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Review

Stakeholder Mapping and Analysis of the Renewable Energy Industry in Indonesia

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Abstract: The development of renewable energy in Indonesia is still in a relatively fledgling state, yet it is forecast to increase. The Government of Indonesia has formulated and implemented several strategic programs, compiled under several binding frameworks, namely the National Energy Policy and the General Plan for National Energy. The government is committed internationally to reduce its greenhouse gas emissions as part of its Nationally Determined Contributions. However, unearthing the dynamics of renewable and sustainable energy in Indonesia requires a detailed stakeholder analysis of all relevant and major actors. This paper aims to provide a stakeholder analysis of actors in the renewable and sustainable energy sector in Indonesia as a whole, using a Political, Economic, Social, Technological, Legal and Environmental (PESTLE) analysis methodology. The results have indicated that existing policies are not yet perfect, given that the renewable energy industry is still quite minimal, especially in the current conditions of falling oil prices. In the future, it is hoped that the government can formulate a breakthrough policy to improve existing policies in the renewable energy sector, such as by giving ease to investors in the renewable energy sector, including the effective and efficient supply chain management of renewable energy.

Keywords: PESTLE; stakeholder analysis; renewable energy; sustainability; policy; Indonesia; supply chain management

1. Introduction

In the renewable energy sector, the Association of Southeast Asian Nations (ASEAN) has targeted to secure 23% of its primary energy from modern and sustainable renewable energy sources by 2025. This exact figure and the deadline are also included in Indonesia's National Energy Policy for its national renewable energy sector. This means that quantitatively, Indonesia has deliberately set its national renewable energy goals to be in line with the regional target. The renewable energy sector is a crucial point of concern in ASEAN, and one that cannot afford to overlook growing population levels (along with increased energy demand) and dwindling reserves of indigenous fossil fuels (which equates to larger amounts of imports and, thus, negative external consequences and costs) which have set renewables to be the primary foreseeable alternative for the region. In order to effectively construct the relevant power infrastructure for renewable energy, some estimates state that ASEAN countries together need to invest at least USD 27 billion annually, a total of USD 290 billion by 2025. It is this same intra-regional demand that, in fact, opens up pathways for Indonesia to undertake comparative research with other ASEAN countries to achieve the common goal for renewable energy.

Zooming in on the Indonesian context, the utilization of renewable energy in Indonesia is still relatively small, at approximately 8.66 GW, yet ironically, Indonesia has a fairly large potential for renewable energy, namely 801.2 GW, that can be expanded on and utilized. Among others, this encompasses 75 GW of mini/micro hydro, 32.6 GW of biomass, 532.6 GWp of solar energy,

113.5 GW of wind energy, 18 GW of ocean energy and 29.5 GW of geothermal energy [1], wherein the largest potential (12,837 MW) is found in Sumatera, and the smallest in Papua (75 MW).

The utilization of the potential for renewable energy has not yet been optimized for electricity generation. The current total installed capacity for renewable energy in Indonesia is approximately 55,528 MW, which, among others, is comprised of 5.02 GW of mini/micro hydro or 7% of total potential; 1.74 GW of bioenergy or 5.3% of total potential; 0.08 GWp of solar energy or approximately 0.01% of total potential; 6.5 MW of wind energy or 0.01% of total potential; 0.3 MW of ocean energy or approximately 0.002% of total potential; and 1.44 GW of geothermal energy or 5% of the total potential.

The development of renewable energy is part of a strategic program of the Indonesian government, and this has to be utilized for the greatest benefit of the people, especially underdeveloped, outlying and rural regions [2]. Both the central and regional governments are tasked to supply energy from renewable energy. Currently, the development of renewable energy refers to President Regulation No. 79 of 2014 on the National Energy Policy (PP KEN). The regulation states that the contribution of renewable energy in the national primary energy mix in 2025 should reach 23%, with a composition of 5% of biofuels, 5% of geothermal, 5% of biomass, nuclear, water, solar, and wind energy, and 2% of liquefied coal [3].

The National Energy General Plan targets the provision of primary energy in 2025 as equivalent to 405 million tons oil equivalent (MTOE), comprised of 25% of oil fuels, 30% of coal, 22% of gas and 23% of renewable energy. Renewable energy is targeted for 94 MTOE with a distribution of 69 MTOE (45 GW) for electric power from renewable energy, and 25 MTOE from biofuel, biomass, biogas and coalbed methane (CBM) at 15.6 KL, 8.3 million tons, 489.9 million m^3 and 46 million metric standard cubic feet a day (MMSCFD) respectively. The current 55 GW of national power plant capacity is targeted to increase to 135 GW by 2025. Likewise, power plant capacity from renewable energy, currently 8.7 GW (15.7%), is targeted to increase to 45 GW by 2025; an approximately 33% increase. Among others, this is comprised of geothermal energy power plants, water/mini/micro hydro energy power plants, bioenergy power plants, solar energy power plants, wind energy power plants, and ocean energy power plants, at 7.2, 21, 5.5, 6.4, 1.8 and 31 GW, respectively.

Renewable energy must be developed in order to resolve the matter of dwindling fossil energy sources. Currently, Indonesia is a country with the highest energy consumption growth rate in the world. With this situation, Indonesia is almost a net importer of oil; in 2014 alone, Indonesia imported 203,846,000 barrels of oil [4]. Based on data from the 2015 Indonesia Energy Outlook, published by the Technology Assessment and Application Agency, Indonesia's final energy consumption increased from 778 million barrels of oil equivalent in 2000 to 1211 million barrels of oil equivalent in 2013, or an average growth of 3.46% per year. These high levels of consumption have caused faster usage of fossil fuels in comparison to discoveries of new reserves. If renewable energy is not optimally developed soon, the increase in consumption could decrease the availability life of energy in Indonesia.

Being part of the ASEAN, Indonesia is currently at a crossroads as the domestic energy demand continues to grow, bringing new and imminent challenges in the supply of sustainable yet affordable energy. In spite of the target set by ASEAN (23.2% from renewable energy by 2025), current policies in many ASEAN countries enabling the deployment of such forms of renewable energy only reach less than 16.9% of the renewable sources, leaving around a 6.3% gap. To close this gap, every ASEAN country, including Indonesia, is responsible for contributing to the increase in the renewable energy share. The amount of contribution is proportional to the size of the country, the overall in-country energy demand and the availability of local renewables. Table 1 shows that Indonesia has the highest contribution to the ASEAN target.

