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An Overview of Renewable Energy Policies in Indonesia and Malaysia: Challenges in Investment and Decentralised Governance

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An Overview of Renewable Energy Policies in Indonesia and Malaysia: Challenges in Investment and Decentralised Governance

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ABSTRACT

Southeast Asia is one of the regions most exposed to the dangers of climate change, as well as a major contributor of greenhouse gases. To combat climate change, the region must wean off its use of fossil fuels, and make a transition to the use of renewable energies. With this in mind, this paper looks at the renewable energy policies of Indonesia and Malaysia, both of whom despite having Net Zero targets, face significant challenges in the renewable energy rollout. The paper provides an overview of their renewable energy policies and challenges. Focusing on domestic policy, it finds that Indonesia has for various reasons been unable to attract the requisite investments into its renewable energy sector, while Malaysia has found difficulties in implementing policies due to its decentralised structure. The paper concludes by gesturing the way forward for future studies, including by engaging with emerging literature in different fields.

KEYWORDS: *renewable energy; Southeast Asia; climate change; Indonesia; Malaysia; solar energy*

1. Introduction

COVID-19 has caused great damage since it appeared on the global scene in early 2020, and has precipitated a worldwide call to policy action. Yet, COVID-19 is just the "dress rehearsal" for the greater impending danger of climate change. On one hand, Southeast Asia is one of the regions most exposed to the dangers of climate change, with more intense rainfall leading to more frequent and intense coastal floods.[4] In monetary terms, reports estimate that the region stands to lose around US$28 trillion over the next half decade if it does not mitigate against the climate risks.[5] On the other hand, Southeast Asia is a major contributor to climate change, and is set to become an even bigger contributor of greenhouse gases, as energy consumption in the region is projected to double in the next two decades.[6] As the war in

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[3] Research Assistant, Asia Competitiveness Institute, Lee Kuan Yew School of Public Policy, National University of Singapore. Email: sayjye@nus.edu.sg

[4] Chow, Winston. "We're in a Climate Casino. Here's How to Fight against the Odds," *The Straits Times*, August 25, 2021, https://www.straitstimes.com/opinion/were-in-a-climate-casino-heres-how-to-fight-against-the-odds.

[5] Jacob, Charmaine. "Southeast Asia Could Lose $28 Trillion If It Fails to Act Fast on Climate Change, Report Finds," *CNBC*, September 2, 2021, https://www.cnbc.com/2021/09/03/southeast-asia-could-lose-28-trillion-from-climate-inaction-deloitte.html.

[6] IRENA. *Renewable Energy Market Analysis Southeast Asia.* Abu Dhabi: IRENA, 2018. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Jan/IRENA_Market_Southeast_Asia_2018.pdf.

Ukraine has reminded us, over-reliance on fossil fuels generation will soon become an unsustainable situation that must be urgently addressed.

It is against this backdrop that renewable energy or green transition has gained additional importance around the world, including Southeast Asia. The price of renewable energy has steadily declined over the last decade, as large-scale photovoltaic (PV) installations and onshore wind farm costs declining by 80 and 40 percent respectively.[7] Importantly, pursuing renewable energy can also help Southeast Asian states to work towards resolving the energy trilemma of energy security, independence, and decarbonisation. Renewable energy adoption is also touted to bring health benefits, a more equitable form of energy distribution, and greater job opportunities, and therefore seems a worthwhile investment. The Association of Southeast Asian Nations (ASEAN) has pledged to have 23% of their energy mix come from renewable sources, while each individual country has set their own renewable energy and carbon emissions goals. On the level of individual member states, some ambitious targets have been made. However, there is doubt if these targets have been achieved as the decarbonisation process has been handicapped by powerful interest groups, leading analysts to note that "Not one Southeast Asian country has produced a realistic plan to realize any such commitments."[8]

This study focuses on two neighbouring countries within ASEAN – Indonesia and Malaysia, both of whom despite having Net Zero targets, have made little progress on these commitments. In 2018, the two countries accounted for almost 60% of the region's carbon emissions, and Indonesia has been touted by researchers as the key economy that can spur regional decarbonisation.[9] This paper investigates this progress (or lack thereof), providing an overview of their renewable energy policies and challenges, with a greater focus on solar energy. Policy design, the subject of this analysis, has been touted as a key determining the adoption of enabling technologies, system operations, market design and business models. Ideally, all four aspects should form an ecosystem to scale up renewables. For example, if solar PV is introduced in the market by policy (enabling technologies), it gives new opportunities to operate the system differently (system operation), the policy will also decide whether the scheme is subsidised or not (market design). The policy will also determine whether the asset can be further monetised such as selling of carbon offset (business models). A visualisation of the importance of policy design can be seen in Figure 1 below.

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[7] IRENA. *Renewable Power Generation Costs In 2019.* Abu Dhabi: IRENA, 2020. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Jun/IRENA_Power_Generation_Costs_2019.pdf.

[8] Vriens, Hans. "Southeast Asia energy policies on track to disaster," *Nikkei Asia*, 12 October 2021, https://asia.nikkei.com/Opinion/Southeast-Asia-energy-policies-on-track-to-disaster.

[9] Seah, S., McGowan, P. J. K., Low, M. Y. X., Martinus, M., Ghoshray, A., Lorusso, M., Wong, R., Lee, P. O., Elliott, L., Setyowati, A., Rahman, S., and Quirapas-Franco, M. J. Energy Transitions in ASEAN. British High Commission and the COP26 Universities Network, 2021. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1032373/Energy_Transitions_COP26_Universities_Network_Policy_Report.pdf

