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UTILIZATION OF ROOFTOP SOLAR SYSTEM FOR INDONESIAN ECONOMIC RECOVERY POST-COVID-19

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ABSTRACT

Pandemic Covid-19 brought an economic impact on many countries around the world, including Indonesia. To explore and formulate a post-pandemic economic recovery strategy that is oriented towards sustainable development, it is relevant now that the government considers the utilization of rooftop solar systems. Albeit its initial failure in the market, Indonesia's biggest power in renewable energy lies within solar and the government must actively promote its future endeavors, nonetheless. Rather than giving out the USD 1 billion budget into a one-time solution like electricity subsidies and fee relief schemes, investing in rooftop solar systems is wiser for long-time considerations. To put into perspective the importance of renewable energy in the energy mix, this paper will provide a comparison between Indonesia and German in energy transition and explain how the rooftop solar system could act as a strategy to accelerate Indonesian economic growth post-Covid-19. This research will use a normative legal method, particularly statute and comparative approach.

Keywords: Renewable Energy Mix, Rooftop Solar System, Covid-19.

INTISARI

Pandemi Covid-19 membawa dampak ekonomi bagi banyak negara di dunia, termasuk Indonesia. Guna menggali dan merumuskan strategi pemulihan ekonomi pasca pandemi yang berorientasi pada pembangunan berkelanjutan, maka relevan sekarang pemerintah mempertimbangkan pemanfaatan PLTS Atap. Meskipun kegagalan awalnya di pasar, kekuatan terbesar Indonesia dalam energi terbarukan terletak pada tenaga surya dan pemerintah harus secara aktif mempromosikan upaya masa depannya. Daripada memberikan anggaran USD 1 miliar ke dalam solusi satu kali seperti subsidi listrik dan skema keringanan biaya, berinvestasi dalam PLTS atap lebih bijaksana untuk pertimbangan jangka panjang. Untuk melihat pentingnya energi terbarukan dalam bauran energi, makalah ini akan memberikan perbandingan antara Indonesia dan Jerman dalam transisi energi dan menjelaskan bagaimana tata surya atap dapat bertindak sebagai strategi untuk mempercepat pertumbuhan ekonomi Indonesia pasca-Covid-19. Penelitian ini akan menggunakan metode hukum normatif, khususnya pendekatan undang-undang dan komparatif.

Kata kunci: Bauran Energi Baru Terbarukan, PLTS Atap, Covid-19.

INTRODUCTION

Renewable energy utilization and development (RE development) seems to be an increasing trend all over the world. Along with the increase of population, the demand for electricity will also increase as it is a driving force to support most human activities.[1] Especially at this difficult time, pandemic Covid-19, where social distancing is the new normal and work being done remotely instead of at an office or Work from Home (WFH), undoubtedly there will be a substantial increase in most household's electricity demand. The Director of Development and Electricity Business of the Ministry of Energy and Mineral Resources Hendra Iswahyudi stated that electricity consumption in July 2020 reached 20.18 terawatt hours (TWh), an increase from the previous month which only reached 19.2 TWh.[2] This certainly will be a problem since increase in electricity consumption means more money to spend while people's purchasing power is stagnant if not declining at best due to economic recession.[3] Taxpayers need access to cheap electricity so that their daily needs can be inherently fulfilled, or they will be rampant about where the tax money has been invested into. Renewable energy therefore becomes mandatory, not an option anymore.

The world has seen more renewable energy investment over the years, from around USD 80 billion in 2005 to more than USD 310 billion in 2017.[4] Pursuant to the Paris Agreement, most countries have agreed to transition towards a low carbon economy which can be achieved through RE development. As a result, studies related to the technology, financing, and policy for RE development are increasing over the years.[5]

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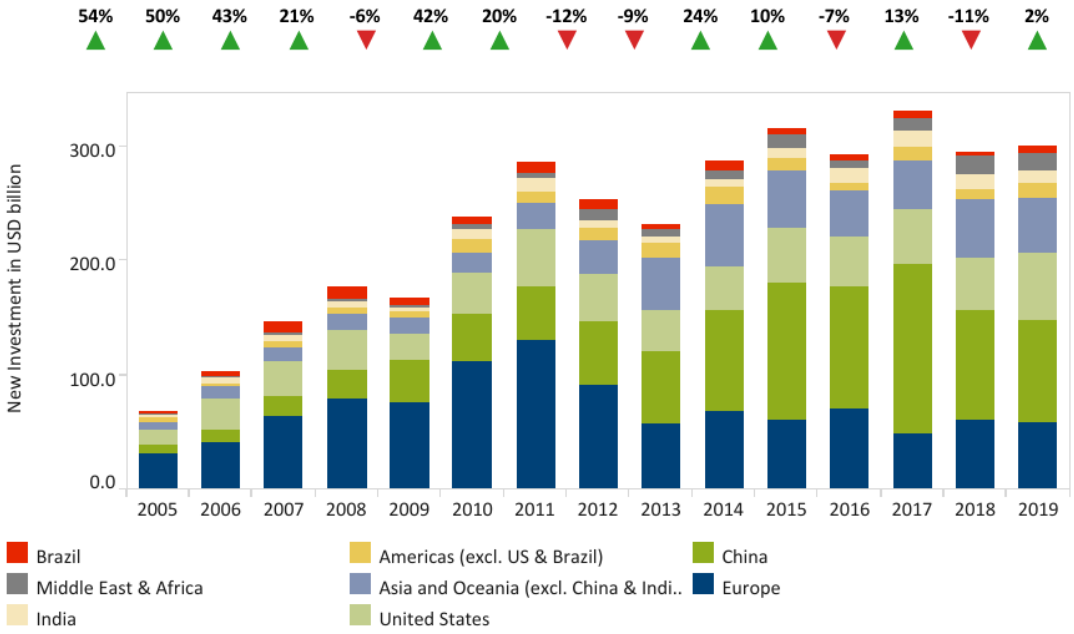
1 Agus Sugiyono and others, *Indonesia Energy Outlook 2014: Energy Development in Supporting Fuel Substitution Program* (Pusat Teknologi Pengembangan Sumberdaya Energi BPPT 2014), p. 2

2 Rull R Ramli, 'Kementerian ESDM: Konsumsi Listrik Mulai Berangsur' *Kompas* (18 August 2020) <https:// money.kompas.com/read/2020/08/18/131700726/kementerian-esdm--konsumsi-listrik-mulai-berangsur-naik?page=all> accessed 10 January 2021.

3 Adrian Wail Akhlas, 'Indonesia's Inflation Hits Record 20-Year Low in August amid Declining Purchasing Power' *The Jakarta Post* (Jakarta, 2 September 2020) <https://www.thejakartapost.com/news/2020/09/01/indonesias-inflation-hits-record-20-year-low-in-august-amid-declining-cpi.html> accessed 10 January 2021.