Although Indonesia's vast natural resources, on the one hand, have enabled the country to take advantage of any form of renewable energy, be it solar, wind, hydro, geothermal, biomass, biofuel, biogas, among many others, on the other hand, the lack of appropriate government policies to boost the renewable energy deployment has somehow jeopardized the acceleration of renewable energy deployment, to remain in line with the ASEAN's goals.

Table 1. Contribution toward increasing ASEAN's renewable energy share to 23.2% [5].

Country	Renewable Energy Shares
Indonesia	+1.7%
Vietnam	+1.3%
Malaysia	+1.0%
Thailand	+1.0%
Philippines	+0.4%
Myanmar	+0.4%
Lao PDR	+0.2%
Singapore	+0.1%
Cambodia	+0.1%
Brunei Darussalam	+0.02%

Bearing in mind the need to fulfil development and utilization targets for renewable energy in Indonesia, this research aims to identify the obstacles and unearth the inner workings of the implementation of distribution for renewable energy, by enacting a PESTLE policy mapping and stakeholder analysis. The main goal is to dissect and analyze the specific relationships of interest within Indonesia's renewable energy sector and holistically approach the need to adequately cover all relevant terrain in the renewable and sustainable energy sector. This is done by observing agencies or institutions, involved parties and all relevant stakeholders in the industry with an ultimate goal to better elucidate the various points of dispute among stakeholders and thus come to a recommendation for institutional actors as to how to better promote renewable energy in Indonesia.

2. Research Approach

This research adopts Political, Economic, Social, Technological, Legal, and Environmental (PESTLE) analysis for its approach. PESTLE analysis is a framework or tool typically used in business and management to analyze the environment they are operating in or are planning to launch new operations in. PESTLE analysis can also be used to monitor the macro-environmental or external factors that play a role in impacting on that environment.

The political analysis looks at the extent and impacts of state power on the economy. For example, certain environmental policies may enforce penalties for corporations unable to comply. Economic factors encompass direct impacts on economic capacity, be it of an organization, industry sector/market, or nation-state. Social factors examine the social context of these institutions including, but not limited to, population analytics, demographics and cultural trends. Technological factors are related to technological advancement, including research and development (R&D), niche technologies and automation. Legal factors take into account laws and policies, including consumer protection laws, safety standards, and labor laws. Environmental factors are all those critical factors that are conditioned or impacted on by environmental issues, geographical location, global changes in climate, weather, etc.

PESTLE analysis has often been used to unravel issues and discourse that are mainly qualitative in nature, and as such difficult or rather unsuitable to be resolved quantitatively. In particular, it can be used to analyze and break down various problems more holistically. PESTLE analysis has recently been applied to certain industrial sectors, such as the conventional, fossil-fuel [6,7] as well as renewable [8–10] energy industries. By using PESTLE analysis, new strategic policies can be developed to replace and renew policies that are no longer effective or efficient.

3. Research Findings

Using PESTLE analysis, the stakeholders of the renewable energy industry will be hereby identified. Stakeholders are referred to as individuals, groups or institutions that have interests or concerns in the state of affairs within an organization, and typically can affect or be impacted on by the organization's activities, targets or policies.

3.1. Political

The Energy Law [2] is the legal umbrella for the energy sector in Indonesia. It contains several primary objectives for energy management in Indonesia, as decreed in Article 3, such as: energy independence (as the ultimate national objective, notwithstanding Indonesia's situation of near net importer); ensuring the availability of energy sources; ensuring the management of energy resources is optimal, integrated and sustainable; efficient utilization of energy; ensuring public access to energy; improving industry capacity and domestic energy services in order to be more independent; creation of jobs; and ensuring environmental sustainability.

The Energy Law established the National Energy Board with the authority to plan and formulate long-term energy policies, as outlined in the National Energy Policy. The latest National Energy Policy was approved by the House of Representatives in early 2014. It encompasses targets for renewable energy utilization, elaborated in the National Energy General Plan, that must be completed within one year after the approval of the National Energy Policy. Specifically, the target for renewable energy has been set at 23% of the total energy mix by 2025, and 31% by 2050. This policy requires an increase from the 5% that had been achieved in 2010. These targets update previous targets as part of Vision 25/25; meanwhile, renewable energy targets for 2025 are 2% lower than Vision 25/25. In addition, these new targets do not indicate the existence of nuclear power. These new targets also update the 17% target for renewable energy in 2025, which is an important part of the regulation regarding the National Energy Policy [11].

Other laws and regulations related to specific sectors complement the legal umbrella, such as foreign investment. Law no. 25 of 2007, for instance, is the primary policy framework concerning investment, which elaborates the principles of the establishment and operation of business activities [12]. This law provides a Negative Investment List, which identifies sectors that are open and closed for private investment. The energy sector is generally open for investment, even though there are several requirements that need to be adhered to, such as [13]:

- Power plants with power capacities smaller than 1 MW are specified for small and medium enterprises and cooperatives;
- Power plants with power capacities between 1–10 MW are open for partnership between domestic and foreign companies—even though there are restrictions that necessitate domestic ownership of more than 50% [14]; and
- Power plants with power capacities larger than 10 MW are open for foreign capital ownership by up to 95%.

Various stakeholders are involved in the formulation of renewable energy policies and their implementation; these stakeholders possess several roles in the formulation of renewable energy policies and their implementation [15]:

1. The Ministry of Energy and Mineral Resources: responsible for policies and regulations in the energy sector. Possesses the Directorate-General of Renewable Energy and Energy Conservation in connection with administrative interests and support for renewable energy and energy efficiency. Manages the electricity sector through the Directorate-General of Electricity and Energy Utilization and supervises the performance of electricity companies, including the State Electricity Company–PLN.
2. National Energy Board: accommodates seven ministries as members and eight non-governmental members, that are responsible for the formulation of the National Energy Policy;
3. National Development Planning Agency (BAPPENAS): economic planning which also encompasses the energy sector;
4. Ministry of Finance: conducts control over government budgets and expenditures, including investments and incentives for renewable energy;

5. Ministry of Agriculture: manages palm oil plantations, etc., that are reserved for raw materials for biofuels;
6. Regional, provincial and regency/municipal governments: play an important role in policy implementation through the development of regulations and issuance of permits; and
7. Other government institutions: The Ministry of Environment and Forestry has influence on renewable energy, for example through the utilization of forest land for geothermal development; the Ministry of State-owned Enterprises supervises state-owned energy enterprises and influences energy policy implementation; the Ministry of Industry is responsible for issues related to industry.