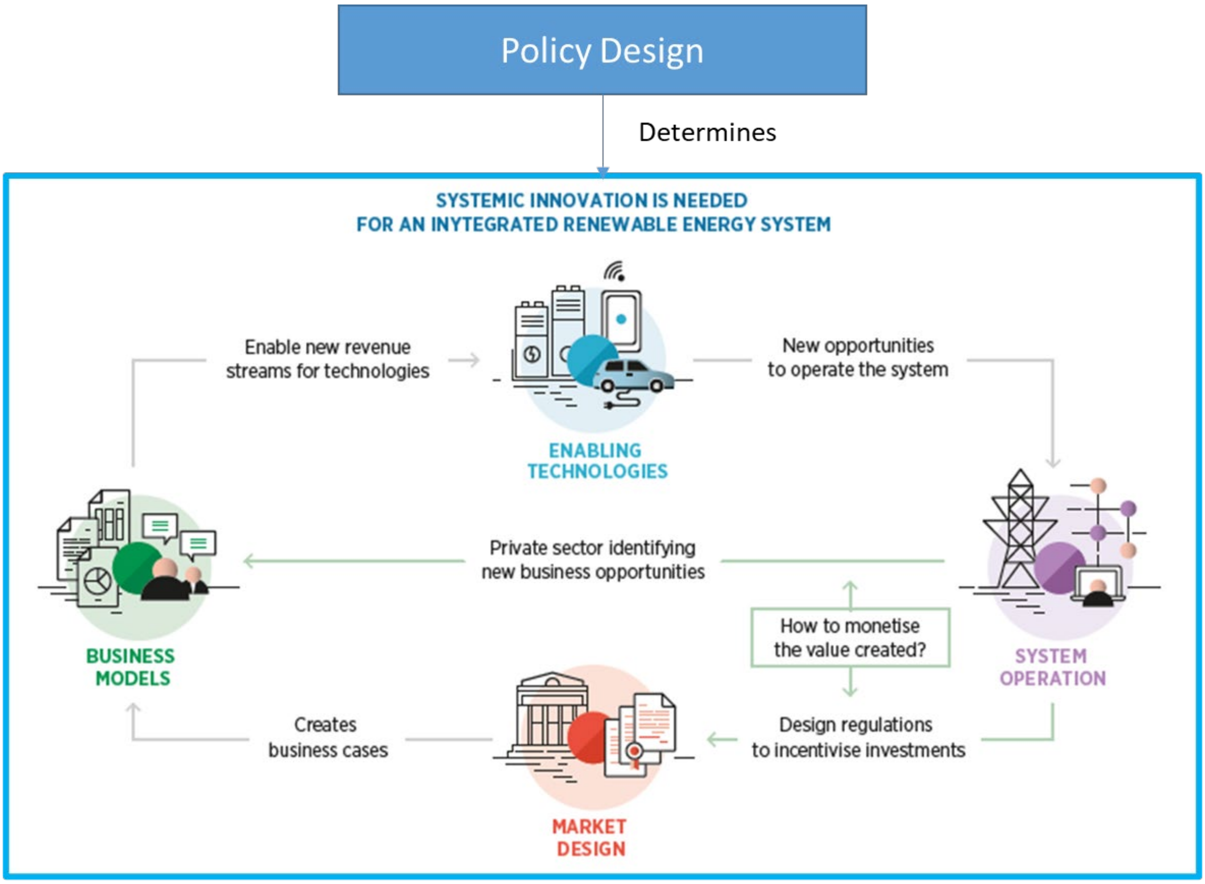

Figure 1: Policy design. Source: Adapted from IRENA, Innovation Landscape for a Renewable-Powered Future: Solutions to Integrate Variable Renewables[10]

To be clear, this paper does not aim to provide a direct *comparison* about the state of renewable energy adoption across both countries (though implications might arise, and it might indirectly provide one in any case) as given each country's own specific circumstances of each nation, it might be analytically misleading to do so. This does not mean that comparative analysis cannot or should not be pursued by future studies – as long as they are justified with a basis for comparison. This paper also focuses on *policy*, but is not intended to downplay or wave away focus on *politics*. This will be further tackled in the concluding section.

This paper will proceed as follows. Section 2 offers a brief overview of the technical details behind the adoption of renewable energy to provide valuable background information. Section 3, and 4 puts forward overviews of renewable energy policy in Indonesia and Malaysia respectively. Section 5 concludes the paper by briefly discussing how research can be carried forward, tapping into scholarly literature in various fields.

2. Technical Overview

If policymakers aim to decarbonise the energy sector, they will need to strategize far ahead to create a network of infrastructure that both powers and also is powered by renewables. For both Indonesia and Malaysia, the scaling of solar energy has been identified as a way forward due to considerable utilisable solar technical potential. This section briefly details five

[10] IRENA. *Innovation Landscape for A Renewable-Powered Future: Solutions to Integrate Variable Renewables.* Abu Dhabi: IRENA, 2019. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Feb/IRENA_Innovation_Landscape_2019_report.pdf.

technical features or challenges associated with solar energy that must be considered in a country's energy planning process, each with its own costs and benefits. They are respectively – cost uncertainty of solar panels; lower capacity factors; grid flexibility and ancillary services; land use concerns; and decommissioning practices.

a. Cost uncertainty of solar panels

Policymakers should consider the price of materials and technologies across the entire eco-system of solar energy-related implementation, a key issue being the price of raw materials. While it has been generally accepted that the price of solar panels has steadily fallen since at least 2010, this does not entail that future prices will remain stable. 2021 saw a spike in the price of silicon metal due to production shortages in China.[11] Refinery and purification turn silicon metal into polysilicon, the main material for solar cells or wafers. After a decade of steep price decline, the price of polysilicon rebounded for the second time and hit US$32.62 per kilogram, the highest since 2011.[12]

Analysts estimate that in the long run, the price of polysilicon may not affect the energy costs of solar that will be priced to the consumers as developers could offset the high material costs with energy efficiency technologies.[13] However, in the short run, this could cause a cascading effect to the actors and energy development plans. For instance, the unforeseen price shock in solar panels will increase the costs to the developers. While developers seek to lower the costs, a delay in commissioning the transmission level solar projects would be expected. This in turn will cause an energy gap in a country (for example, having only 0.8GW commissioned vs. 1.0GW planned), and as part of the remedial plan, governments may have to accept solar bids at a higher energy price in near term to prevent late commissioning.

b. Uneven capacity factor

It is important to consider the capacity factor of renewable energies, with capacity factor defined as the "measure of how much energy is produced by a plant compared with its maximum output."[14] Among all the common renewable energy technologies, hydropower has the highest capacity factor at 39.1%, followed by wind energy at 34.8%, and the lowest being solar energy at 24.5%.[15] This is more clearly exhibited in Figure 2.

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[11] Chia, Krystal, Dan Murtaugh, and Mark Burton. "Silicon's 300% Surge Throws Another Price Shock at the World," *Bloomberg*, October 1, 2021. https://www.bloomberg.com/news/articles/2021-10-01/silicon-s-300-surge-throws-another-price-shock-at-the-world.

[12] Ibid.

[13] Murtaugh, Dan and Brian Eckhouse. "Rising prices of solar modules could disrupt the sector," *Al Jazeera*, May 24, 2021. https://www.aljazeera.com/economy/2021/5/24/bbdropping-solar-module-prices-which-helped-boost-sector-hit-bum.

[14] National Renewable Energy Laboratory. "Solar Energy and Capacity Value". *U.S. Department of Energy*. https://www.nrel.gov/docs/fy13osti/57582.pdf

[15] US Department of Energy. "What is Generation Capacity?" https://www.energy.gov/ne/articles/what-generation-capacity

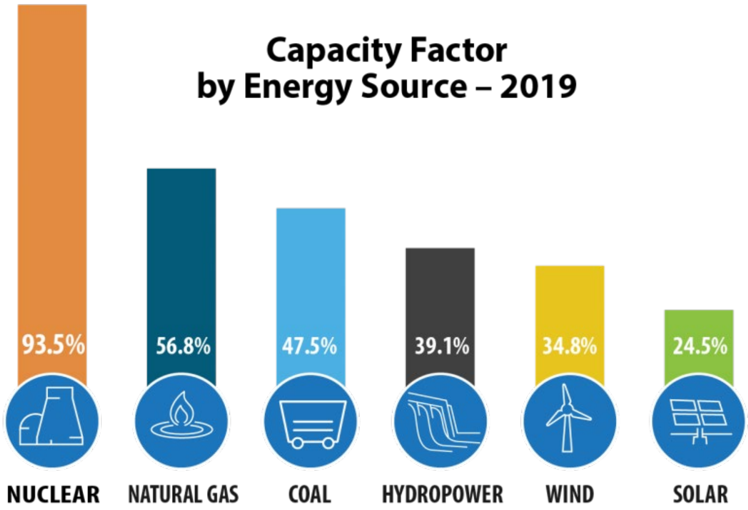

Figure 2: Capacity Factor by Energy Source. Source: U.S. Energy Information Administration[16]

As shown in Figure 2, coal technology's capacity factor is double than that of solar technology's capacity factor, whereas nuclear technology's capacity factor is double than that of coal. This means that retiring one coal project of 30GW will need more than 60GW of solar in a country's power system – that is assuming all solar panels are functioning at its peak, which is impossible as solar technology is intermittent. Similarly, retiring one 10GW nuclear project will need 20GW of coal projects for sustenance. Therefore, when governments decide not to renew the licence of coal projects, the equivalent countermeasures must first be in place, lest there be power shortages which could in turn lead to undesirable socio-political effects.

c. Grid flexibility and ancillary services

When variable renewable energy generation exceeds a certain level of demand in a country, grid flexibility and ancillary services will be required to meet that demand. Energy storage technologies can cover multiple applications from balancing demand variations to the stabilisation of intermittent supplies. For solar energy, a key issue is that solar energy is not produced at night, leaving an energy gap. Figures 3 and 4 show this.