4 See Graph 1.

5 Horschig, T., & Thrän, D., 'Are decisions well supported for the energy transition? A review on modeling approaches for renewable energy policy evaluation', 7(5), (Energy, Sustainability and Society, 2017), <https://energsustainsoc.biomedcentral.com/articles/10.1186/s13705-017-0107-2>



Graph 1. Global trends in renewable energy investment[6]

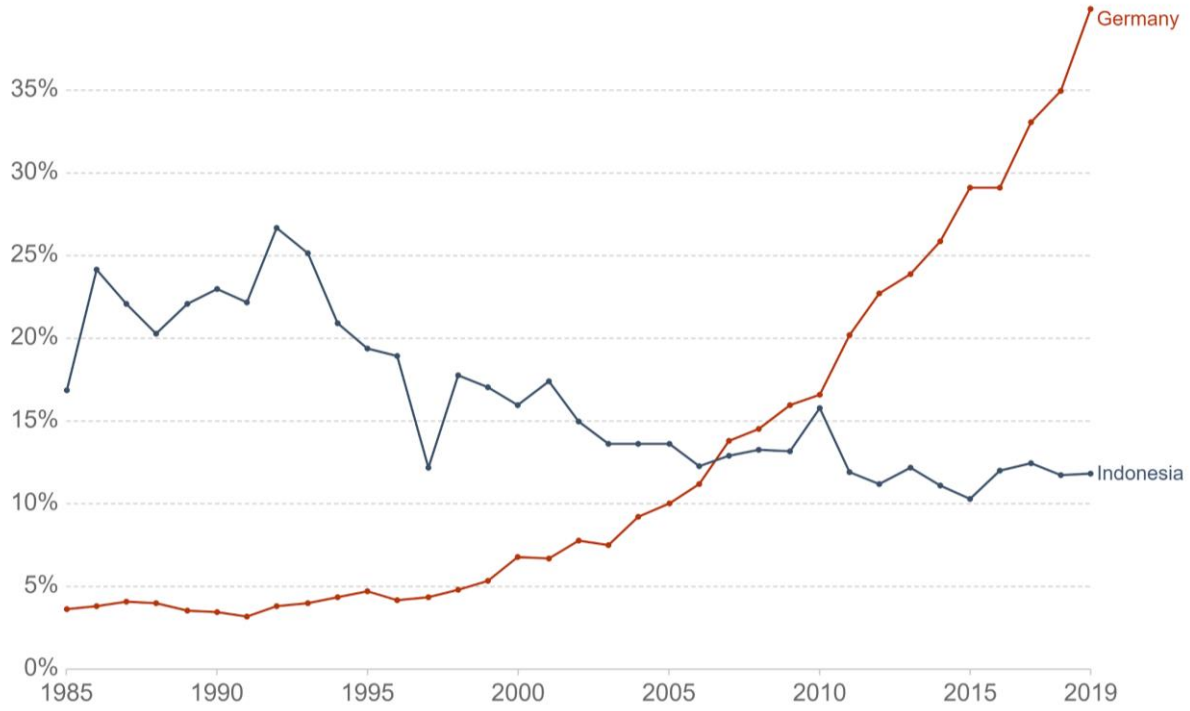
Presidential Regulation No. 22 of 2017 on the General National Energy Plan (RUEN) targets a renewable energy mix of 23% by 2025 and 31% by 2050. This national policy was a translation of the Government Regulation No. 79 of 2014 on National Energy Policy (KEN) using assumptions of certain economic and population growth in Indonesia. From the enactment of KEN, it is evidently shown that Indonesian government is abidden with the train of NRE utilization and development trends, in which transitioning toward a low carbon economy.

Germany, as the world's fourth largest economy, has been credited with one of the most effective energy transitions from fossil fuels to renewables.[7] *Energiewende* is a German energy transition initiative focused on four key drivers: (1) climate change (by lowering carbon dioxide emissions); (2) nuclear phase-out; (3) energy security (by reducing fossil-fuel dependence); and (4)

[6] International Renewable Energy Agency, 'Investment Trends' retrieved from <https://www.irena.org/Statistics/ View-Data-by- Topic/Finance-and-Investment/Investment-Trends> accessed 10 January 2021.

[7] Institute for Essential Services Reform, *Igniting Rapid Deployment of Renewable Energy in Indonesia: Lessons Learned from Three Countries* (IESR, Jakarta 2018), <http://iesr.or.id/wp-content/uploads/2019/05/IESR_ Research_Igniting-a-Rapid-Deployment-of-RE-in-Indonesia.pdf>, p. 18.

competitiveness and growth (industrial policies).[8] In contrast, Indonesia's energy mix seems to be falling off of renewables, it is declining, in fact.[9]



Graph 2. Share of electricity production from renewables[10]

Despite its government's commitment and vision, reality is often a boisterous ride for Indonesia's edge. Indonesian renewables portion in the energy mix started at 16.90% in 1985 and is falling apart to 11.80% in 2019, a -5.10pp absolute change and 30% relative drop overall.[11] That is otherworldly, pale in comparison with German renewables portion growth, which is a relative 994% increase and +36.25 pp absolute change.

Table 1. Share of electricity production from renewables[12]

Country	Start	End	Absolute Change	Relative Change

8 Institute for Essential Services Reform, (n.7), p. vi.

9 See Graph 2.

10 Our World in Data, 'Share of electricity production from renewables' retrieved from <https://ourworldindata.org/grapher/share-electricity-renewables?tab=chart&time=earliest.2019&country=DEU~IDN> accessed 10 January 2021

11 See Table 1.

12 Our World in Data, 'Share of electricity production from renewables' retrieved from <https://ourworldindata.org/grapher/share-electricity-renewables?tab=table&time=earliest.2019&country=DEU~IDN> accessed 10 January 2021.

Indonesia	16.90%	11.80%	-5.10 pp	-30%
Germany	3.65%	39.89%	+36.25 pp	+994%

Indonesia has abundant amounts of renewable energy resources, especially in solar energy, considering its climate that has year-round sunshine and mass geographic conditions, making it almost perfect to utilize solar energy. However, Indonesia is still lagging behind other countries despite its huge potential. One way to bring changes in the sector is to conduct a comparative study and/or learn from other countries which have been successful, in this case, transitioning toward green energy from conventionals. This journal aims to compare Indonesian and German renewable energy frameworks and take key lessons as to what can be done for Indonesia's future in best accordance with its potentials.

METHODS

The method of finding the law that relates to the issue posed by the facts of the case is legal research. Legal research and analysis are interrelated, and conducting legal research typically requires the use of analysis concepts. In legal research, there are three sorts of research methods: normative legal research, empirical legal research, and socio-legal research. The normative legal research will look into all components of positive law that apply in a certain jurisdiction. The empirical legal research, on the other hand, studies the applicable legal provisions and conditions that arise in society. The socio-legal research technique integrates the aspects of sociology and law.[13] The research method used in this paper is a normative legal research in statute approach and comparative approach that refers to norms, regulation, and doctrines in legal study. The type of data used is secondary data, which is obtained through official documents, books, and thesis. Data collection is done by studying the literature on legal materials.

RESULTS AND DISCUSSIONS

1. Renewable Energy Frameworks

Natural resource economics is a scope of science that studies how humans allocate scarce natural resources and studies the allocation of these natural resources. The faster the economic growth and development, the more natural resources are needed in the production process. Thus, economic

[13] William H. Putman, *Legal Research, Analysis and Writing, Second Edition* (Delmar Cengage Learning, New York 2010). <https://pdf.zlibcdn.com/dtoken/df9920683e8200baad93ec6655497fbc/Legal_research,_analysis,_and_ writing_by_Putman,_W_5968889_(z-lib.org).pdf>, p. 27.

development that must be implemented is environmentally sound development in the sense that it does not deplete natural resources and damage the environment.[14]

The green economy refers to an economic sector which focuses on the resilience of the environment. A green economy is an anticipation of black economic activity, namely economic growth dependent on fossil fuels such as coal, petroleum, and natural gas. The scope of the green economy is green energy development, which relies on renewable energy to substitute fossil fuel oil and energy storage with effective use of energy. A green economy is thus considered capable of achieving sustainable economic development and minimizing environmental pollution, global warming, natural resource depletion and deterioration of the ecosystem.[15]

Sustainable development is a process of change that occurs in situations where the exploitation of natural resources, investment, and technology and institutional development support each other to increase the potential of the current and future generations in meeting development needs.[16] In relation to energy, sustainable energy development can be achieved by providing access to an effective and adequate energy mix for national energy needs by providing a larger portion of renewable energy sources as well as increasing energy efficiency and mastery of energy-saving technologies.[17]

Energy security, defined by the International Energy Agency (IEA) as the availability of adequate quantities of energy resources, affordable prices, sustainability and safety in energy procurement.[18] In the meantime, according to Yergin, energy security is a term in which a country can protect

[14] Musa Jega Ibrahim, 'Introductory Chapter: Economics, Natural Resources and Sustainable Development', *Emerging Issues in Economics and Development* (IntechOpen 2017) <https://www.intechopen.com/books/emerging-issues-in-economics-and-development/introductory-chapter-economics-natural-resources-and-sustainable-development> accessed 2 July 2021.

