre for Energy, 2016). The country's new and "renewable energy" strategy, which was introduced in 2006, intends to promote the development of "renewable energy" sources and raise the proportion of "renewable energy" sources in the nation's energy blend. The plan includes several components, such as encouraging investments in "renewable energy", improving "renewable energy" technologies, and increasing energy efficiency (McNeil et al., 2019). The most crucial governmental action is the establishment of a feed-in tariff (FIT) to promote investment in "renewable energy" projects. For the "renewable energy" generated by the project, the FIT system gives a fixed price, ensuring a predictable and steady return on investment for investors. The policy supports public-private partnerships to build "renewable energy" infrastructure because it offers tax incentives for "renewable energy" projects (McNeil et al., 2019). This strategy also supports the means of "renewable energy" in the transportation industry through the advancement of biofuels and electric vehicles.

Due to the lack of experienced human resources in the industrial sector, as well as bureaucratic constraints and the limited availability of financing for "renewable energy"

projects, the impact of increasing "renewable energy" is limited. Furthermore, most of the country's energy use in Indonesia still comes from fossil fuels despite various legislative efforts (Setyowati, 2020). The government can take into account enacting beneficial rules and regulations, expanding access to funding for "renewable energy" projects, and raising public knowledge and education about "renewable energy" to hasten the expansion of "renewable energy" in Indonesia. Additionally, Indonesia has the potential to benefit from international collaboration and financial support for the growth of "renewable energy" sources. Indonesia can meet its "renewable energy" targets and support international efforts by overcoming these difficulties.

Indonesia has an overall system for promoting environmentally friendly power development. This includes Law 17 of 2007, which supports sustainable power projects by implementing a public Long-Term Development Plan that provides financing for such projects (Setyowati, 2020). Additionally, Governmental Regulation 79 of 2014 aims to reduce Indonesia's reliance on fossil fuels and encourages the change from dirty and sustainable energy sources (Suparjo et al., 2021). This regulation also includes provisions for increasing power supply at the national level and improving power access, particularly in remote rural settings of the country. Indonesia's definition of sustainable power includes Mixed Renewable Energy (MRE). As such, its goal for sustainable power development includes MRE activities, such as pilot testing, in preparation for full-scale commercialization. The National Energy Council is reviewing the country's national energy plan and intends to incorporate MRE into Indonesia's energy blend (Quirapas and Taeihagh, 2021).

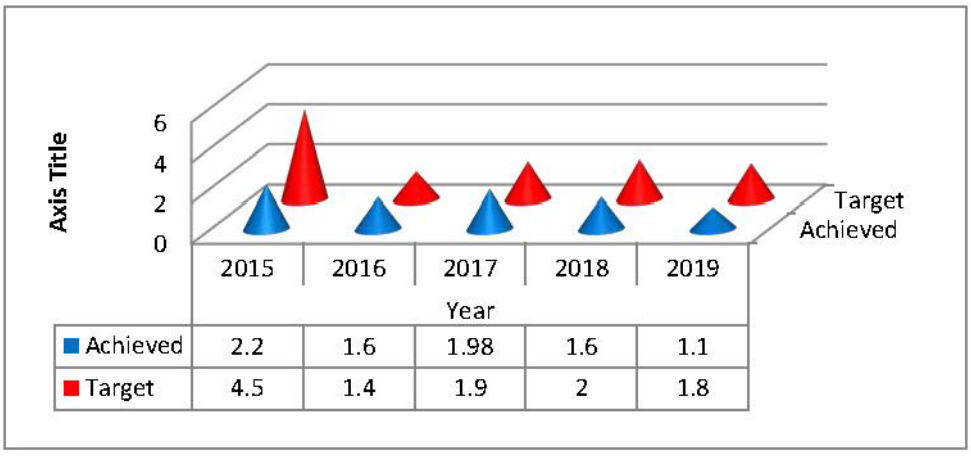
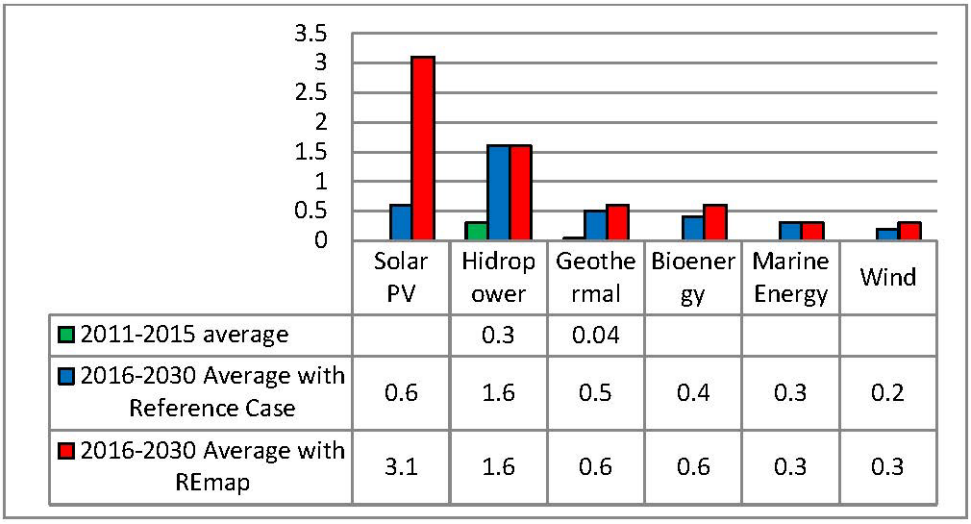