[16] US Department of Energy. "What is Generation Capacity?" https://www.energy.gov/ne/articles/what-generation-capacity

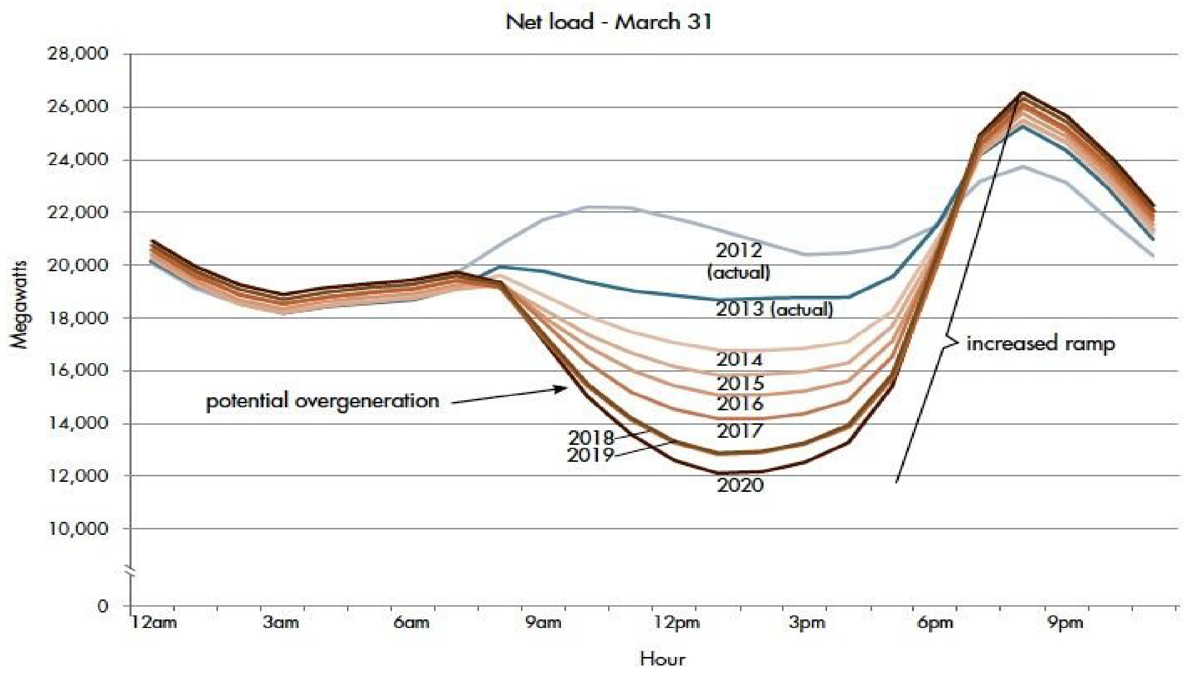

Figure 3: Duck curve 1. Source: California Independent System Operator[17]

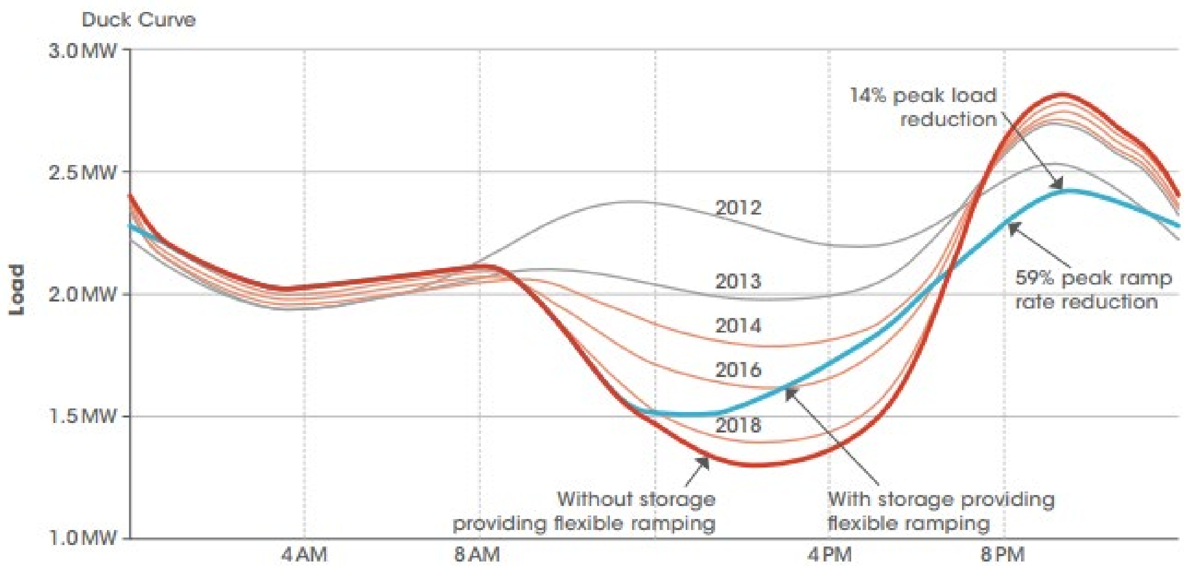

Figure 4: Duck curve 2. Source: IRENA, Utility-Scale Batteries Innovation Landscape Brief[18]

Figures 3 and 4 above shows the "duck curves" where during the day, a large number of solar prosumers reduce their energy consumption from the grid because most of them now generate their own electricity (see curve 2020 vs curve 2013 at 1pm). This will lead to an overgeneration of energy during the day from the "baseload plants" which in many countries are mostly from coal or gas plants. At night, these solar consumers will all have to consume energy from the grid, leading to a sharp surge of energy demand in a short timespan (see curve 2020 vs curve 2013, 4pm to 7pm). The winding down of energy generation during the day and

[17] US Department of Energy. "Confronting the Duck Curve: How to Address Over-Generation of Solar Energy?" https://www.energy.gov/eere/articles/confronting-duck-curve-how-address-over-generation-solar-energy

[18] IRENA. *Utility-Scale Batteries Innovation Landscape Brief.* Abu Dhabi: IRENA, 2019. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Sep/IRENA_Utility-scale-batteries_2019.pdf.

sudden ramping up as the day represents a key the issue for grid operators. The role of energy storage as a balancer seeks to minimise the impacts caused by winding down and ramping up of the baseload plants (see blue curve in Figure 4).

d. Land use concerns

Like other energy projects, the adoption of renewable energy will also cause negative environmental impacts if improperly managed. One possible impact is potential land loss, as the total land use of renewables (acres needed in producing one MW) are higher than the fossil fuels and nuclear projects. Coupled with their lower capacity factor, renewables will need large amounts of land to produce the same yield as the other technologies. On the flipside, renewables are quiet and relatively easy to deploy, solar being the best example as solar panels can be mounted directly on rooftops. As offshore technology matures, this could become a non-problem in the future. For example, solar energy can be harnessed on sea with floating solar panels. The continued R&D will also normalise offshore wind technology making it affordable and reliable as a "baseload" energy, where the potential of ocean energy (making use of wave kinetics) can also be harnessed.[19] This is shown in Figure 5.