[15] Doreen Fedrigo-Fazio and Patrick ten Brink, *Briefing: Green Economy, What Do We Mean by Green Economy?* (UNEP Division of Communications and Public Information 2012), p. 4.

[16] United Nations, 'What is Sustainable Development?' retrieved from <https://www.un.org/sustainable development/blog/2015/09/what-is-sustainable-development/> accessed 11 January 2021.

[17] Nur Tri Harjanto, 'Dampak Lingkungan Pusat Listrik Tenaga Fosil dan Prospek PLTN sebagai Sumber Energi Listrik Nasional', 1(1), 39, (Pusat Teknologi Bahan Bakar Nuklir, BATAN 2008), <http://jurnal.batan.go.id/ index.php/pin/article/download/2546/2330>, p. 39.

[18] International Energy Agency, 'Energy security: Ensuring the uninterrupted availability of energy sources at an affordable price', retrieved from <https://www.iea.org/areas-of-work/ensuring-energy-security> accessed 11 January 2021.

itself and grow by prioritizing security and the availability at reasonable rates of sufficient energy reserves, both oil and various other forms.[19]

Depending on where it comes from, energy is classified as primary or secondary. Primary energy commodities such as crude oil, hard coal, and natural gas are produced or collected directly from natural resources.[20] All energy commodities that are not primary but are derived from primary commodities are classified as secondary commodities. Primary and/or secondary energy transfer produces secondary energy. In the meantime, energy sources can be classified as renewable or non-renewable.

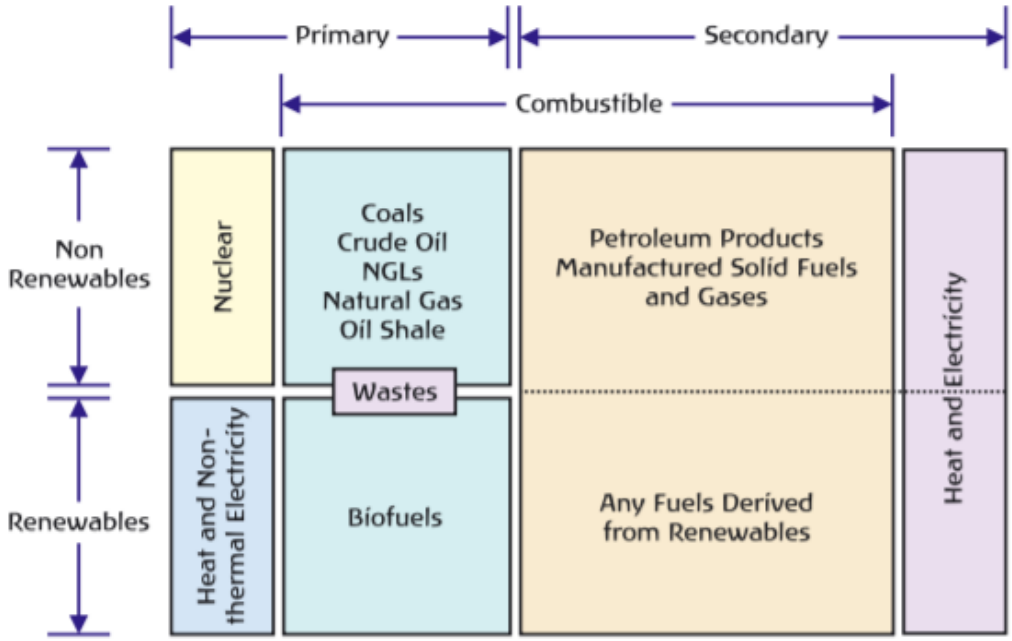


Figure 1. Terminology for energy commodities[21]

The World Council for Renewable Energy (WCRE) defines renewable energy in the form of solar, wind, water, sea, geothermal, biomass, and others which are derivatives of solar energy which are naturally renewable through natural processes. The IEA divides renewable and waste products into three groups in the "Renewables and Waste Questionnaire."

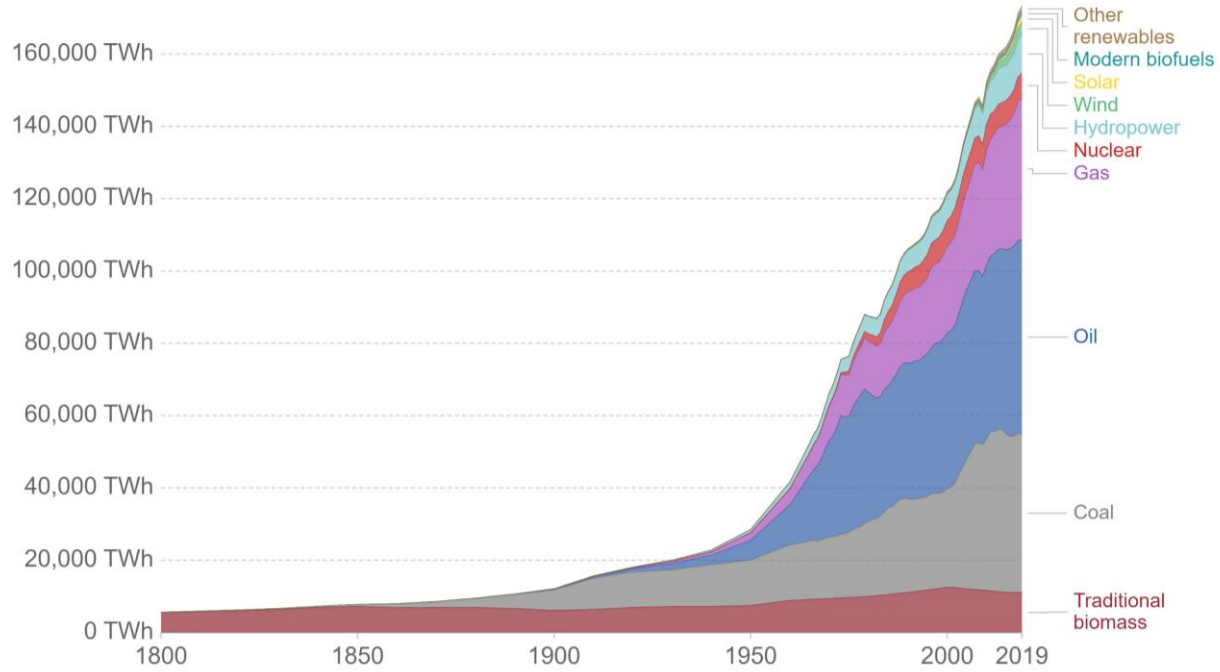
[19] Daniel Yergin, 'Ensuring Energy Security', 85(2), 69, (Council on Foreign Relations, 2006), <https:// www.jstor.org/stable/20031912>, p. 71.

[20] See Figure 1.

[21] International Energy Agency, *Energy Statistics Manual* (OECD/IEA, Paris 2005), <https://ec.europa.eu/eurostat/ramon/statmanuals/files/Energy_statistics_manual_2004_EN.pdf>, p. 18.