However, it needs to be noted that in contrast to practices in various countries including Thailand and the Philippines, there is no independent regulator in Indonesia to resolve disputes and give recommendations/determine prices.

The decentralization reform has caused the reallocation of authorization for investment policies to regional governments, which necessitates project developers to comply with the authorities of both central and regional (decentralized) governments. The decentralization reform, implemented since 2001, has caused a transfer of authority in policy. Project developers must comply with regulations that have been instated at various levels. Within certain limits that are decreed in the Law on Taxes and Regional Retribution, both provincial government and regional governments can enforce their own fiscal policies related to renewable energy, issue permits for regional electricity companies, as well as determine regional electricity tariffs.

The actors of renewable energy policies are public and private companies which include:

- The State Electricity Company (PLN): owns a large share of power plants, handles the majority of transmission of distribution.
- Independent Power Producers (IPPs): several currently exist
- Individual IPPs that sell electricity from renewable energy power plants to PLN
- Fuel distributors: includes Pertamina, PT AKR Corporindo, PT Surya Parna Niaga (SPN), Shell and Petronas
- Biofuel producers

The Ministry of Finance is committed to supporting the development and utilization of renewable energy in Indonesia, in order to assist Indonesia in achieving its ambitious targets for reducing greenhouse gas emissions, increase its energy security, and facilitate access to energy and regional development. However, although there are several beneficial and potential sources of renewable energy to be developed, Indonesia has not yet succeeded in fully optimizing their development, as seen in Indonesia's energy mix policy. Meanwhile, neighboring countries have succeeded in developing and utilizing renewable energy.

The State Electricity Company (PLN) currently has no obligations to increase the number of renewable energy power plants that are connected to its grid. This means that in outlying regions, thermal generators are prioritized due to faster construction time and ease of integrating them with other sources of energy. PLN projects that, until 2021, only approximately 13% of output will be derived from renewable energy. In fact, even when taking into account the fact that there will be an opportunity to shift to renewable energy outside the generation sector, the company is still struggling to achieve the National Energy Policy target for 2025, namely 23%, for all energy sources.

Explicit targets from PLN for the utilization of renewable energy, consistent with renewable energy targets decreed in the National Energy Policy (23% of the energy mix in 2025 and 31% in 2050), will place added pressure on PLN to attain Power Purchase Agreements (PPAs) for renewable energy. For example, if the current proportion of renewable energy that is used for power generation is maintained (a little above 5%), the 23% target for the energy sector as a whole would mean that 46% of energy input to the power generation sector would have to come from renewable sources,

an increase from the current input of 13%. If only 25% of renewable energy is used for power plants, the proportion of renewable energy used for power generation needs to be increased from 13% to 23%. These targets help increase investor trust, in that the PLN possesses long-term commitment to use renewable energy sources. These targets must be supported by remuneration incentives for senior PLN management, which reflects the importance of target realization.

In many cases, renewable energy would be more expensive to develop than the fossil fuels. For this reason, if the PLN desires to achieve these targets, commercial flexibility and more significant price determination are required, ideally under the supervision of an independent regulator. The benefits of efficiency would also help the PLN fulfil its targets of renewable power.

The implementation of renewable energy targets for the PLN is one of the priorities of the Ministry of Finance. In addition, it requires cooperation with other ministries in order to significantly increase the utilization of renewable energy, because the PLN cannot achieve these targets without the correct incentives. Direct costs that are associated with this reform are considered to be low, even though they depend on the commercial flexibility given to the PLN; target realization would require additional public resources.

The Ministry of Energy and Mineral Resources has contrived obligations for the use of biodiesel and bioethanol. Fuel distributors are obligated to mix their products with biofuels, pursuant to Regulation of the Ministry of Energy and Mineral Resources No. 32 of 2008 [16], which was amended by the Letter of Decree of the Ministry of Energy and Mineral Resources No. 25 of 2013 [17]. Fuel distribution for the transportation, industry and commercial sectors are obligated to have biofuel increased by 25% and bioethanol increased by 20% by 2025. In the industry sector, only mining is applicable for this regulation, but the Ministry of Energy and Mineral Resources is planning to encompass more sectors in the future. A 30% biodiesel consumption in 2025 is also required for power plants. It is worth noting that there has yet to be a more comprehensive assessment on the impacts of biofuel production in Indonesia, especially related to both direct and indirect changes in land use due to increasing production of biofuels [18].

The percentage of renewable energy (except biomass) in the primary energy supply has been in a stable position, namely a little under 5% for the past few years [19]; it is still 20% short of the target for 2030, and 26% short of the target for 2050. Indonesia requires significant effort to develop the potential of renewable energy if it desires to achieve the National Energy Policy target.

The percentage of biodiesel use in the transportation sector has increased, but the use of biofuels in other sectors is still low. If biodiesel usage can grow rapidly, the biodiesel targets determined by the Ministry of Energy and Mineral Resources can be achieved. However, conversely, bioethanol production was stopped in 2010 due to inefficient production. Bioethanol was used for the consumer goods industries, but the mixing of bioethanol for transportation was stopped in 2010 because domestic production also ended. Indonesia's target for 20% bioethanol mixing in 2025 in the transportation, industry and commercial sectors requires strengthening in government support and a significant increase of capacity.

3.2. Economic

Although Indonesia is the largest exporter of coal in the world, it still receives challenges in energy security and demand—especially the import of crude oil—which to date has experienced a fairly dramatic increase. Indonesia has surpassed Australia as the largest exporter of coal in the world (based on mass) in 2011. However, continuously rising domestic oil consumption, limited investments and declining production has caused Indonesia in 1999 and 2005 to become a net importer of oil and other oil-based products.