Figure 2. Renewable Investment in Indonesia
Source: IESR. Available online: http://iesr.or.id/wp-content/uploads/2019/12/Indonesia-Clean-Energy-Outlook-2020- Report.pdf (accessed on 26 Jun 2021).

The table 2 shows the "renewable energy" investment achieved and targeted in Indonesia from 2015 to 2019. In 2015, the achieved investment in "renewable energy" was 2.2, below the targeted investment of 4.5. However, in 2016, the achieved investment decreased to 1.6, below the targeted investment of 1.4. In 2017, the achieved investment increased to 1.98, slightly higher than the targeted investment of 1.9. The investment achieved in 2018 fell again to 1.6, below the target of 2.0. Ultimately, the investment realization in 2019 was 1.1 and below the target of 1.8. Overall, the data shows that Indonesia's achieved investment in "renewable energy" from 2015 to 2019 was mainly below the targeted investment, except for 2017. The highest gap between the achieved and targeted investment was in 2015, where the achieved investment was only half of the targeted investment. Additionally, the achieved investment fluctuated significantly, with a decrease in 2016, 2018, and 2019 compared to the previous years. This suggests there may be challenges in consistently attracting investment in "renewable energy" in Indonesia (Setyowati, 2020).

In 2013, "renewable energy" accounted for 19% of worldwide energy consumption, but the ASEAN region's energy demand is projected to increase 2.4 times by 2040, according to the 5th ASEAN Energy Outlook. This growth in energy demand is expected to drive economic expansion in the region, with ASEAN's GDP tripling from USD 2.56 trillion in 2015 and its total population growing to over 760 million at 0.7% per year, compared to 630 million in 2015. However, increasing energy demands, particularly in Indonesia, where oil demand is expected to rise while supply dwindles, pose a challenge to the region's energy security and economic development (Setyowati, 2020).

The table 3 provides average growth rates for different "renewable energy" sources between three time periods: 2011-2015, 2016-2030 with a reference case, and 2016-2030 with the Renewable Energy Map (Remap) scenario. Solar PV has the highest average growth rate in all three time periods. From 2011 to 2015, the average growth rate for solar PV was 0.6, which increased significantly to 3.1 from 2016 to 2030 with the RE map scenario. Hydropower has the second-highest average growth rate, with an average growth rate of 0.3 from 2011 to 2015, which increased to 1.6 from 2016 to 2030, both in the reference case and the RE map scenario. Geothermal energy has a relatively low growth rate from 2011 to 2015, with an average of 0.04. However, it increases significantly in the following period, reaching an average of 0.5 in the reference case and 0.6 in the RE map scenario. Additionally, the average annual growth rate for bioenergy from 2011 to 2015 was only 0.4. In the subsequent decade, it marginally rises, averaging 0.6 in the reference case and the RE map scenario.



	Solar PV	Hidropower	Geothermal	Bioenergy	Marine Energy	Wind
2011-2015 average		0.3	0.04			
2016-2030 Average with Reference Case	0.6	1.6	0.5	0.4	0.3	0.2
2016-2030 Average with REmap	3.1	1.6	0.6	0.6	0.3	0.3

Figure 3. Annual Installations of Renewable Power in 2011-2015, in the Reference Case for 2030 and with Remap
Source: Solar Magazine (2019) https://solarmagazine.com/solar-profiles/indonesia/

With an average growth rate of 0.3 throughout the two time periods, marine energy is showing a steady upward trend. With an average growth rate of 0.2 from 2011 to 2015, wind energy has the lowest average growth rate. However, it modestly rises in the following period, averaging 0.3 in the reference case and the RE map scenario. Overall, the data indicate that hydropower and solar photovoltaics are the two "renewable energy" sources expanding fastest

DISCUSSION

Indonesia is a populous developing country with rapid economic growth, which presents several challenges for implementing the new renewable energy policy. One of the biggest challenges is the country's heavy reliance on nonrenewable energy sources, especially oil, and gas, which account for more than 80% of the country's energy mix. Indonesia's energy security and economic expansion are seriously threatened by the depletion of these resources and the nation's rising energy needs. In order to address this issue, the Indonesian Government has worked to promote renewable energy sources like solar, wind, biomass, and hydropower. A legislative foundation for the development of renewable energy projects is created by Law No. 17 of 2007 and Government Regulation No. 79 of 2014, which also support the switch to clean and renewable energy. The National Energy Board also looks into how mixed renewable energy (MRE) might be incorporated into the country's energy sources. Despite these efforts, Indonesia's efforts to implement new and renewable energy regulations encounter several obstacles (Gillispie, 2020; Mohan

et al., 2020). The main barrier is a need for more technology and infrastructure for producing and distributing renewable energy, particularly in rural areas of the nation. The fundamental objective of the nation's energy strategy is to provide all citizens with clean energy. However, this makes it challenging for the Government to do so.