Group I consist of products that must be transformed into electricity to be captured, such as hydro, wind, tide, wave, ocean, and solar photovoltaic. Group II consists of products that are manufactured and then used in a variety of ways in the transformation and final consumption sectors, but because they cannot be held in the traditional sense, no stock change data can be provided, such as geothermal and solar thermal. Group III consists of products that are manufactured and then used in a variety of ways in the transformation and final consumption sectors, but which can be held in the traditional sense and for which stock change statistics can be reported due to their nature, such as industrial wastes, municipal solid wastes, solid biomass, biogas, and liquid biofuels.[22]

Oil is the primary source of energy for the world's population, followed by coal, gas, and finally hydroelectric power.[23] Traditional biomass, such as wood and charcoal, was the major source of energy until the mid-nineteenth century. The rise of coal, followed by oil, gas, and finally hydropower, coincided with the turn of the twentieth century and the industrial revolution. Solar and wind power were not introduced to the mix until the 1980s.[24] The renewable energy mix is the proportion of total final energy consumption that is made up of renewable energy.[25]



22 International Energy Agency, (n.21), p. 116.

23 See Figure 4.

24 See Figure 2.

25 Badan Perencanaan Pembangunan Nasional, *Metadata Indikator Pilar Pembangunan Ekonomi: Pelaksanaan Pencapaian Tujuan Pembangunan Berkelanjutan (TPB)/Sustainable Development Goals (SDGs) Indonesia* (BAPPENAS, 2020), p. 8.

Figure 2. Energy consumption by source[26]

1.1. Indonesia

Given the increase of renewable energy in Indonesia from 2009 to 2019, which averaged 0.5% each year, the country's renewable energy mix is nowhere near the goal of 23% by 2025 set out by KEN.[27] The renewable energy referred to in KEN includes geothermal, hydro, wind, solar, tidal, and biomass energy.[28] According to the Ministry of Energy and Mineral Resources, renewable energy share in the primary energy supply mix in 2019 is 9,58%.[29]

Oil and coal, which make up 35.03% and 37.28% of the existing energy mix, respectively, are Indonesia's most relied sources for energy.[30] Through Law No. 16 of 2016 on Ratification of the Paris Agreement to the United Nations Framework Convention on Climate Change, Indonesia has become a ratifying party to the Paris Agreement. Indonesia has committed to reducing greenhouse gas emissions by 26% by 2020 under the Paris Agreement. Therefore, it is important to revitalize the current framework, figure out what needs to be stimulated and identify barriers to RE development, and why Indonesia is still heavily reliant on oil and coal, so that the Government can fulfill its commitments as written.

The basis for renewable energy policy in Indonesia is the Law No. 30 of 2007 on Energy ("Energy Law"). It stipulates that renewable energy is the energy coming from the renewable source of energy.[31] Renewable energy sources are energy sources that are produced from sustainable energy resources, such as earth heat, wind, bioenergy, sun rays, water flow and waterfalls, and the movement and change in sea layer temperature, if effectively controlled.[32]

The Law No. 30 of 2009 on Electricity ("Electricity Law") sets limits to prioritize the use of NRE.[33] However, the mandate of this law has not been implemented optimally, considering: (1) RUEN and its derivative documents (KEN) still budget for the use of renewable energy in a mix

[26] Our World in Data, 'Global primary energy: how has the mix changed over centuries?' retrieved from <https://ourworldindata.org/energy-mix#:~:text=Low%2Dcarbon%20sources%20are%20the,geothermal%20and%20wave%20and%20tidal.&text=Despite%20producing%20more%20and%20more,coal%2C%20oil%2C%20and%20gas.> accessed 11 January 2021.

[27] Menteri ESDM, *2019 Handbook of Energy and Economic Statistics of Indonesia* (Menteri ESDM, Jakarta 2019) <https://www.esdm.go.id/assets/media/content/content-handbook-of-energy-and-economic-statistics-of-indonesia-2019.pdf>, p. 10-11.

[28] Government Regulation No. 79 of 2014 on National Energy Policy, Article 1 paragraph 6.

[29] Menteri ESDM, (n.27), p. 11.

[30] Menteri ESDM, (n.27), p. 11.

[31] Law No. 30 of 2007 on Energy, Article 1 paragraph 7.

[32] Law No. 30 of 2007 on Energy, Article 1 paragraph 6.

[33] Law No. 30 of 2009 on Electricity, Article 6 paragraph 2.

portion of 23% by 2025, and (2) realization of development projects renewable power plants which are still under 10% of the total power generation for public use. From this it can be seen that the Government has not prioritized the use of renewable energy despite its statement of commitments.

There are various stakeholders to the development of renewable energy, notably: 1) Ministry of Energy and Mineral Resources, who is in charge of creating and implementing the country's energy policy; 2) *Pembangkit Listrik Negara* (PLN), a state-owned electrical corporation in Indonesia that is in charge of power generation, transmission, distribution, and delivery to the general population; 3) House of Representatives (DPR), the legislative body; 4) Investment Coordinating Board (BKPM), the authority to carry out policies and services in the sphere of investment coordination; 5) Ministry of Finance, the ministry in charge of authorizing any tax breaks that may be offered; and 6) Ministry of State-Owned Enterprises, the ministry in charge of PLN's management and setting its goals, performance, and budget.

The electricity market in Indonesia is divided into two sectors: generation; transmission and distribution. There are three actors in the generation sector, amongst others: PLN, the largest generator of power; followed by Independent Power Producers (IPPs); and Private Power Utilities (PPUs). The transmission, distribution, and retailing however are not separated and fully controlled by PLN. IPPs that wish to produce electricity, must sell it to PLN under a Power Purchase Agreement in accordance with Electricity Law[34] and Decision of the Constitutional Court of the Republic of Indonesia No. 111/PUU-XIII/2015. The implementation of electricity supply business activities can be carried out by the private sector as long as it does not imply erosion of the State's monopoly on the electricity supply business sector.[35] This monopoly is justified by Law No. 5 of 1999 on the Ban on Monopolistic Practices and Unfair Business Competition ("Competition Law"). The exception to State-Owned Enterprises (BUMN) from the prohibition of monopoly is not intended to prohibit competition from the private sector, even foreign business actors, but rather to ensure the fulfillment of basic needs for the entire community.[36]

Pursuant to Minister of Energy and Mineral Resources Regulation No. 50 of 2017 on the Utilization of Renewable Energy Sources for Power Supply ("Permen ESDM 50/2017"), last amended by Minister of Energy and Mineral Resources Regulation No. 4 of 2020 ("Permen ESDM 4/2020"), PLN is obligated to make power purchase from power plants utilizing Renewable Energy Sources.[37] In accordance with KEN, PLN is required to prioritise the purchase of electricity on a must-run basis, meaning that PLN must prioritise the dispatch of such plants against available capacity from conventional/thermal plants. However, such an obligation only required a minimum

[34] Law No. 30 of 2009 on Electricity, Article 4 paragraph 2.

[35] Decision of the Constitutional Court of the Republic of Indonesia No. 111/PUU-XIII/2015.

[36] Law No. 5 of 1999 on the Ban On Monopolistic Practices and Unfair Business Competition, Article 51.

[37] Minister of Energy and Mineral Resources Regulation No. 50 of 2017 on the Utilization of Renewable Energy Sources for Power Supply, Article 2 paragraph 1.

capacity of 10 MW, which is pale in comparison to thermal plants. PLN noted that Indonesia's existing coal power plants capacity is 34.743 MW as of 2019[38], that is 347330% greater than the minimum required for renewables.[39] Since most thermal power plants are not versatile (it is difficult to ramp up/down instantly), PLN might prefer to reduce the generation of renewables when demand is lower than electricity supply.[40]

Indonesia's renewable energy manufacturing industry is still well short of its full potential. The lack of a local renewables manufacturing industry contributes to higher renewables technology costs in comparison to other countries.[41] The PLN sees renewables as a burden on its budget as it has to pay increased costs to developers of renewables when the energy tariffs stay flat and the company's electricity subsidies have been reduced.[42] Not to mention that there is the issue of many political interests involved, especially the decades old occupant in the coal industry, that hinders financing of RE development so that they can secure their seats while keeping their coal mining businesses going.