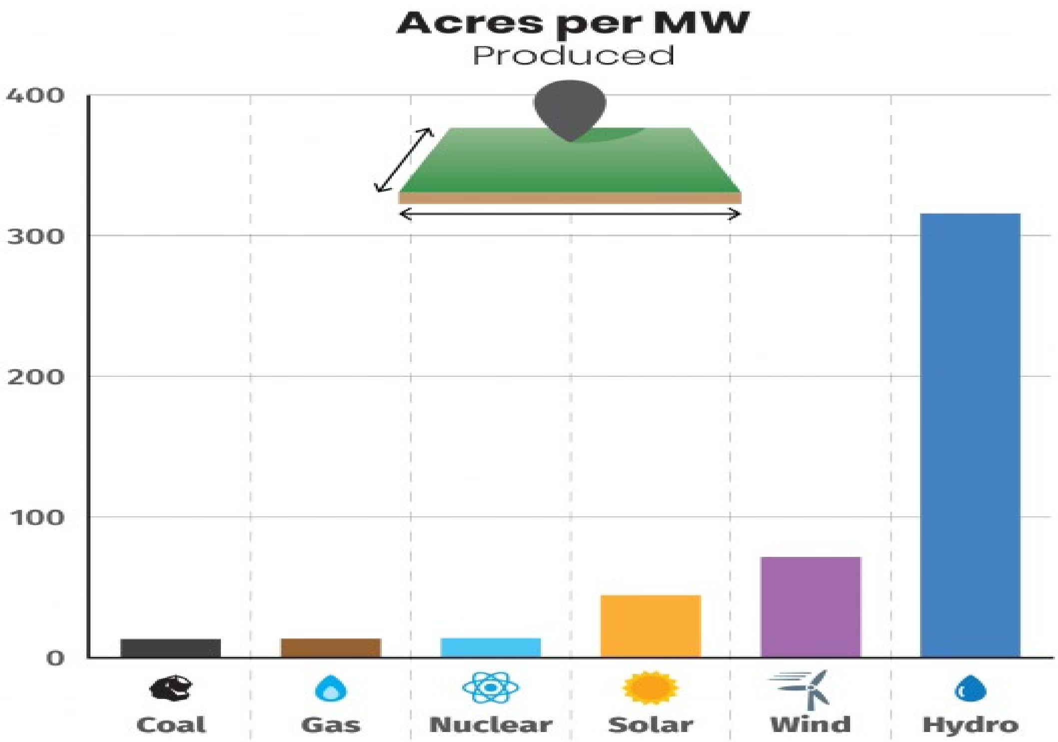

Figure 5: Acres per MW produced. Source: ANSTO[20]

e. Decommissioning practices

With a lifespan of about 30 years, solar panels will contribute significant amounts of e-waste by 2050. According to IRENA, there will be 60–78 million tonnes of cumulative PV

[19] IRENA, *Offshore Renewables: An action agenda for deployment*. Abu Dhabi: IRENA, 2021. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/Jul/IRENA_G20_Offshore_renewables_2021.pdf

[20] Australian Nuclear Science and Technology. "Advanced nuclear reactors". Accessed 24 January 2022. https://www.ansto.gov.au/research/programs/nuclear-fuel-cycle/advanced-nuclear-reactors

panel waste with China, United States, Japan, India, and Germany having a higher share than the rest of the globe.[21] It is estimated that the raw material recovery from the waste could salvage up to USD$15 billion, which is enough to produce 2 billion panels. Hence, there will be a need for mandatory waste regulation policy implemented when national solar PV installations exceed certain aggregate capacity. This regulation policy or framework will encourage the growth of domestic recycling businesses and provide avenues for enterprises to come up with innovative solutions to promote a circular economy – already in ASEAN's sights, with its Framework for Circular Economy for the ASEAN Economic Community, released in October 2021.[22] Figure 6 provides more information.

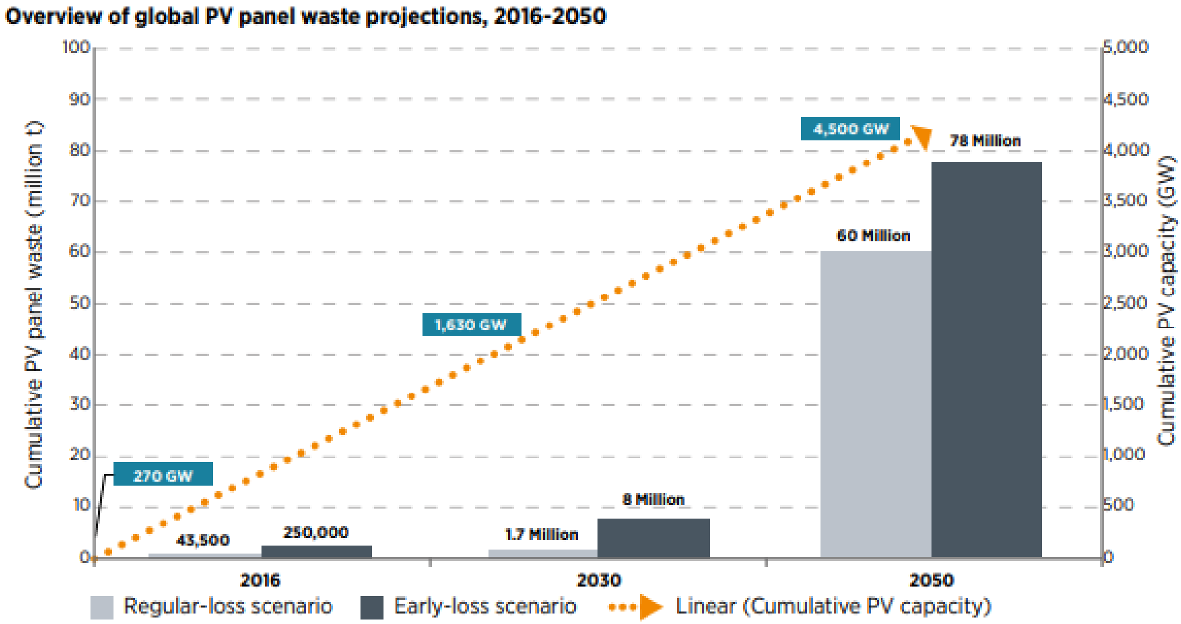

Figure 6: Overview of global PV panel waste projections, 2016-2020. Source: IRENA, End-of-life management solar photovoltaic panels[23]

With these five technical features in mind, this paper moves on to give a policy overview of the renewable energy policies and challenges in both Indonesia and Malaysia.

3. Renewable Energy in Indonesia: Difficulty in Attracting Investment

More than just being the biggest economy in ASEAN, Indonesia is among the world's fastest growing countries in terms of energy consumption. Projected to become the world's fourth largest economy by 2030, Indonesia is also expected to triple its energy consumption from 2017 levels by the same year, driven by higher purchasing power and more reliable electrification rates.[24] Yet Indonesia is also acutely vulnerable to the effects of climate change,

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[21] IRENA. *End of Life Management Solar Photovoltaic Panels.* Abu Dhabi: IRENA, 2016. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2016/IRENA_IEAPVPS_End-of-Life_Solar_PV_Panels_2016.pdf.

[22] Association of Southeast Asian Nations (ASEAN). "ASEAN adopts framework for Circular Economy." ASEAN, 21 October 2021. https://asean.org/asean-adopts-framework-for-circular-economy/

[23] IRENA. *End of Life Management Solar Photovoltaic Panels.* Abu Dhabi: IRENA, 2016. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2016/IRENA_IEAPVPS_End-of-Life_Solar_PV_Panels_2016.pdf.

[24] IRENA, "Renewable Energy Prospects: Indonesia (Executive Summary)," March 2017, pp.3.

to which it is historically a major contributor.[25] The World Bank (WB) and Asian Development Bank (ADB) ranked Indonesia in the top-third of countries facing climate risks such as flooding and extreme heat.[26] Research also points to Indonesia's energy sector overtaking forestry to become the country's largest emissions contributor by 2027.[27] Given these concerns, there is a pressing need for Indonesia to pursue an environmentally sustainable mode of development, starting from its energy landscape. To this end, the Indonesian government has unveiled a succession of plans to reduce Indonesia's reliance on fossil fuels and its carbon footprint, leveraging Indonesia's tremendous renewable energy potential. McKinsey reported that the country's renewable energy sources could generate more than six times its current energy needs in 2020 if fully tapped.[28] Furthermore, renewable energy represents a considerable potential market, with some estimating the renewable energy market to be almost USD$40 billion from 2020 to 2025.[29]

Yet these plans face significant challenges in implementation, and renewables only make up a small fraction of Indonesia's energy generation input at present. This gap can be seen clearly in Figure 7 below. According to the WEF, Indonesia ranked 71st out of 115 countries on its energy transition index with a score of 56, far behind Malaysia (39th, 64) and Singapore (21st, 67).[30] The roadblocks behind Indonesia's relatively slow action on renewable energy are manifold, especially given the complex nature of the political economy of climate change, which involves international supply chains, domestic political coalitions, international funding, and so on. This section looks at Indonesia's domestic policies, and place less attention on both the international dimensions or background behind the policy formation, as well as the domestic political economic conditions. This is solely meant to focus the analysis on a single factor (domestic policy), and is not intended in any way as a dismissal of the other factors. With this in mind, it finds that Indonesia's slow progress in cultivating a strong renewable energy sector can be (partially) explained by factors such as cost and risk factors; market structure and the role of the PLN; and policy uncertainty. These factors coalesce around the issue of the inability to attract sufficient investments to cultivate the renewable energy sector.