The increasing dependence on imported fuels has burdened the financial sector. To date, government policy is to subsidize oil fuel prices to push the expansion of access to energy. However, on the other side, this also causes Indonesia to be vulnerable to price fluctuations in the international market. The 2013 State Budget, as approved by the Budget Committee at a plenary session of the

House of Representatives, states that oil fuel subsidies reached Rp200 trillion, with the largest oil fuel subsidies allocated for "premium" fuel and diesel. This challenge is prone to enlarging, because economic growth requires a large amount of energy.

Increasing renewable energy sources can increase Indonesia's energy security and decrease its dependency on fossil fuels. An increase of renewable energy can reduce dependency on imported oil and price fluctuations, as well as spur the diversification of energy sources and stabilize the trade balance. In this case, without setting aside the increase in demand for transportation fuels, the right incentives, price restructuring, and political commitment for the biofuel industry could stabilize the import of oil fuels, both premium and diesel, in 2020 [20].

The ocean and fishery sector is also deeply affected by the energy issue. This is due to the abundant amount of renewable energy that originates from the ocean. Ocean energy can be exploited in various forms, such as wind power, solar power, current power, wave power, tidal power, and differences in ocean temperature. Nevertheless, to date these ocean energy potentials have not yet been optimally utilized, and dependence on fossil energy has persisted. Facts show that advances in the optimization of ocean resources are sluggish. Therefore, coastal areas and small islands have the opportunity to become national energy stocks due to the large amount of potential energy contained in surrounding waters. On the other side, to date these regions are also pockets of poverty, one factor of this being limited energy supplies.

There are several variables that support the development of renewable energy, such as:

- The economic prospect of projects—Renewable energy projects must be able to bring in levels of return that are adjusted to risk. Currently, there are several renewable energy technologies in Indonesia that do not give good levels of return due to unsupportive policies. Energy subsidies are the primary obstacles to fulfilling Indonesia's renewable energy targets. Although aimed at increasing the production of renewable energy and reducing the proportion of energy originating from fossil fuels, energy price policies are counterintuitive to this objective. When energy subsidies decrease, at least the reduction of these subsidies are allocated to price externalities for energy consumption, such as carbon dioxide emissions, especially in power plants, which in the future will support renewable energy. Through the National Action Plan for Reducing Greenhouse Gas Emissions (RAN-GRK), implemented by the National Development Planning Agency, Indonesia has committed to reduce its greenhouse gas emissions. From the aspect of cost effectiveness, the best way to achieve this is through price determination. The government has taken important steps through cooperation with the Partnership for Market Readiness, and by undertaking preparatory work to introduce market instruments to support mitigation activities [21]. Calculations for carbon prices from energy production and energy price usage, which can potentially be initiated in the electricity sector, would make renewable energy sources more competitive as well as increase their absorption. Cutting back on energy subsidies is a high-priority policy reform for the Ministry of Finance [22]. The Ministry of Finance directly controls subsidy budgets, including those used to cover fuel and electricity. Therefore, even with major political challenges, Indonesia is in a strong position to gradually remove its energy subsidies in the mid-range. The utilization of renewable energy will receive a positive impact, because the market will achieve a new equilibrium wherein conventional energy sources are no longer unjustly benefited. In addition, cutbacks on energy subsidies would also reduce public expenditures.
- Access to financing—Apart from the level of profit from renewable energy projects, investment will not be realized if there is only a small amount of remaining capital. Not only does financing need to be available with fair levels of interest to reflect investment risk, but there also needs to be access to the proper types of financial services, as well as a consistent tolerance level on risks, with a risk profile that underlies investments. This is known to be a specific challenge for Indonesia, where many financial institutions are unwilling to invest in what is perceived as new and risky technologies [23].

- Political-Economy—As a foundation for the other two variables, there needs to be a good political-economic environment. Investors in renewable energy projects must possess the belief that there is strong commitment, both now and in the future, for policies that facilitate strong economic prospects for projects as well as access to financing. A larger framework also needs to be supportive of private investors.

3.2.1. Fiscal Incentives in the Development of Renewable Energy

The primary fiscal incentive for renewable energy was regulated through the Regulation of the Ministry of Finance (PMK) No. 21/PMK.011/2010 [24]. This regulation gives tax incentives for all renewable energy producers and all assembly and imports of machinery required for production. These incentives were given through case-by-case consideration, and included terms related to income tax, value added tax, import duty, and taxes paid by the government. Terms for income taxes encompass:

- 30% reduction in net income out of total investment (for 6 years, at 5% per year);
- acceleration of permanent asset depreciation used in renewable energy production, which varies depending on the asset type;
- a 10% income tax for dividends received by non-residents in renewable energy production (or in accordance with tax agreements);
- compensation for loss, which helps producers absorb losses throughout several years before receiving income, thus reducing tax payment for 5 or 10 years, with the possibility of consideration of further extending compensation periods; and
- exception from Article 22 of income tax, for the import of machinery and tools required for renewable energy production.

This decree was implemented in compliance with Government Regulation No. 1 of 2007 [25], which was later updated through President Regulation No. 52 of 2011 [26]. Furthermore, Regulation of the Ministry of Finance No. 21/PMK.011/2010 [24] gives exceptions for value added tax and import duty, as well as several taxes covered by the government:

- exemption of value added tax applies to import of machinery and tools, but does not include spare parts required by companies for the utilization of renewable energy sources;
- exemption of import duty for capital and machinery used for renewable energy production can be requested if it is included in the master list. This only applies if these goods are not available in Indonesia, or if the product specifications in Indonesia are not suitable. This exemption applies for two years and can be extended for one more year; and
- the government can choose to pay certain taxes or duties if the given sector is included in annual laws on the State Budget.