1.2. Germany

Renewable energy is at the core of the German energy transition program (*Energiewende*). This program and/or goals for the energy turnaround is adopted in the *Klimaschutz Program 2030 der Bundesregierung zur Umsetzung des Klimaschutzplans 2050* (Climate Action Program 2030). It stipulates that the share of renewable energies in electricity consumption is to be 65% in 2030.[43] According to Frauenhofer Institute for Solar Energy Systems (ISE), in the first half of 2020, 136B KWh were generated from renewable energies, an increase of 9,7% compared to the average of 2019. The overall share of the renewable energy mix in Germany is 55,8%.[44]

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38 Norman Harsono, 'PLN wants environment ministry to undo power plant emissions cap' retrieved from <https://www.thejakartapost.com/news/2020/09/01/pln-wants-environment-ministry-to-undo-power-plant-emissions-cap.html> accessed 12 January 2021.

39 Calculated with percentage calculator on <https://vat-calculator.net/percentage-calculator/>.

40 Institute for Essential Services Reform, (n.7), p.15.

41 Institute for Essential Services Reform, (n.7), p.16.

42 Institute for Essential Services Reform, (n.7), p.16.

43 Federal Ministry of Finance, 'What is the Cli-mate Ac-tion Pro-gramme 2030?' retrieved from <https://www.bundesfinanzministerium.de/Content/EN/Standardartikel/Topics/Priority-Issues/Climate-Action/2019-09-19-climate-action-programme-2030.html> provides explanations to *Klimaschutz Program 2030 der Bundesregierung zur Umsetzung des Klimaschutzplans 2050*'s key elements, accessed 13 January 2021.

44 Fraunhofer ISE, 'Net electricity generation in the first half of 2020: record share of renewable energies of 55,8%' retrieved from <https://www.ise.fraunhofer.de/en/press-media/press-releases/2020/net-energy-production-first-half- of-2020.html> accessed 13 January 2021.

Renewable energy policy in Germany is generally managed by federal law and determined by the Federal Government, particularly the Federal Ministry for Economic Affairs and Energy (*Bundesministerium für Wirtschaft und Energie*, BMWi). Renewable energy sources are defined as: hydropower, including wave, tidal, salinity gradient, and marine current energy; wind energy; solar radiation energy; geothermal energy; energy from biomass, including biogas, biomethane, landfill gas, and sewage treatment gas; and energy from the biologically degradable part of waste from households and industry, as defined in Article 3(21) *Erneuerbare-Energien-Gesetz* (EEG).[45]

The renewable energy market was liberalized in 1998.[46] It has three main sectors: 1) the operator of renewable energy facilities (*Anlagenbetreiber*); 2) electricity network operators (*Netzbetreiber*); and electricity suppliers (*Elektrizitätsversorgungsunternehmen*). In contrast to Indonesia, where the major actor is the PLN, a BUMN, the main actors in Germany are private entities. The Federal Network Agency (*Bundesnetzagentur*, BNetzA) in Germany is also responsible for the regulation of Germany's electricity and gas networks, whereas Indonesia relies on the PLN.

Germany has been an early bird in the RE development since its enactment of the EEG in 2000.[47] The Act to Reduce and End Coal-Fired Power Generation (*Gesetz zur Reduzierung und zur Beendigung der Kohleverstromung*) comes into force in 2020. It aims to end the black economy from the usage of coal by 2038 and switch to a green economy by consuming renewable energies instead, namely to reduce emissions and provide the public with a safe, cost-effective, efficient, and a climate-compatible energy supply.[48] The law lays out a step-by-step plan to get out of it, including compensation for future power plant shutdowns.[49] However, this provision was contested by the Federal Constitutional Court. A coal plant operator filed a preliminary injunction request, requesting additional compensation for the decommissioning of hard-coal plants.[50] The coal plant operator lacked standing because the plant was 85.9% owned by municipalities, and thus could not use constitutional rights, which are required for this type of legal protection,

45 *Erneuerbare-Energien-Gesetz,* Article 3 paragraph 21.

46 Deloitte, *European Energy Market Reform, Country profile: Germany* (Deloitte, 2015), <https:// www2.deloitte.com/content/dam/Deloitte/global/Documents/Energy-and-Resources/gx-er-market-reform-germany.pdf>, p. 3.

47 ICLG, 'Germany: Renewable Energy Laws and Regulations 2021', retrieved from <https://iclg.com/ practice-areas/renewable-energy-laws-and-regulations/germany> accessed 13 January 2021.

48 *Gesetz zur Reduzierung und zur Beendigung der Kohleverstromung.* Article 2.

49 *Gesetz zur Reduzierung und zur Beendigung der Kohleverstromung*, Article 57.

50 Ground A *BVerfG, Beschluss der 1. Kammer des Ersten Senats vom 18. August 2020.*

according to the court.[51] Private power plant operators, on the other hand, may bring constitutional claims against the law in the future.[52]

Political climate targets, public sentiment, and the need to address the electricity supply gap from nuclear phase-out by 2022 and coal phase-out by 2038 are currently the key drivers for RE development.[53] Financing instruments and funding does not seem to hinder Germany that much. German Investment and Development Company (*Deutsche Investitions-und Entwicklungsgesellschaft, DEG*) offers ways to decrease financial stress and attract investments.[54] Additionally, the German government-owned development bank (*Kreditanstalt für Wiederaufbau, KfW*) offers various support programs, including but not limited to: 1) climate partnerships with business; 2) developing public private partnership; 3) up-scaling; and 4) studies for feasibility studies.[55] Furthermore, there are even more incentives in Germany to promote renewable energy.[56]

To sum, the German strategies to energy transition are as follows: 1) electricity market liberalization; 2) consistency of favourable renewable energy framework conditions; 3) establishing a state-owned bank assigned to fund renewable energy projects; 4) private sector involvement; 5) social acceptance and support for renewable energy.[57]

Compared to incumbent utilities, opening up monopoly markets has encouraged new players to come up with competing investments and investment strategies that were primarily interested in maintaining their previous nuclear and fossil investments. Short-term and balancing markets have allowed grid operators to incorporate renewables safely and effectively, as imbalances have been reduced to ever lower levels, despite the rise in renewables. The majority of the imbalances are balanced around the market, where high or low (negative) price signals will favor investors who may provide short term additional or reduced supply.[58] This market regime has contributed, for

[51] Ruling *BVerfG, Beschluss der 1. Kammer des Ersten Senats vom 18. August 2020.*

[52] Beck-aktuell, 'Urgent motion against the coal exit law failed', retrieved from <https://beck-online.beck.de/ Dokument?vpath=bibdata%2Freddok%2Fbecklink%2F2017216.htm> accessed 13 January 2021.

[53] *Erneuerbare-Energien-Gesetz*, Article 1 paragraph 1.

[54] Institute for Essential Services Reform, (n.7), p. 34.

[55] Rödl and Partner, 'Wege zur Finanzierung von Erneuerbare-Energien-Projekten in Schwellen- und Entwicklungsländern. Nürnberg. Retrieved from <https://www.roedl.de/themen/erneuerbare-energien/2016-10/ finanzierung-erneuerbarer-energienprojekten-in-entwicklungslaendern> accessed 13 January 2021.

[56] RES LEGAL Europe, 'Promotion in Germany' retrieved from <http://www.res-legal.eu/search-by-country/ germany/tools-list/c/germany/s/res-e/t/promotion/sum/136/lpid/135/> accessed 13 January 2021.

[57] Institute for Essential Services Reform, (n.7), p. 34.

[58] Fabian Joas, 'Electricity system in Germany: understanding the current situation' retrieved from

example, to the retrofitting of thermal power plants or the use of hydro/pumped hydro, demand response or small-scale investment in batteries in the coming years. As a result, the power grid in Germany remains to be among the safest in the world.[59]

The German government has also created an environment favourable for renewable energy to nourish. As the key policy instrument, the EEG has given priority grid access to renewables and technology-specific 15-20-year tariffs based on technology costs at respective time points. For instance, there are auctions for larger power plants, which have further lowered the cost of wind and solar energy, on the basis of a well-established regulatory system.[60] Furthermore, Germany also has a state-owned bank that offers loans and support at a lower interest rate for multiple renewable energy projects.[61] Private investment and participation in renewable energy sources is known to be a crucial stimulant for the transformation of the energy sector in a state. Their participation would allow competition with existing utilities and force them to adapt as well.[62]

In addition to all political, economic and technological factors, the German population has a high degree of acceptance and enthusiasm for renewable energies and the transition to energy. Solar rooftops are seen by private households as an investment. Wind projects, on the other hand, are being established by cooperatives created by groups of people.[63] In conclusion, because of the EEG, energy consumers in Germany are capable of turning themselves into energy producers.