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[25] Evans, Simon, "Analysis: Which countries are historically responsible for climate change?" Carbon Brief, 5 October 2021. https://www.carbonbrief.org/analysis-which-countries-are-historically-responsible-for-climate-change

[26] WBG and ADB, "Climate Risk Country Profile: Indonesia," 2021, pp.12. https://reliefweb.int/sites/reliefweb.int/files/resources/climate-risk-country-profile-indonesia.pdf.

[27] Setyowati, Abidah. "Commentary: Is Carbon Neutrality Possible for Coal-Addicted Indonesia?" *Channel NewsAsia*, 22 Jul 2021. https://www.channelnewsasia.com/commentary/indonesia-coal-pln-carbon-net-zero-renewable-climate-change-2040561.

[28] McKinsey & Company, "Ten Ways to Boost Indonesia's Energy Sector in a Postpandemic World," *McKinsey & Company*, December 2021, pp.13. https://www.mckinsey.com/industries/oil-and-gas/our-insights/ten-ways-to-boost-indonesias-energy-sector-in-a-postpandemic-world

[29] Tetra Tech, "Indonesia Renewable Energy Business Opportunities." Prepared for U.K. Foreign & Commonwealth Office, British Embassy Jakarta. https://www.the-eic.com/portals/0/Website/Publications/Indonesia-Business-Opportunities-Study.pdf

[30] World Economic Forum, "Fostering Effective Energy Transition 2021," *World Economic Forum*, April 2021, pp. 13. http://www3.weforum.org/docs/WEF_Fostering_Effective_Energy_Transition_2021.pdf.

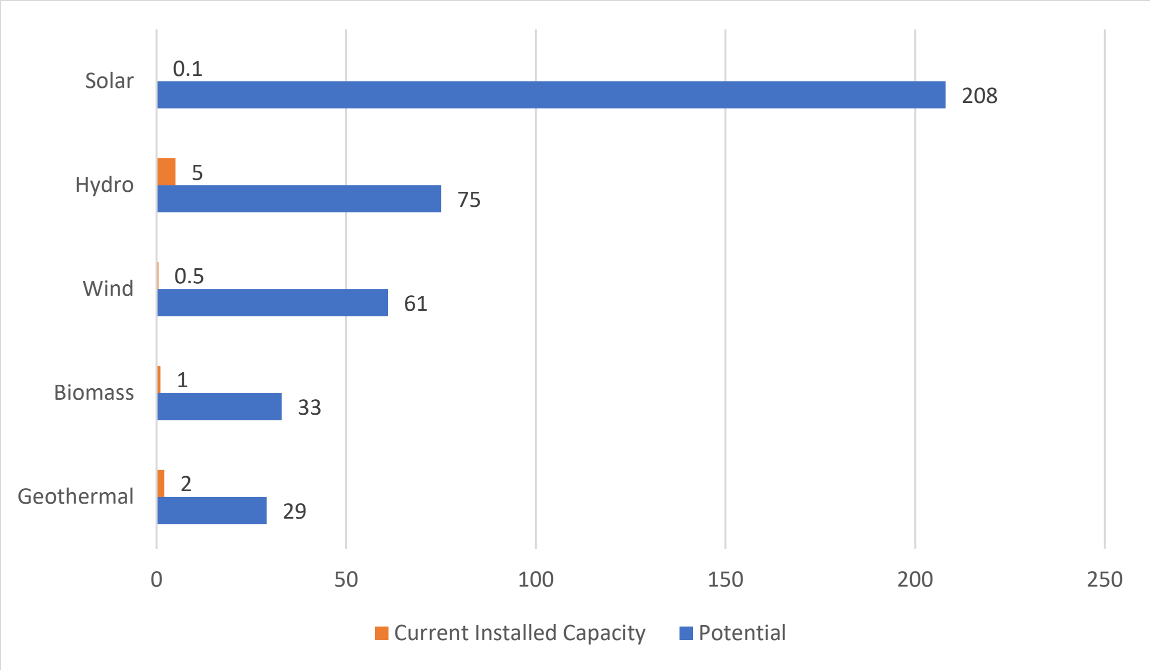

Figure 7. Potential and Current Installed Capacities of Renewable Energy in Indonesia (GW). Source: McKinsey.[31]

2.1 Indonesia's Energy Landscape

Indonesia had been a net exporter of oil in the 1980s with enough left over for domestic consumption, but in the 1990s shifted its energy generation sources towards coal. The decline of Indonesia's oil and gas reserves, along with the discovery of significant coal reserves, led to this reorientation of Indonesia's energy landscape. Indonesia went from an oil and gas exporter to an importer of both resources, while it became the world's second largest coal exporter after Australia. In 2018, coal accounted for about 50% of the country's electricity generation, followed by gas (29%), renewables (14%) and oil (7%).[32] Overall, fossil fuels constitute over 85% of Indonesia's energy sources, as seen in Figures 8a and 8b.

[31] McKinsey & Company, "Ten Ways to Boost Indonesia's Energy Sector in a Postpandemic World," *McKinsey & Company*, December 2021, pp.12. https://www.mckinsey.com/industries/oil-and-gas/our-insights/ten-ways-to-boost-indonesias-energy-sector-in-a-postpandemic-world

[32] Government of Indonesia, "Indonesia Energy Outlook 2019," Sep 2019, pp.8. https://www.esdm.go.id/assets/media/content/content-indonesia-energy-outlook-2019-english-version.pdf.

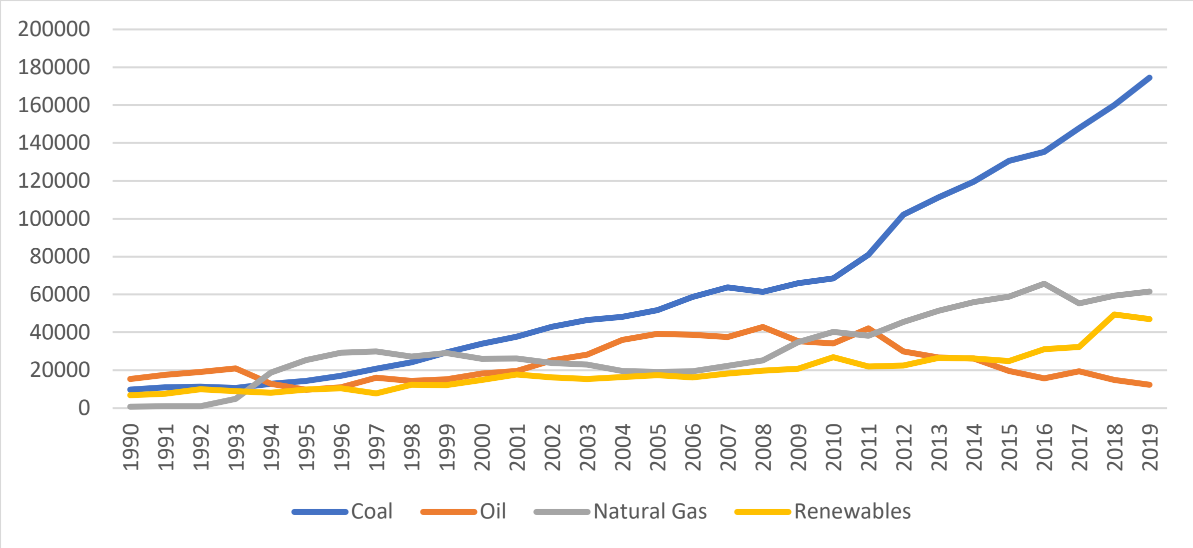

Figure 8a. Total Electricity Generation in Indonesia by Source, 1990-2019 (GWh)