The high cost of renewable energy compared to conventional energy sources is an additional difficulty. Despite recent price reductions, renewable energy is still quite expensive compared to fossil fuels. This makes renewable energy sources challenging to compete in the energy market, particularly without significant political incentives. Another significant barrier is the general public's need for knowledge about renewable energy. Adopting renewable energy, technology may be hampered since many Indonesians need to be made aware of the benefits of renewable energy sources (Amir & Amir, 2020; Brien et al., 2018). Land acquisition is another issue that significantly hinders the construction of renewable energy facilities. Property ownership in Indonesia is sometimes complicated and may include some parties, making it challenging for the Government to acquire land for renewable energy projects. Furthermore, bureaucratic obstacles and corruption could prevent the implementation of laws pertaining (Mikkal, 2020; Published, 2020; Robison & Hadiz, 2017).

Complicated laws and procedures may delay renewable energy project approval, and corruption may lead to poor project management, resource misallocation, and inaccurate budgeting. Despite these barriers, Indonesia has many opportunities to advance innovative and renewable energy policies. The country has abundant renewable energy-producing natural resources, including biomass, geothermal energy, the sun, and wind. A young, expanding labor force in the country is also available for instruction and training in developing and using renewable energy technology. Additionally, Indonesia could draw foreign capital for green energy ventures. The Government promotes investment and welcomes foreign investors by, among other things, offering tax benefits and streamlining the investment process. Furthermore, implementing legislation for renewable energy can assist Indonesia's economy and society. In order to combat climate change, The growth of renewable energy initiatives can improve the country's economy, reduce its reliance on fossil fuels, and help reduce greenhouse gas emissions.

Complicated laws and procedures may delay renewable energy project approval, and corruption may lead to poor project management, resource misallocation, and inaccurate budgeting. Despite these barriers, Indonesia has many opportunities to advance innovative and renewable energy policies. The country has abundant natural resources that can be used to create renewable energy, including biomass, geothermal energy, the sun, and wind (Ferretti, 2020; Suparjo et al., 2021). A young, expanding labor force in the country is also available for instruction and training in developing and using renewable energy technology. Additionally, Indonesia might attract foreign funding for projects using green

energy. The Government promotes an environment that is favorable to investment and draws international investors through, among other things, tax incentives and other measures (P. et al., 2017; Report, 2016). Additionally, according to Lev et al. (2020), the adoption of renewable energy rules might be advantageous for Indonesia's society and economy. The creation of renewable energy projects can help fight climate change by enhancing the economy, reducing the dependency of the country on fossil fuels, and assisting in reducing greenhouse gas emissions.

CONCLUSION

Developing "new and renewable energy" (NRE) in Indonesia has enormous potential to contribute to the country's efforts to reduce carbon emissions and provide energy security. The NRE policy must be implemented successfully in Indonesia, but various obstacles must be solved. Technical, monetary, and legal obstacles and a lack of community knowledge and participation are obstacles.

The high cost of NRE infrastructure compared to more conventional energy sources like coal is one of the main obstacles. The limited funding options and investors' level of risk makes this more difficult. The Government must offer more enticing incentives and policies to draw investment in NRE development to overcome this problem. Another issue is the regulatory environment, which needs to strengthen the guarantee that the NRE policy will implement correctly, such as accelerating licensing procedures, and adopting NRE standards and rules, including building a different institutional framework for NRE development. Public participation and education are also required to implement the NRE policy successfully. Through community-based initiatives and public-private partnerships, the Government should increase public knowledge of the advantages of NRE and promote public involvement in its development. There are substantial prospects for the growth of NRE in Indonesia in addition to these difficulties. Furthermore, there are several renewable energy sources that can be implemented immediately, such as solar energy, small-scale hydro energy, and in the future, it is possible to consider nuclear energy because of its high level of efficiency.

Implementing the NRE policy in Indonesia requires a collaborative effort between the Government, private sector, and civil society. The Government needs to provide the necessary support and incentives, while the private sector needs to invest in NRE development and promote innovation. Civil society must be involved in NRE development through community-based projects and public participation. By addressing the challenges and embracing the opportunities, Indonesia can successfully transition towards a more sustainable and environmentally friendly energy system.

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