2. Indonesian Rooftop Solar System (Program Surya Nusantara)

Although it is true that the Indonesian renewable energy mix is still far behind its initial target, when the average growth is 0.5% per year, we can agree that it is impractical to suddenly pump an extra 13%. Indonesia could instead seek for the second-best thing to happen, in which the underutilized solar potential comes into account. Compared to Germany, for example, one of the countries in Europe with a four-season climate that limits their solar exposure, Indonesia has the potential to generate 10 times as much solar power.[64] According to the Ministry of Energy and Mineral Resources, Indonesia just started to extract energy from solar power plants and solar

<https://www.renac.de/fileadmin/renac/media/Projects/Energy_Dialogue/2018_June/03_Agora_Joas_web.pdf> accessed 13 January 2021.

59 Fabian Joas, (n. 59).

60 Institute for Essential Services Reform, (n.7), p. 34.

61 Institute for Essential Services Reform, (n.7), p. 34.

62 Institute for Essential Services Reform, (n.7), p. 34.

63 Institute for Essential Services Reform, (n.7), p. 34.

64 Septian Denny, 'Potensi Energi Tenaga Surya RI 10 Kali Lebih Besar dari Jerman.' retrieved from <https://www.liputan6.com/bisnis/read/2493191/potensi-energi-tenaga-surya-ri-10-kali-lebih-besar-dari-jerman> accessed 11 January 2021.

photovoltaics in 2018, amassing 355.986 BOE out of 1.532.201.883 BOE total energy consumption.[65] In fact, solar PV has the highest resource potential in Indonesia at 532,6 GW.[66]

Table 2. Renewable power capacity and the total potential of renewable power[67]

GW	Reference Case 2030		Theoretical potential for renewable power capacity	Theoretical potential by renewable energy power technology						
	On-grid power capacity	On-grid renewable power capacity		Solar PV	Large hydropower	Small hydropower	Bioenergy	Geothermal	Marine energy (tidal)	Wind (onshore)
Total Indonesia	**193.5**	**55.8**	**716.4**	**532.6**	**75.0**	**19.4**	**32.7**	**29.5**	**18.0**	**9.3**
Sumatra	**39.2**	**17.6**	**196.2**	137.1	15.6	5.7	15.6	12.9	8.3	1.0
Java-Bali	**119.8**	**19.1**	**71.5**	38.7	4.3	2.9	9.2	10.1	2.4	3.9
Kaliman-tan	**10.3**	**5.4**	**184.2**	149.0	21.6	8.1	5.1	0.2	-	0.3
Sulawesi & Nusa Tenggara	**20.3**	**11.6**	**97.6**	66.8	10.8	1.8	2.6	4.8	6.9	3.9
Maluku & Papua	**3.9**	**2.1**	**166.8**	140.9	22.8	0.8	0.2	1.5	0.4	0.3

Citizens could be participants in producing renewable energy using solar rooftops. As amended in Minister of Energy and Mineral Resources Regulation No. 13 of 2019 ("Permen ESDM 13/2019"), Minister of Energy and Mineral Resources Regulation No. 49 of 2018 on the Use of the Rooftop Solar System by PLN Consumers ("Permen 49/2018") was released as an implementation of the

65 Menteri ESDM, (n.26), p. 21.

66 See Table 2.

67 Gielen, D., Saygin, D., & Rigter, J., *Renewable Energy Prospects: Indonesia, a REmap analysis* (IRENA, Abu Dhabi 2017). <https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Mar/IRENA_REmap_Indonesia_report_2017.pdf?la=en&hash=79237811C02D9722E35F5049ACBA278B126493BB>, p. 44.

Government's mandate for PLN to purchase excess power generated from solar rooftop owned by PLN customers.

The rooftop solar system includes solar modules, inverters, customer electrical connections, safety systems, and kWh meters for the export-import of customer electrical energy to PLN. The installation location is placed on the roof, wall, or other part of the building owned by PLN consumers.

The aim of the Solar Rooftop installation is to save costs on PLN customer account costs in the sense of the Permen ESDM 13/2019 and Permen ESDM 49/2018. The government is setting a range of new norms for the installation and procurement of excess power from solar rooftops: 1) obligation to obtain an installation permit from PLN[68]; 2) the maximum capacity is determined at 100% of the PLN connected power[69]; 3) the amount of excess power purchased by PLN from solar rooftop is 65% of the real value of excess power recorded on the PLN meter[70]; and 4) obligations for industrial category PLN customers who wish to use solar rooftop to pay capacity charge.[71]

According to the Ministry of Energy and Mineral Resources, the benefits of a rooftop solar system includes but not limited to the following: 1) save on electricity subsidies in the long run; 2) reduce electricity costs for PLN customers; 3) save on PLN electricity production costs; 4) creating new jobs; 5) encourage the growth of the domestic solar industry, including the supporting service industry; 6) increased use of renewable energy; 7) reduce greenhouse gas emissions.[72]

Since the enactment of Permen 49/2018, stakeholders have expressed their dissatisfaction. Despite the tremendous potential of this technology as a low-hanging fruit to achieve the 23% renewable energy goal, the new legislation is viewed as a way to prevent the mass use of solar rooftops.[73] It

68 Mineral Resources Regulation No 49 of 2018 on the Use of the Rooftop Solar System by PLN Consumers, Article 4.

69 Mineral Resources Regulation No 49 of 2018 on the Use of the Rooftop Solar System by PLN Consumers, Article 5.

70 Mineral Resources Regulation No 49 of 2018 on the Use of the Rooftop Solar System by PLN Consumers, Article 6.

71 Mineral Resources Regulation No 49 of 2018 on the Use of the Rooftop Solar System by PLN Consumers, Article 14 paragraph 2.

72 Sutijastoto, 'Roadmap dan Strategi Pengembangan Energi Baru Terbarukan di Indonesia' retrieved from <http://iesr.or.id/wp-content/uploads/2020/05/190520-Program-Surya-Nusantara-EBTKE.pdf> accessed 14 January 2021.

73 Arinaldo, D., Adiatma, J.C., Simamora, P., *Indonesia Clean Energy Outlook: Reviewing 2018, Outlooking 2019* (IESR 2018), <http://iesr.or.id/wp-content/uploads/2018/12/Indonesia-Clean-Energy-Outlook-2019-new.pdf>, p. 19.

failed to meet expectations, the scheme is unattractive, there is a capacity cap, requiring quarterly restart, and lacking transparency.[74]

Just 65% of the electricity exported by solar rooftops will be paid by PLN, far smaller than the planned 1:1 scheme. Compared to 7 to 8 years under the 1:1 system, this results in a longer payback period of 11 to 12 years. In addition, for industrial users, there are capacity charges and emergency charges.[75] There is a capacity cap, meaning the rooftop solar system cannot exceed grid-tied capacity. Requiring quarterly restart, meaning that the exported electricity would counter imports. If the export is greater than the import, the surplus can be accrued up to 3 months prior to nullification of the balance. The balance was restarted annually under previous PLN regulation. Transparency issue meaning that if the net metering scheme application is denied, the PLN is not obligated to reveal the reason for the rejection. Furthermore, PLN is also not required to install the net metering within a defined period of time after approval of the application. However, PLN must mount the metering system within 15 days after the applicant submits a certificate of fitness for service.[76]

Instead of major cities in Java, PLN officials indicated that the solar rooftops are specifically for regions with an inadequate power supply.[77] However, with no differentiation in electricity tariffs, users in remote areas will be put in a disadvantageous position as they will receive less compensation (and longer payback period) relative to users in big cities because, due to logistics costs, rooftop solar system prices are higher in remote areas. Therefore, a more practical solution is needed to incentivize the interest of rooftop solar systems.