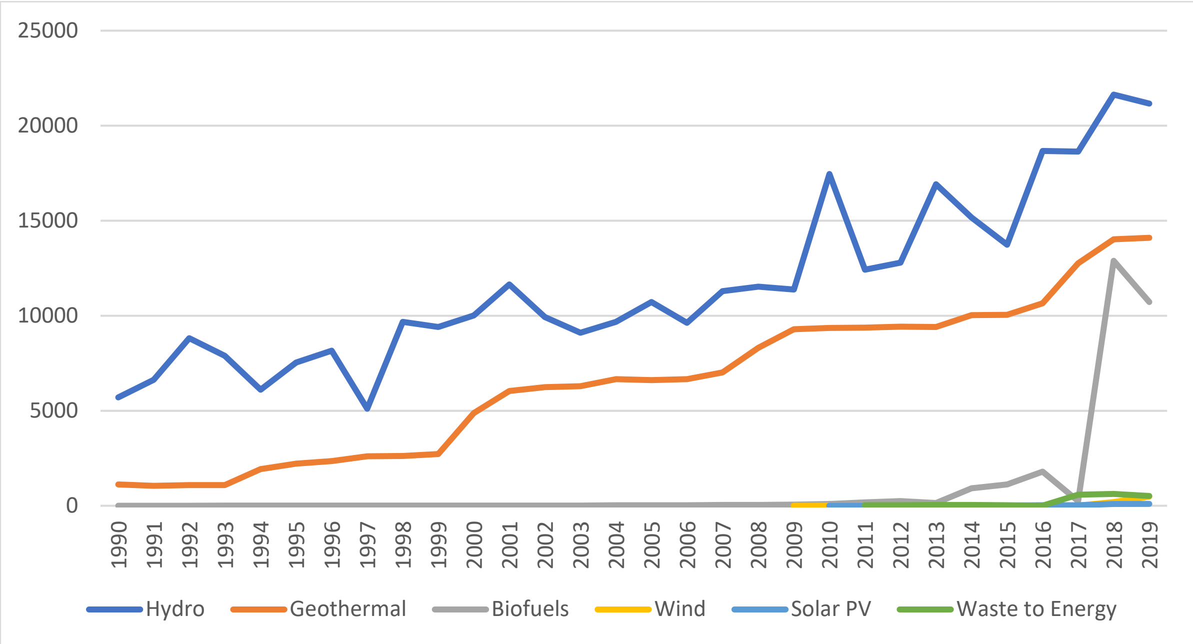

Figure 8b. Total Electricity Generation from Renewable Sources in Indonesia, 1990-2019 (GWh). Source: IEA.[33]

While Figure 8a shows that renewables have increased as a proportion of Indonesia's energy mix since the 1990s, Figure 7 shows that current trends are barely scraping the surface of their potential. Much of Indonesia's renewable energy sources remain untapped, particularly that of solar energy, the potential of which outstrips the combined potential of the other four sources. This is especially the case when compared to its neighbours, where the country is described as "a severe regional laggard in solar", with "less than 1% of Vietnam's 19GW" installed.[34] Yet, Figure 8b shows that hydro and geothermal power projects constitute the vast majority of Indonesia's renewable energy capacity, at 57% and 21% respectively. In contrast,

[33] International Energy Agency. "Indonesia". https://www.iea.org/countries/indonesia. Accessed 29 October 2021.

[34] Maulia, Erwida. "Indonesia struggles to turn to the light." *Nikkei Asia*, October 30 2021. https://asia.nikkei.com/Spotlight/Environment/Climate-Change/Asia-s-climate-crisis/Indonesia-struggles-to-turn-to-the-light

only 150 MW of solar projects had been installed by 2020, amounting to about 3% of Indonesia's solar photovoltaic (PV) capacity.[35] To understand why this discrepancy exists, it would be prudent to assess Indonesia's renewable energy policies and roadmaps.

2.2 Indonesia's Renewable Energy Policies

Indonesia's policy approach to renewable energy is the cumulation of several overlapping plans. At the overarching level, the 2005-2025 National Long Term Development Plan (RPJMN) outlines the vision of Indonesia as a self-reliant country. Key to this vision is the establishment of a reliable and efficient energy grid that can cover the entire island chain.[36] Moreover, the strategy explicitly calls for the adoption of renewable energy in the medium-term due to the environmental impacts of fossil fuels and the need to reduce reliance on external sources for Indonesia's energy needs.[37] These themes of energy diversification and self-reliance continue to inform Indonesia's energy transition.

The policy landscape below this is more complex, visualised in Figure 9. The Ministry of Energy and Mineral Resources (MEMR) is the agency in charge of Indonesia's energy sector, and its broad goals are outlined in the 2014 National Energy Plan (KEN) and implemented under the Presidential Regulation No.22/2017 on National Energy Planning (RUEN), both of which run until 2050.[38] The KEN and RUEN support the RPJPN's focus on energy diversification and self-reliance, and set a target energy mix of 0.4% oil, 22% gas, 55% coal and 23% "new and renewable" energy by 2025.[39] This 23% goal is in line with Indonesia's commitment to reduce emissions made during the COP 21 conference in 2015. These energy plans also operate in tandem with Indonesia's electricity plans, including the National Electricity Master Plan (RUKN), Regional Electricity Plan (RUKD) and Electricity Supply Business Plan (RUPTL). These three plans build on each other in much the same way as the KEN and RUEN; the RUKN is the basis for the RUKD and is essentially a 20-year estimation of electricity demand and supply that outlines how new energy resources can be utilised, but it is also subject to review once every three years. In turn, the RUPTL complements both the RUKN and RUKD as a 10-year business development plan for the electricity sector and is reviewed annually.[40]

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[35] ADB, "Indonesia Energy Sector Assessment, Strategy, and Road Map," Asian Development Bank., Dec 2020, pp.17. https:// www.adb.org/sites/default/files/institutional-document/666741/indonesia-energy-asr-update.pdf.

[36] Government of Indonesia, "Law of the Republic of Indonesia No.17/2007 on Long-Term National Development Plan of 2005-2025," *BAPPENAS*, pp 22, 36. https://policy.asiapacificenergy.org/sites/default/files/LONG-TERM%20NATIONAL%20DEVELOPMENT%20PLAN%20OF%202005-2025%20%28EN%29.pdf. Accessed 24 January 2022.

[37] "Law of the Republic of Indonesia No.17/2007," pp. 42, 65.

[38] The Ministry of National Development Planning (*BAPPENAS*) prepares the RPJMN, the Ministry of Finance (MOF) looks after budget allocations, the Ministry of Public Works and Public Housing regulates water usage rights, and the Ministry of Environment and Forestry approves access to land for renewable energy projects. The National Energy Council brings seven of these ministries and energy sector stakeholders to produce the KEN, approve the RUEN, and is coordinated by the Coordinating Ministry for Maritime and Investment Affairs.

[39] Government of Indonesia, "*Peraturan Pemerintah Republik Indonesia No.17/2014 Tentang Kebijakan Energi Nasional*," *BAPPENAS*, pp.8.

[40] ADB, "How Better Regulation can Shape the Future of Indonesia's Electricity Sector," *ADB*, Dec 2020, pp. 15. https://www.adb.org/sites/default/files/publication/668226/better-regulation-future-indonesia-electricity-sector.pdf.