In 2012, Rp815 billion from income taxes in the geothermal sector was paid by the government. Government Regulation No. 52 of 2011 [27], implemented through the Regulation of the Ministry of Finance No. 144/PMK.011/2012 [28], gives the same incentives with clearer procedures, but only for certain sectors. This regulation gives incentives for companies investing in sectors/regions that are deemed to possess high national priority and encompasses 129 types of investment (52 types of investment in certain sectors and 77 types of investment in certain regions), which include:

- power plants: new energy technologies including hydrogen, CBM, coal gasification and liquefaction, renewable energy technology including hydro, solar, wind, and ocean energy;
- geothermal energy: all geothermal exploration, drilling, and electricity generation;
- processing of organic waste in palm oil factories to produce biogas as supplies, in order to produce electricity or hydrogen; and
- the bioenergy industry (biodiesel, bio-oil and bioethanol).

The Directorate-General of Taxes gave approval on facilities, based on recommendations from the Head of the Investment Coordinating Board (BKPM). The Directorate-General of Taxes will release decisions of approval within ten days subsequent to receiving recommendations from the Investment Coordinating Board—to date, these terms are the only time limitations for the approval process. Approved terms for tax facilities can be used in the fiscal year wherein investors have realized at least 80% of investment plans, after the Directorate-General of Taxes pays its field audits and releases letters to verify that these investments have been realized. After the tax facilities have been given, receivers of these facilities must submit periodic reports (on the due date of these taxes) on investment realization, production, and details on permanent assets, ownership, transfer and replacement. If companies have fulfilled the requirements for these two regulations, they can choose to make a request to use regulation No. 144/PMK.011/2012 or No. 21/PMK.011/2011.

3.2.2. Repairing and Stabilizing the Price Regime of Renewable Energy

The incessantly shifting nature of price regimes for renewable energy has created market uncertainty. Often-occurring changes in price regimes have made current policy frameworks for prices less transparent, sustainable and consistent. This has caused investors to be uncertain about investments. A primary example of this are the price policies for geothermal and mini-hydro energy; meanwhile, there is always intense discussion on whether or not the system will change back into a competitive tender system with price ceilings. Likewise, the hope for an increase in feed-in tariffs (FITs) for mini-hydro developers has caused developers to postpone investment.

For renewable power generation facilities below 10 MW, the current FITs regime seems to be widely successful and needs to be maintained in accordance with potential. For renewable power generation facilities above 10 MW, several price guidelines for different technologies need to be implemented. These guidelines need to give price estimations that are hoped to later be approved and included in PPAs.

To promote fiscal sustainability, price ranges and prices within these ranges need to consider the economic feasibility of renewable energy technologies, which can be calculated by comparing generation prices from renewable energy technologies with generation prices from conventional technologies that are usually found in certain locations (avoidable generation prices).

The lack of price guidelines, except for those related to geothermal energy, has caused difficulties for stakeholders to have conviction in the development of electricity sales for currently existing projects, due to uncertainty over generally prevailing prices. Consequently, this leads to disregarding a number of renewable energy opportunities from the energy supply side. At the same time, the official FITs system is likely to be difficult to maintain, given the differing conditions throughout the country–differences that will highlighted for larger facilities that produce larger output.

Price controlling is needed so that efficiently operating generators can be expected to fulfil rational targets for internal rates of return (IRR). Financial models that support the price calculations also need to be publicized so that stakeholders can assess the existing assumptions.

3.2.3. Budget Composition of Ministries for the Renewable Energy Sector

As an attempt to increase the utilization of renewable energy, the government allocated Rp2,116 trillion in the 2016 Revised State Budget, with a utilization target for renewable energy amounting to 18,600 MW in 2019. Funding for the development of renewable energy that is derived from the 2016 State Budget will be focused on solar energy. The number of solar energy power plants that will be built by the government will significantly increase, with a targeted total capacity of solar energy power plants of 18,359 kWp, increasing from 5070 kWp from the previous year.

Apart from being allocated for the construction of solar energy power plants, other types of infrastructure that will be built in 2016 are 6122 kWp of micro-hydro energy power plants, 850 kilowatts (kW) of wind energy power plants, 1500 kW of urban waste energy power plants, 3000 kW of waste

energy power plants, 1000 kW of seaweed bioenergy power plants, 5000 kW of bio-oil energy power plants, 23,100 kiloliters (kl) of biofuel tanks, and public lighting in 10 cities.

In its development, the government has conducted budget efficiency for ministries/agencies and regional transfers for the 2016 fiscal year. Budget cutbacks for ministries/agencies are initiated because targets for state revenues in the 2016 Revised State Budget are likely to be unable to be realized. In this case, the Ministry of Energy and Mineral Resources is one ministry/agency that has experienced budget cutbacks of Rp900 billion. In fact, government data state that the institution that has suffered the largest budget cutback is the Directorate-General for Renewable Energy and Energy Conservation.

The budget for the Directorate-General of Renewable Energy and Energy Conservation, previously Rp2.1 trillion, has been reduced to Rp1.7 trillion–a cutback of almost Rp400 billion. Nevertheless, the government still attempts to maintain strategic programs that are primary priorities in the sector of renewable energy and energy conservation. For example, the government did not cut back on the Bright Indonesia Program to electrify outlying villages that are still without electricity. Cutbacks in the Directorate-General of Renewable Energy and Energy Conservation are aimed primarily at projects that are impossible to realize by 2016. An example is the construction of micro-hydro energy power plants in Papua, at the border between Indonesia and Papua New Guinea, which to date have not received Environmental Impact Assessment licenses. In addition, the budget for waste energy power plants in Bali has also been abolished due to preparatory difficulties. The Directorate General of Renewable Energy and Energy Conservation stated that the fairly large budget cutback was due to the cancellation of a project to install solar panels on the rooftops of three airports–Medan, Bali and Makassar.

3.3. Social

In 2011, 66 million people (approximately 27% of the entire population) did not have access to electricity and 102 million people (approximately 42% of the entire population) relied on traditional biomass for cooking [29]. With the large dispersion of islands and geographical size, Indonesia faces an extraordinary challenge in the process of connecting its residents to electricity access.

The operational costs for diesel generators in rural areas in Indonesia were estimated to be in the range of Rp3000–9000/kWh [30]. Conversely, a 100 kW solar energy power plant in an island in eastern Indonesia only produces costs of Rp2800/kWh. A hybrid system which combines solar energy power plants and diesel generators could become an interesting choice for a number of regions in Indonesia. Several studies indicate that this system gives a more reliable supply of electricity with smaller costs compared to only relying on solar energy power plants (with a lower level of reliability). This potential has been acknowledged and inserted by the PLN into the development plan for constructing solar energy power plants in 1000 islands, which targets the installation of 620 MW of solar energy power plants in outlying regions by 2020, by creating mini and micro networks that combine diesel generators, biomass and solar panels [31].