3. Current Issues Pertaining to the Covid-19 Pandemic

Pandemic Covid-19 undeniably delivered a strong hit to Indonesian economy, resulting in economic recession. To tackle this challenge, Indonesian government spends a total budget of Rp 15.398 trillion, an equivalent of more or less USD 1 billion.[78] One of the suggested recovery programs post-Covid-19, is diversion of electricity subsidies and fee relief schemes.[79]

74 Arinaldo, D., Adiatma, J.C., Simamora, P, (n.71), p.19.
75 Arinaldo, D., Adiatma, J.C., Simamora, P, (n.71), p.19.
76 Arinaldo, D., Adiatma, J.C., Simamora, P, (n.71), p.19.
77 Arinaldo, D., Adiatma, J.C., Simamora, P, (n.74), p.19.
78 See Table 3.
79 Sutijastoto, (n. 73).

Program	Duration	Budget	Customers
Free electricity for 450VA homes and 50% discount for 900VA subsidized homes	Apr-June	Rp 3.5 trillion	31.38 million
	July-Sept	Rp 4.338 trillion	31.63 million
	Oct-Dec	Rp 4.338 trillion	31.88 million
Free electricity for 450VA businesses and 450VA industries	May-Oct	Rp 109 billion	477,489
	Nov-Dec	Rp 42 billion	501,513
No minimum electricity fees for 900VA+ businesses, industries, public services and special customers	July-Dec	Rp 3.071 billion	1.25 million
Total		Rp 15.398 trillion	33.64 million

Table 3. Electricity fee relief for households and businesses amid pandemic[80]

With the cross-sectoral impact of the pandemic Covid-19, there are opportunities to promote green economy recovery that is not business-as-usual with the use of renewable energy. In addition to providing economic stimulus for those in need, a green economic recovery strategy such as the rooftop solar system can also encourage employment, encourage domestic industry, and contribute to achieving climate targets. Synergy and optimal preparation are needed, as well as high political commitment to change the direction of economic recovery in Indonesia to green economic recovery.

Although the good will of the Indonesian government to address the economic recession to subsidize electricity is appreciated by many, the decision itself is unwise. The government is spending trillions of rupiahs for a "one time purchase". It would not solve the real issue, rather only temporarily mitigate the impact of the pandemic. Had another economic recession hit again in the future, the government would have to spend another large sum of money to fight against it.

[80] Norman Harsono and Dzulfiqar Fathur Rahman, 'Govt to Spend $1b on Electricity Fee Relief for Households, Businesses amid Pandemic' (12 August 2020) <https://www.thejakartapost.com/news/2020/08/12/govt-to-spend-1b-on-electricity-fee-relief-for-households-businesses-amid-pandemic.html> accessed 3 July 2021.

Therefore, a more sustainable solution is preferred so that it could solve the economic problem while boosting the growth of renewables in the energy mix.

4. Key Lessons

The success story from Germany's renewable energy transition may give many inspirations and benchmarks for other countries to switch for a greener economy. There are several key strategies that can be derived from the description of both Indonesian and German frameworks and standing. Firstly, the German government is highly cooperative, they show full support and efforts to develop renewable energy. Not only did Germany set their energy policies to transition from thermal energy to renewables, but they also took active roles. For instance, liberalization of the electricity market, incentives, and other access to financing options with low interest rates. Secondly, there is political support and commitment from the government.[81]

Comparing Germany and Indonesia is definitely not apple-to-apple. Both countries have different conditions and profiles such as poverty level, human resources, technology, and GDP. However, we can safely agree that potentially wise, Indonesia should be among the top renewable energy producers in the world, yet Indonesia is still lagging behind in terms of RE development. The Indonesian government should learn to not orient the policies for short term solutions, rather a long-term energy transition like Germany did.

Albeit its failure in meeting the expectations of many, the potential for rooftop solar systems is still there, it is the future and one of Indonesia's strong suits. Through the diversion, consumers will be worry free since all the installation funds will be covered by National Income and Expenditure Budget (APBN), and Regional Income and Expenditure Budget (APBD). Local governments, too, need not worry because the Ministry of Finance has a budget tag to help the financing of climate change, including the energy transition. According to Sri Mulyani, the Ministry of Finance, the need for climate change-related funds is projected to exceed approximately Rp 3.461 trillion by 2030.[82] Together with the budget spent by the government to subsidize, there is a lot of money that could be allocated into providing access to rooftop solar systems particularly for remote areas. If the government decided to shift their focus into providing solar panels for its citizens, not only would it be an on-going solution to the economic recession, but it will also open opportunities for them to engage and generate power to sell, potentially boosting the economic recovery.

CONCLUSION

[81] Institute for Essential Services Reform, (n.7), p. 34.

[82] Cantika Adinda Putri, 'Sri Mulyani: Atasi Perubahan Iklim RI Butuh 3.641 Triliun' CNBC Indonesia (11 June 2021) <https://www.cnbcindonesia.com/news/20210611142403-4-252402/sri-mulyani-atasi-perubahan-iklim-ri-butuh-rp-3461-triliun> accessed 3 July 2021.

Potential-wise, Indonesia should be among the top renewable energy producers in the world, yet Indonesia is still lagging behind in terms of RE development. From the comparative approach with Germany, there are few key takeaways that could be taken and possibly incorporate to Indonesian renewable energy policies: electricity market liberalization, consistency of favourable renewable energy framework conditions, establishing a state-owned bank assigned to fund renewable energy projects, private sector involvement, and social acceptance and support for renewable energy.

In an effort to meet the Government's target to increase the level of the renewable energy mix, especially solar power, which is available massively and for free, the policy contained in Permen ESDM 49/2018. Incentives, or at least non-discriminatory treatment, must be given to parties who wish to switch to a rooftop solar system and contribute to the sustainability of environmentally friendly energy.

Due to pandemic Covid-19, Indonesia is undergoing an economic recession. The government is spending trillions of rupiahs to subsidize locals, a not so wise decision as it acts as a “one time purchase”. What the writer suggests instead is that the budget for subsidies should be diverted into providing rooftop solar systems as it is renewable and has many benefits. Hitting two birds with one stone, increasing the renewable energy mix while also recovering the economy.

REFERENCES

Primary Sources

Law No. 5 of 1999 on the Ban on Monopolistic Practices and Unfair Business Competition (ID.)

Law No. 30 of 2007 on Energy (ID.)

Law No. 30 of 2009 on Electricity (ID.)

Law No. 16 of 2016 on Ratification of Paris Agreement to the United Nations Framework Convention on Climate Change (ID.)

Government Regulation No. 79 of 2014 on National Energy Policy (ID.)

Presidential Regulation No. 22 of 2017 on the General National Energy Plan (ID.)

Minister of Energy and Mineral Resources Regulation No. 50 of 2017 on Utilization of Renewable Energy Sources for Power Supply (ID.)

Mineral Resources Regulation No 49 of 2018 on the Use of the Rooftop Solar System by PLN Consumers (ID.)

Minister of Energy and Mineral Resources Regulation No 13 of 2019 on Amendment to Minister of Energy and Mineral Resources Regulation No. 49 of 2018 on the Use of the Rooftop Solar System by PLN Consumers (ID.)

Minister of Energy and Mineral Resources Regulation No. 4 of 2020 on Amendment to Government Regulation No. 50/2017 on Utilization of Renewable Energy Sources for Power Supply (ID.)

Decision of the Constitutional Court of the Republic of Indonesia No. 111/PUU-XIII/2015 (ID.)

Erneuerbare-Energien-Gesetz (DE.)