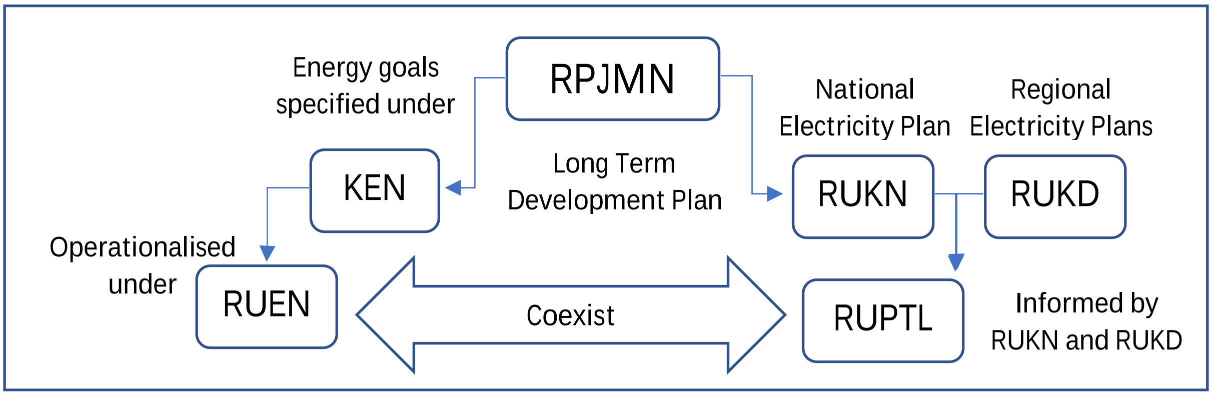

Figure 9. Flowchart of the Indonesian Policies Concerning Renewable Energy

A key consequence of these overlapping documents and timeframes is a vague, uncertain, and sometimes contradictory development path. The plans do not include specific guidelines on how to meet the outlined targets; moreover, the electricity plans, which are updated on a more regular basis, tend to come up with new targets without accompanying explanations. The RUPTL for 2018-2027 echoes the KEN 2014's aim for an energy mix of 0.4% oil and 55% coal for 2025, but the RUKN for 2015-2034 calls for an energy mix of less than 25% oil and over 30% coal for the same year. Even broad targets are not immune to sudden shifts, with the 2021-2030 RUPTL raising its proportion of targeted renewable energy from 30% by 2028 to 48% by 2030.[41] In addition, the announcement and cancellation of projects is often poorly explained. In the RUPTL for 2019-2028, for example, several coal projects in Java were reintroduced to the document after promises to remove them, while solar targets were reduced by 13%.[42] Amid this lack of clarity, at least three points stand out:

a. Continued coal dependence

Coal plays a dual role in Indonesia's economy – it is domestically consumed, accounting for 60 percent of its energy, and as of December 2021, Indonesia is currently the world's biggest exporter of coal. Coal remains both a key source of revenue as well as a source of geostrategic relevance – major powers like China and India have much greater reason to develop friendly relations with Indonesia to ensure access to this strategic resource. While pledging to increase its renewable energy usage, Indonesia is also slated to add an additional 27 GW of coal-fired generation under the RUPTL, increasing the share of coal in the electricity mix to 60-65%.[43] Coal's attractiveness is not only due to its relative abundance as a resource in Indonesia, but also its higher reserve to production ratio compared to oil.

Significantly, the coal industry is one of the most politically influential in Indonesia, as various academic studies have stressed.[44] This means that there are additional political

[41] Government of Indonesia, "Indonesia to Add 41GW from "Green" RUPTL," *MEMR*, 29 May 2021. https://www.esdm.go.id/en/media-center/news-archives/kejar-penambahan-41-gw-pemerintah-susun-ruptl-hijau.
[42] Hamdi, Elrika. "Indonesia's Solar Policies: Designed to Fail?" *IEEFA*, Feb 2019, pp.2. https://ieefa.org/wp-content/uploads/2019/02/Indonesias-Solar-Policies_February-2019.pdf
[43] ADB, "Indonesia Energy Sector Assessment, Strategy, and Road Map," pp.21.
[44] For example, see Atteridge, A., Aung, M.T. and Nugroho, A. *Contemporary coal dynamics in Indonesia*. SEI working paper 2018-04, 2018. Stockholm Environment Institute, Stockholm.

roadblocks for its phaseout, compared to neighbouring countries like Vietnam.[45] Coal also plays an important part in Indonesia's development not only for domestic usage, but also because the exports create revenue used to fund development projects. Scaling up renewable energies in Indonesia would disrupt the place of the coal industry, challenging both their domestic legitimacy and export markets. Yet, with the recent announcement that China is going to stop financing of new coal plants, it remains unclear how this trend will continue.

b. Large-scale hydro and geothermal project plans

Indonesia's state-owned utility company, *Perusahaan Listrik Negara* (PLN) has relied on hydro and geothermal power to increase the proportion of renewable energy in its energy mix. With the world's most substantial potential geothermal capacity, and with plenty of areas for long term hydropower projects, this is perhaps unsurprising.[46] Hydropower in particular offers a consistent source of energy that does not require significant technological leaps to harness, cementing its popularity. 17.9 GW of new hydropower capacity is targeted for completion by 2025, along with 3 GW of smaller hydro projects.[47]

However, hydropower and geothermal energy projects also carry significant risks. The plan to build 6-9 GW of cascading hydropower generators in North and East Kalimantan's Kayan river, a central effort in the RUPTL, will not only impact the local wildlife, but also risks becoming stranded if economic growth in the region is slower than expected.[48] In North Sumatra, the 150 MW Batang Toru hydropower project attracted criticism when it was reported that it threatens the only known habitat of the critically endangered Tapanuli orangutan.[49] Moreover, hydro and geothermal projects are typically large-scale, and are ill-suited to supply electricity to rural areas via isolated mini-grids. As such, other areas such as solar PV projects should be explored.

c. Ambiguities in Solar PV projects

Beyond the sheer scale of Indonesia's solar potential (400,000 MW, according to its energy ministry[50]), mini-PV grids, ranging from standalone 10–150-watt household systems to 10 kilowatt mini-grids, offer a viable and more environmentally-friendly means for Indonesians who live in remote areas to gain access to electricity.[51] Yet, before 2021, solar energy has been comparatively overlooked or taken for granted, as seen in the aforementioned

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[45] Xue, Gao, Michael Davidson, Joshua Busby, Christine Shearer, and Joshua Eisenman, "The Challenges of Coal Phaseout: Coal Plant Development and Foreign Finance in Indonesia and Vietnam." *Global Environmental Politics* (2021), 21(4): 110-133. https://doi.org/10.1162/glep_a_00630

[46] ADB, "Indonesia Energy Sector Assessment, Strategy, and Road Map," pp.16-17.

[47] ADB, "Indonesia Energy Sector Assessment, Strategy, and Road Map," pp.17.

[48] Hamdi Elrika, and Putra Adhiguna, "Putting PLN's Net Zero Ambition Into Context: The Numbers will Need to Add Up," *IEEFA*, Jun 2021. http://ieefa.org/wp-content/uploads/2021/06/Putting-PLNs-Net-Zero-Ambition-Into-Context_June-2021.pdf, pp.17.

[49] Nicholas Jong, Hans. "Dam that Threatens Orangutan Habitat Faces Three Year Delay," *Mongabay*, 15 Jul 2020. https://news.mongabay.com/2020/07/batang-toru-hydropower-dam-tapanuli-orangutan-delay-nshe/.

[50] Straits Times, "Coal-dependent Indonesia starts tapping huge solar power potential," *The Straits Times*, 6 Jan 2022. https://www.straitstimes.com/asia/se-asia/coal-dependent-indonesia-starts-tapping-huge-solar-power-potential

[51] ADB, "How Better Regulation can Shape the Future of Indonesia's Electricity Sector," pp.18-19. Officially, Indonesia's electrification rate reached 99% by 2020, though the quality of this coverage is unstable and prone to blackouts.

sudden reduction in solar PV targets in the RUPTL 2019. It was given an increase in 2021 plans, but the zig-zagging will no doubt leave investors sceptical.