The current national unemployment level is at 5.13%, a significant improvement when compared to 11.2% in 2005 [32]. However, the majority of these new jobs are of low quality. The International Labor Organization (ILO) estimates that approximately 60 to 63% of workers are categorized as vulnerable workers, casual workers, outsourced workers and family workers [33]. These types of work generally do not give adequate social protection, and do not fulfil the minimum wage standards of workers or give opportunities for social dialogue. Therefore, the ILO, with support from the government, has promoted green jobs, which are environmentally sound and friendly jobs. More precisely, green jobs will help reduce the consumption of energy and raw materials, catalyze the decarbonization process of the economy, protect and improve the ecosystem and biodiversity and minimize the production of waste and pollution. In addition, the ILO has declared that a job can be categorized as a green job if the job is adequate, productive, and contains the opportunity to receive ample wages, social protection and social security for workers and their families, as well as the right to conduct social dialogue.

The geothermal and biomass energy subsectors currently provide around 5000 green jobs. In addition, the majority of the 331,000 green jobs in the manufacturing sector are connected to the production of renewable energy components, whereas the majority of the 187,000 green jobs in the construction sector are connected to the installation and assembly of renewable energy power plants. Renewable energy has a large potential to spur the growth of quality jobs in Indonesia, because green jobs involve labor-intensive work. For example, solar panels require 3 to 10 times the number of workers compared to crude oil and coal; wind and biomass energy power plants can absorb up to three times the number of labor-intensive workers compared to conventional resources [34].

Important aspects of job creation from renewable energy that need to be considered, therefore, include: (1) the rigidity of the labor market, meaning that there are short-term costs, such as training, so that workers are able to undertake jobs that are related to renewable energy; (2) the high level of labor intensiveness indicates that the productivity of labor is low; and (3) the high cost of renewable energy has a negative effect on competition and price, although this is less of a concern if renewable energy replaces the more costly conventional energy.

3.4. Technological

The development of the renewable energy sector requires reliable and cost-effective technology [35]. For this reason, there needs to be a form of cooperation with related parties in order to adequately develop this sector. With rapid advances in renewable energy technology, there needs to be an improvement in the determination of renewable energy prices in accordance with economic conditions so that the sector can compete with fossil energy prices. In addition, there needs to be a joint commitment between the government and business actors, and support from the national financial sector in order to build capital-intensive, technology-intensive and high-risk infrastructures for renewable energy. This can be done through support in the form of fiscal incentives, investment guarantees, regulation assurances, and subsidies, as well as special attention to isolated regions and frontier islands that directly border other countries.

To date, the majority of technology for the development and utilization of renewable energy is supplied by foreign parties. Several renewable energy technologies have been mastered, such as small- to medium-scale power plants and biogas technology for non-electricity needs.

One of the main obstacles in the development of renewable energy is government policies that give a relatively small number of subsidies and incentives for investors in green technology. Subsidies are still too small compared to subsidies for primary fossil energy, whereas investment costs for renewable energy are still high due to minimal domestic components being available for this technology. Consequently, the value of renewable energy is uncompetitive compared to fossil energy. Existing conditions result in a relatively long and uncertain period for profit, which means that investments in renewable energy are unattractive for both national and foreign investors. There are currently a number of technology developers and manufacturers of renewable energy systems in Indonesia; however, they are vocal in expressing their concern about the lack of incentives from the government, especially regarding the pricing schemes of renewable and sustainable energy.

3.5. Legal

Energy in Indonesia is regulated by Law No. 30 of 2007 [2]. This Energy Law also established the National Energy Board with the authority to plan and formulate long-term energy policies, as elaborated in the National Energy Policy. The latest National Energy Policy was approved by the House of Representatives in early 2014 and encompasses targets for the utilization of renewable energy. Other laws and regulations complement the legal umbrella connected to specific fields, such as foreign investment. Law No. 25 of 2007 is the main policy framework related to investment, which elaborates the principles of establishment and operations for business activities [12].

Connected to the regulation of the utilization and tariffs for renewable energy, the following are several legal frameworks that are targeted by existing policy implementations.

3.5.1. Geothermal Energy

The government has given special technological incentives and general incentives, including FITs and PPA standards.

The Regulation of the Ministry of Energy and Mineral Resources No. 17 of 2004 on Power Purchasing from Geothermal Power Plants and Geothermal Steam for Geothermal Power Plants [36] has instated the tariff ceiling for electricity generated by geothermal power plants, as a guideline for prices determined in PPAs after the tendering process. In this new regulation, tariffs are determined based on location and Commercial Operation Date plans, in order to give assurance and anticipate effects from inflation. In 2015, the tariff ceiling ranged from USD 0.118 to USD 0.254 depending on location and will increase to between USD 0.159 and USD 0.296 by 2025 for projects with subsequent Commercial Operation Dates. This regulation revised the regulation of 2012, which bases tariffs on project locations, whether or not these projects are connected to medium- or high-voltage grids. This regulation also still mandates the PLN to develop the PPA model for geothermal projects.

There is a special revolving fund facility, the Geothermal Fund Facility (GFF), aimed at reducing risk related to geothermal exploration. The Government Investment Unit manages funds which aim to reduce early-stage development risk by giving support to the collection of high-quality data and information on new and potential geothermal locations. This project development stage usually uses up between USD 15–25 million over roughly three years, which encompasses at least 10% of total capital expenditures [37]. The GFF aims to reduce these obstacles through anticipated services and products; primarily, as stipulated in the Regulation of the Minister of Finance No. 3/PMK 011 of 2012 [38], the GFF provides:

- up to USD30 million of loans for explorations at the interest rate of the central bank, paid only if a location is proved to be productive; funding is given to the regional government (which has possibly conducted external tendering for the subsequently proved locations) and qualified private investors; and
- information and data which have been verified by reputable consultants, with real costs and an additional 5% margin, paid for by interested parties.