Klimaschutz Program 2030 der Bundesregierung zur Umsetzung des Klimaschutzplans 2050 (DE.)

Gesetz zur Reduzierung und zur Beendigung der Kohleverstromung (DE.)

BVerfG, Beschluss der 1. Kammer des Ersten Senats vom 18. August 2020 (DE.)

Secondary Sources

Books

Badan Perencanaan Pembangunan Nasional, Metadata Indikator Pilar Pembangunan Ekonomi: Pelaksanaan Pencapaian Tujuan Pembangunan Berkelanjutan (TPB)/Sustainable

Development Goals (SDGs) Indonesia (BAPPENAS, 2020).

Fedrigo-Fazio D and Brink P ten, briefing: Green Economy, What Do We Mean by Green Economy? (UNEP Division of Communications and Public Information 2012).

Gielen, D., Saygin, D., & Rigter, J., Renewable Energy Prospects: Indonesia, a REmap analysis (IRENA, Abu Dhabi 2017). <https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Mar/IRENA_REmap_Indonesia_report_2017.pdf?la=en&hash=79237811C02D9722E35F5049ACBA278B126493BB>.

Ibrahim MJ, 'Introductory Chapter: Economics, Natural Resources and Sustainable Development', Emerging Issues in Economics and Development (IntechOpen 2017) <https://www.intechopen.com/books/emerging-issues-in-economics-and-development/introductory-chapter-economics-natural-resources-and-sustainable-development> accessed 2 July 2021.

Institute for Essential Services Reform, Igniting Rapid Deployment of Renewable Energy in Indonesia: Lessons Learned from Three Countries (IESR, Jakarta 2018). <http://iesr.or.id/wp-content/uploads/2019/05/IESR_Research_Igniting-a-Rapid-Deployment-of-RE-in-Indonesia.pdf>.

International Energy Agency, Energy Statistics Manual (OECD/IEA, Paris 2005), <https://ec.europa.eu/eurostat/ramon/statmanuals/files/Energy_statistics_manual_2004_EN.pdf>.

Menteri ESDM, 2019 Handbook of Energy and Economic Statistics of Indonesia (Menteri ESDM, Jakarta 2019) <https://www.esdm.go.id/assets/media/content/content-handbook- of-energy-and-economic-statistics-of-indonesia-2019.pdf>.

Sugiyono A and others, Indonesia Energy Outlook 2014: Energy Development in Supporting Fuel Substitution Program (Pusat Teknologi Pengembangan Sumberdaya Energi BPPT 2014).

William H. Putman, Legal Research, Analysis and Writing, Second Edition (Delmar Cengage Learning, New York 2010). <https://pdf.zlibcdn.com/dtoken/df9920683e8200baad93ec6655497fbc/Legal_research,_analysis,_and_writing_by_Putman,_W_5968889_(z-lib.org).pdf>.

Websites

Adrian Wail Akhlas, 'Indonesia's inflation hits record 20-year low in August amid declining purchasing power' retrieved from <https://www.thejakartapost.com/news/2020/09/01/indonesias-inflation-hits-record-20-year-low-in-august-amid-declining-cpi.html.>.

Arinaldo, D., Adiatma, J.C., Simamora, P., 'Indonesia Clean Energy Outlook: Reviewing 2018, Outlooking 2019' retrieved from <http://iesr.or.id/wp-

content/uploads/2018/12/Indonesia- Clean-Energy-Outlook-2019-new.pdf>

Beck-aktuell, 'Urgent motion against the coal exit law failed', retrieved from <https://beck-online.beck.de/Dokument?vpath=bibdata%2Freddok%2Fbecklink%2F2017216.htm>.

Deloitte, 'European Energy Market Reform, Country profile: Germany' (Deloitte, 2015), <https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Energy-and-Resources/gx-er-market-reform-germany.pdf>.

Fabian Joas, 'Electricity system in Germany: understanding the current situation' retrieved from <https://www.renac.de/fileadmin/renac/media/Projects/Energy_Dialogue/2018_June/03_Agora_Joas_web.pdf>.

Federal Ministry of Finance, 'What is the Cli-mate Ac-tion Pro-gramme 2030?' retrieved from <https://www.bundesfinanzministerium.de/Content/EN/Standardartikel/Topics/Priority-Issues/Climate-Action/2019-09-19-climate-action-programme-2030.html>.

Fraunhofer ISE, 'Net electricity generation in the first half of 2020: record share of renewable energies of 55,8%' retrieved from <https://www.ise.fraunhofer.de/en/press-media/press-releases/2020/net-energy-production-first-half-of-2020.html>.

Harsono N and Rahman DF, 'Govt to Spend $1b on Electricity Fee Relief for Households, Businesses amid Pandemic' (12 August 2020) <https://www.thejakartapost.com/news/2020/08/12/govt-to-spend-1b-on-electricity-fee-relief-for-households-businesses-amid-pandemic.html>.

ICLG, 'Germany: Renewable Energy Laws and Regulations 2021', retrieved from <https://iclg.com/practice-areas/renewable-energy-laws-and-regulations/germany>.

International Energy Agency, 'Energy security: Ensuring the uninterrupted availability of energy sources at an affordable price', retrieved from <https://www.iea.org/areas-of-work/ensuring-energy-security>.

International Renewable Energy Agency, 'Investment Trends' retrieved from <https://www.irena.org/Statistics/View-Data-by-Topic/Finance-and-Investment/Investment-Trends>.

Norman Harsono, 'PLN wants environment ministry to undo power plant emissions cap' retrieved from <https://www.thejakartapost.com/news/2020/09/01/pln-wants-environment-ministry-to-undo-power-plant-emissions-cap.html>

Our World in Data, 'Global primary energy: how has the mix changed over centuries?' retrieved from <https://ourworldindata.org/energy-mix#:~:text=Low%2Dcarbon%20sources%20are%20the,geothermal%20and%20wave%20and%20tidal.&text=Despite%20producing%20more%20and%20more,coal%2C%20oil%2C%20and%20gas.>.

Our World in Data, 'Share of electricity production from renewables' retrieved from <https://ourworldindata.org/grapher/share-electricity-renewables?tab=chart&time=earliest..2019&country=DEU~IDN>.

Our World in Data, 'Share of electricity production from renewables' retrieved from <https://ourworldindata.org/grapher/share-electricity-renewables?tab=table&time=earliest..2019&country=DEU~IDN>.

RES LEGAL Europe, 'Promotion in Germany' retrieved from <http://www.res-legal.eu/ search-by-country/germany/tools-list/c/germany/s/res-e/t/promotion/sum/136/lpid/135/>

Rödl and Partner, 'Wege zur Finanzierung von Erneuerbare-Energien-Projekten in Schwellen- und Entwicklungsländern. Nürnberg. Retrieved from <https://www.roedl.de/themen /erneuerbare-energien/2016-10/finanzierung-erneuerbarer-energienprojekten-in-entwicklungslaendern>.

Rully R. Ramli., 'Kementerian ESDM: Konsumsi Listrik Mulai Berangsur' retrieved from <https://money.kompas.com/read/2020/08/18/131700726/kementerian-esdm--konsumsi-listrik-mulai-berangsur-naik?page=all>.

Putri CA, 'Sri Mulyani: Atasi Perubahan Iklim RI Butuh 3.641 Triliun' CNBC Indonesia (11 June 2021) <https://www.cnbcindonesia.com/news/20210611142403-4-252402/sri-mulyani-atasi-perubahan-iklim-ri-butuh-rp-3461-triliun> accessed 3 July 2021

Sutijastoto, 'Roadmap dan Strategi Pengembangan Energi Baru Terbarukan di Indonesia' retrieved from <http://iesr.or.id/wp-content/uploads/2020/05/190520-Program-Surya-Nusantara-EBTKE.pdf>

United Nations, 'What is Sustainable Development?' retrieved from https://www.un.org/ sustainabledevelopment/blog/2015/09/what-is-sustainable-development/