Cumulative funding that was available throughout 2011–2013 amounted to more than Rp3.1 trillion (approximately USD217 million). Since then, several funding proposals are in advanced stages, although no real cash has yet been discharged. The Indonesian Geological Body is responsible for subsidized data collection, although no surveys have yet been conducted. Several stakeholders feel that there is uncertainty over the type of products that will be offered by this facility, as well as the interest rate.

3.5.2. Solar Energy

Regulation of the Minister of Energy and Mineral Resources No. 17 of 2013 [39] determined the allocation and price of solar energy. The tender for capacity quotas for solar energy, that will require the PLN to purchase, has been in effect since then. In April 2013, 172.5 MW was tendered with a tariff ceiling of USD0.25/kWh, to be increased to USD0.30/kWh if project developers use more than 40% of local components. Successful bidders must show that they fulfil various administrative, technical and financial conditions; bids with the lowest price for the offered capacity will win. The PLN offers a 20-year PPA standard for successful bidders. A number of developers have expressed concern over the ceiling price, which currently is too low for developing feasible projects, especially when taking into consideration the possibility that many solar panel projects require foreign funding; their concern also includes the poor grid quality, especially outside the Java and Bali grids, which can complicate the transmission of solar-powered electricity that is generated into the grid.

The PLN plans to offer a net metering program for rooftop solar panel generators up to 1 MW; this program has not yet been officially instated nor regulated through ministry-level regulations. Currently, Regulation of the Board of Directors of the PLN No. 0733 of 2013 [40] only stipulates

the basic principles. This allows homeowners to generate electricity from solar panels and transmit their surplus production into the grid, with compensation in the form of reduced electricity bills for customers. The net excess of production is not compensated. Reports [41] show that net calculations would only be attractive for customers who pay the highest tariffs. Stakeholders expect that this policy would take at least one year before it is officially instated.

3.5.3. Small-Scale Renewable Energy Power Plants

Regulation of the Ministry of Energy and Mineral Resources No. 4 of 2012 [42] stipulated that the PLN must purchase electricity from renewable energy projects that have capacities below 10 MW. FITs are available for biomass and biogas technologies (stipulated in Regulation of the Minister of Energy and Mineral Resources No. 27 of 2014) [43], urban solid waste (through the stipulation of the Regulation of the Ministry of Energy and Mineral Resources No. 19 of 2013) [44] and other renewable energies, with prices ranging from Rp970–1798/kWh for low-voltage grids (average tariffs taken into account) and Rp880–1450/kWh for mid-voltage grids (average tariffs taken into account).

3.5.4. Biofuels

Biofuel producers can benefit from subsidies and tax reductions [15]; biofuel producers receive Rp3000/l and bioethanol producers receive Rp3500/l. In addition, biofuel producers fulfil the requirements for value added tax restitution, but this can only be claimed retrospectively.

The government has released a price formula for biodiesel and bioethanol for fuels. Fuel distributors such as PT Pertamina are required to apply this price formula in their tenders for biofuels. The Decree of the Minister of Energy and Mineral Resources No. 2185K/12/MEM/2014 [45] stipulates that biodiesel prices be as large as those of Middle Oil Platts Singapore (MOPS) plus 3.48%.

3.6. Environmental

Indonesia has shown the international community its plans for reducing emissions. The National Action Plan for Reducing Greenhouse Gas Emissions (RAN-GRK) has committed to reduce emissions in 2020 by 26% below the emissions produced from business-as-usual (BAU) with domestic funding, and 41% below BAU if international support is available. RAN-GRK is a working framework for supporting mitigation activities, including within the agriculture, forestry and peatland, energy and transportation, industry, and waste processing fields. Its objective is to become a guideline for the central government and regional governments, the public, and economic actors in conducting planning, implementation, supervision and evaluation of the action plan to reduce greenhouse gas emissions.

Reducing emissions from the energy sector will be important in realizing the formulated objectives. Although emissions from the electricity and transportation sectors only contributed 170 tons of emissions in 2005, i.e., less than 10% of total emissions, these sectors are projected to increase their emissions by more than 8% per year and by approximately 1250 million tons, or almost 40%, in 2030. This projected growth is faster compared to other emission sources.

Several renewable energy options can reduce emissions with relatively low costs. Geothermal energy could give a reduction of approximately 35 $MtCO_2$ per year with costs amounting to only a little above USD10/tCO_2. In addition, the potential to reduce costs from renewable energy sources, including solar panels, biomass and wind, are quite significant, even though these alternatives are on average more expensive, with costs ranging between USD20–30/tCO_2.

Renewable energy resources could also contribute to the improvement and advancement of environmental and human health. Toxic gas emissions and various particles discharged from fossil fuel combustion have negative impacts on human and environmental health in many large cities. Like in other large cities in Southeast Asia, the level of PM10 (particulate matter that is 10 micrograms per cubic meter or less in diameter) in the majority of large cities in Indonesia has surpassed the limit of air quality, as specified by the World Health Organization (WHO). The WHO projects Indonesia's condition, which reflects the lack of policy focus on improving the quality of air in cities. In total,

air pollution has caused approximately 32,300 deaths every year from 2004 to 2015 [46]. In 2011, Indonesia contributed 1,290,000,000 tons of CO_2e, making it the 6th largest greenhouse gas emitter in the world and contributing 4.5% of total global greenhouse gas emissions [47].

4. Discussion

Based on the PESTLE analysis, we can see in a more holistic way how certain aspects of PESTLE dynamically impact on each other. For example, one of the issues pertinent to the legal aspect is the lack of an overarching national law or regulation that will serve as a dedicated legal umbrella for all subsidiary regulations on renewable energy. At present, the Energy Law of 2007 is still too broadly defined and lacks the specific level of elucidation necessary for a truly comprehensive policy on renewable energy. A Renewable Energy Bill is currently being formulated at the House of Representatives, but at present, the lack of such a legal precondition indirectly reflects and leads to a fragile and haphazard political state of renewable energy policies, limited to the ministerial level. These temporary and fleeting policies give a worrying signal to investors of a political regime that is still unsteady in its policy-making.

On a further note, it is interesting to note that in the context of Indonesia, the relative academic lacuna in literature concerning supply chain management for renewable energy is also mirrored by that of a technocratic lacuna of supply chain management planning for renewable energy. We see how ASEAN frameworks have already incorporated crucial infrastructure planning for regional energy flows, such as the ASEAN Power Grid and Trans-ASEAN Gas Pipeline. However, a similar approach at the national level—one that involves a comprehensive geographic mapping and projecting of renewable energy supply chains and infrastructures throughout the Indonesian archipelago—is still lacking. National technocratic discourse on renewable energy primarily still revolves around pricing policies—an unavoidable bone of contention—vis-à-vis the fossil fuel industry.

While the economic aspect of Indonesia's nascent renewable energy industry is one of the most pressing concerns, it can also be perceived as an early checkpoint into more advanced and technical discussion. The renewable energy development does not only encompass project economics, but also "technical constraints, *supply chain capacity* [italicized here for emphasis], social effects, namely to amenity and aesthetics, and environmental impacts" [48]. This "supply chain capacity" translates into abstracting the flows of (renewable) energy and material into modular yet robust upstream-to-downstream planning. Such a supply chain management that specifically serves to accommodate the renewable energy sector must also be holistic in nature [49]. Bearing a similarity to the multifaceted PESTLE analysis, a promising candidate model is Sustainable Supply Chain Management (SSCM) [50], which not only views supply chains in the context of the environment, but also expands their scope to encompass social and ethical issues. PESTLE analysis thus cements the groundwork for a national SSCM framework, as such a framework must necessarily take into account the various stakeholders involved in the entire sector.

Reflecting back on the national planning process on renewable energy, it is vital to implement the previous PESTLE analysis on a comprehensive stakeholder analysis of renewable energy interest groups and actors. An analysis of stakeholders that are involved in the development of renewable energy in Indonesia reflects the implications of implemented policies, as attempts to increase the role of renewable energy. This means that existing conditions become points of reference in the formulation of new policies for developing renewable energy. In connection with the development and utilization of fossil energy, as elaborated in the same method of analysis, patterns of policy implementation in the development of fossil fuels could be indicators in policy formulation for improving the management of renewable energy. Learning from the success of the implementation of fossil energy policies, which was then later implemented to improve the management of renewable energy, is a fairly effective method, and also strengthens arguments for undertaking the transformation from fossil energy to renewable energy.

It should be noted that identifying the relevant stakeholders in Indonesia's renewable energy sector—which inevitably ties in with state actors as well as the fossil fuel sector—is a crucial prerequisite for any serious recommendation for future national policy. In addition, through PESTLE analysis, it is possible to better highlight the criss-crossing and overlapping sectoral interests within the energy sector as a whole.

For example, as mentioned in Section 3, Indonesia requires renewable energy not only to advance towards a low-carbon economy in the face of dwindling fossil fuel reserves, but also to generate green jobs (the social context) and safeguard a sustainable environment for future generations. These points of concern necessarily encompass specific subsectors and stakeholders; promoting green jobs in renewable energy development is related to the national labor conditions and relevant stakeholders, which in turn then stems back to the underemphasized financial value of renewable energy sources in comparison to current fossil fuel standards. Through PESTLE analysis, a better understanding of the interrelationship of these ostensibly different aspects are juxtaposed and highlighted through stakeholders. In this PESTLE analysis, various stakeholders who contribute to the development and utilization of renewable energy have been identified and their interconnectedness is shown in Table 2.

Table 2. Stakeholders of the renewable energy industry in Indonesia.

Stakeholders	Political	Economic	Social	Technology	Environment	Legal
Commission VII of the House of Representatives of the Republic of Indonesia	√				√	√
Budget Committee of the House of Representatives of the Republic of Indonesia		√				
President of the Republic of Indonesia	√				√	
Ministry of Energy and Mineral Resources	√	√				
Ministry of Labor			√			
Ministry of Environment and Forestry					√	
Ministry of Agrarian Affairs and Spatial Planning		√				
Ministry of Transportation			√			
Ministry of Maritime Affairs and Fisheries					√	
Ministry of Finance		√				
Ministry of Trade		√		√		
Ministry of Industry	√					√
National Development Planning Agency	√					
National Energy Board				√	√	
Corruption Eradication Commission						√
Finance and Development Supervisory Agency						√
Supreme Audit Agency						√
Bank Indonesia (Central Bank)	√	√				
Constitutional Court						√
Investment Coordinating Board		√				
Directorate-General of Electricity and Energy Utilization		√				
Directorate-General of Renewable Energy		√				√
Directorate-General of Customs and Excise of the Ministry of Finance	√					
State-owned Enterprises	√	√				
Regionally-owned Enterprises	√	√				
National Banks		√				
Regency Government				√	√	
Provincial Government				√	√	
PLN (State Electricity Company)		√				
Independent Power Producers	√		√	√	√	
Investors	√					
Non-Governmental Organization					√	
Indonesian Chamber of Commerce	√	√			√	
The public			√			

5. Conclusions

The development and utilization of renewable energy has been assessed from the aspect of stakeholders using a PESTLE analysis, in an attempt to identify and correlate existing overlapping and cross-sectoral stakeholder interests in Indonesia's renewable energy sector. Existing policies are still in their infancy and subject to significant upgrades, given that the renewable energy industry is still quite minimal, especially in the current conditions of falling oil prices. The lack of suitable policies has

subsequently exposed the stakeholders and players in renewable energy to various risks–the greatest ones being economic and technological. The ability of the policy makers in Indonesia to identify these risks and mitigate them is indeed the key to success.

In the future, it is hoped that the government can formulate a breakthrough policy to improve the renewable energy sector, such as by giving ease to investors in the renewable energy sector, so as to enable the effective and efficient supply chain management of renewable energy. In addition, it should be noted that Indonesia's targets for renewable energy—23% primary energy mix by 2025—is synchronous with that of the ASEAN as a whole. Therefore, Indonesia should acknowledge and capitalize on this common regional goal and attempt to undertake cross-comparative research programs for national development. A PESTLE analysis for stakeholders in the renewable energy sector will also help cement a starting point for formulating a framework for a comprehensive national supply chain management for renewable energy.

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