There are signs that this is beginning to change in 2021. It remains to be seen how Indonesia will respond to the relative uptick in interest in solar energy, as pandemic-inspired work-from-home arrangements have led more Indonesians to explore home-based electricity generation. This has led the Indonesia Solar Energy Association to forecast that the installed capacity for rooftop solar panels could reach 1,000 MW by 2022, and continue to rise by between 3,000 MW and 5,000 MW each year starting in 2025.[52] Multiple solar farms are being built across Indonesia, including in Batam and West Java. For the latter, the PLN has agreed to purchase solar power-generated electricity at a cost equal to coal-fired plants, overcoming coal's biggest advantage.[53] A project from Australian company Sun Cable to export solar energy from Australia to Singapore also passes through Indonesian waters, and the company has pledged to invest USD2.5billion in related infrastructure in Indonesia. This has been touted as "a good learning experience for Indonesian local partners in building gigawatt-scale solar PV while waiting for the realization (auctions) of the domestic (RUPTL) market in years to come."[54] Yet, importantly, it is unclear how much of the energy produced in these projects will be allocated for Indonesia, and at this stage the impression that has been given is that the priority for Indonesia is the development of basic expertise and infrastructure.

Despite the optimism, Indonesia's trajectory is still far beyond what is desired. Understanding the challenges that this sector faces requires one to look beyond planning documents to assess the implications of the policies themselves.

2.3 Policy Challenges Facing Solar Energy Rollout in Indonesia

The limited development of solar PV projects in Indonesia can be attributed to three key challenges – cost and risk factors for installing and operating PV systems; the structure of the energy market and PLN's role; and policy uncertainty. As mentioned, these challenges coalesce around the issue of the inability to attract sufficient investments into Indonesia's renewable energy sector – a key issue also noted by the Institute for Essential Services Reform (IESR) in its December 2021 report.[55]

a. Cost and Risk Factors

[52] Straits Times, "Coal-dependent Indonesia starts tapping huge solar power potential," *The Straits Times*, 6 Jan 2022. https://www.straitstimes.com/asia/se-asia/coal-dependent-indonesia-starts-tapping-huge-solar-power-potential

[53] Guild, James. "Why Solar Power Could Take Off in Indonesia Soon." *The Diplomat*, 3 November 2021. https://thediplomat.com/2021/11/why-solar-power-could-take-off-in-indonesia-soon/

[54] IESR. *Indonesia Energy Transition Outlook 2022: Tracking Progress of Energy Transition in Indonesia: Aiming for Net-Zero Emissions by 2050*. Institute for Essential Services Reform, 2021, pp. 49 https://iesr.or.id/wp-content/uploads/2022/01/Indonesia-Energy-Transition-Outlook-2022-IESR-Digital-Version-.pdf

[55] IESR. *Indonesia Energy Transition Outlook 2022: Tracking Progress of Energy Transition in Indonesia: Aiming for Net-Zero Emissions by 2050*. Institute for Essential Services Reform, 2021. https://iesr.or.id/wp-content/uploads/2022/01/Indonesia-Energy-Transition-Outlook-2022-IESR-Digital-Version-.pdf. See also Kagda, Shoeb. "Solar power central to Indonesia's clean energy transition." The Business Times, 3 February 2022. https://www.businesstimes.com.sg/asean-business/solar-power-central-to-indonesias-clean-energy-transition

Investing in small-scale PV projects remains prohibitively expensive despite recent trends. From 2010-2018, the global average cost of investment in large-scale PV projects fell 77%, while battery prices have fallen 87% between 2010-2019 to US$156 per KWh.[56] Even in Indonesia, it was observed that the cost of solar panel systems had fallen 90% since 2010.[57] Yet, this only meant that installation of a PV panel system was now US$900-1,200 per kWp (kilowatt-peak, or the maximum electric power that the panel can supply in standard conditions)[58]. This is relatively cheap, but still higher than the global average of around US$883 per kWp.[59] Part of the problem is that Indonesia lags behind other countries in PV manufacturing and project development expertise, and is not yet an integral part of global supply chains, preventing it from benefitting from cheaper PV costs elsewhere.[60] While costs are likely to continue falling, installing a PV system is still expensive for a country whose GDP per capita was measured at US$3,869 by the World Bank in 2020.[61]

Independent power producers (IPPs) and other businesses face both cost and risk issues. IPPs are required by Law No.50/2017 on the Utilisation of Renewable Energy Resources for Electricity Supply to negotiate a selling price to PLN that does not exceed 85% of the latter's generation production cost, or BPP.[62] These baseline costs are heavily subsidised by the Indonesian government, reducing the competitiveness of the eventual sale price. Moreover, there are restrictions on foreign ownership of power generation projects depending on their output,[63] and IPPs are required to utilise locally produced (and thus much more expensive) equipment.[64] Given Indonesia's reliance on coal exports to fund its development revenue, this has also led to international tensions.[65]

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[56] Silalahi, David Firnando. "Why Solar Energy can Help Indonesia Attain 100% Green Electricity by 2050," *The Conversation*, 22 Apr 2020. https://theconversation.com/why-solar-energy-can-help-indonesia-attain-100-green-electricity-by-2050-134807.

[57] Rosana, Francisca Christy. "*Biaya Investasi PLTS Turun 90 persen, di Indonesia Mulai Rp 13 Juta per 1 KWp*," *Tempo.co*, 1 Jun 2021. https://bisnis.tempo.co/read/1467837/biaya-investasi-plts-turun-90-persen-di-indonesia-mulai-rp-13-juta-per-1-kwp.

[58] Sunariyanto, Budi Prayogo and Fitriyanti, Vivi . "Solar Energy can be RI's Trump Card to Provide Electricity to its Most Remote Regions," *The Jakarta Post*, 8 Sep 2021. https://www.thejakartapost.com/academia/2021/09/08/solar-energy-can-be-ris-trump-card-to-provide-electricity-to-its-most-remote-regions-.html.

[59] Statista. "Average installed cost for solar photovoltaics worldwide from 2010 to 2020 (in U.S. dollars per kilowatt)" https://www.statista.com/statistics/809796/global-solar-power-installation-cost-per-kilowatt/. Accessed 24 January 2021.

[60] ADB, "Indonesia Energy Sector Assessment, Strategy, and Road Map," pp.17.

[61] However, there has been dispute over the relative prices of solar power as compared to power sold from the PLN, with a recent article claiming that the former is cheaper. See The Straits Times, "Coal-dependent Indonesia starts tapping huge solar power potential," *The Straits Times*, 6 Jan 2022. https://www.straitstimes.com/asia/se-asia/coal-dependent-indonesia-starts-tapping-huge-solar-power-potential

[62] ADB, "Renewable Energy Tariffs and Incentives in Indonesia: Review and Recommendations," *ADB*, Sep 2020. https://www.adb.org/sites/default/files/publication/635886/renewable-energy-tariffs-incentives-indonesia.pdf, pp.5.

[63] ADB, "Renewable Energy Tariffs and Incentives in Indonesia: Review and Recommendations," pp.43. For projects between 1-10MW, foreign ownership may not exceed 49%, though exceptions are made for geothermal projects of equal to less than 10MW, which allow foreign ownership of up to 67%.

[64] ADB, "Renewable Energy Tariffs and Incentives in Indonesia: Review and Recommendations," pp.43. This is under Law 24/2018 on the National Team for the Increased Utilisation of Domestic Products.

[65] For example, the contradictions within this policy and role of the PLN are the roots beneath Indonesia's controversial move to curb coal exports in late-2021. As natural gas prices sharply rose due to a supply shock, coal demand as a replacement fuel accordingly increased, pushing up the global market price for coal. This made the incentive for Indonesian coal producers to sell to the foreign market higher, leading them to divert supplies away from domestic use. This, in turn, precipitated a domestic supply crunch, leading to the Jokowi administration

Recent announcements have yielded some bright spots in this respect – commercial solar users will be able to fully export their excess power to PLN by August 2022, from 65% previously. Indonesia's President Joko Widodo is also reportedly finalising a presidential regulation on renewable energy pricing that could help to address these cost issues.[66] In the meantime, however, IPPs still struggle to turn a profit from PV ventures due to these regulations.[67] It remains to be seen whether the changes will constitute a substantive shift to allow IPPs greater incentive.

b. Market Structure and PLN's Role

As the single buyer of Indonesia's electricity market, PLN exerts a strong influence on the country's energy transition efforts. Publicly, PLN has pledged to stop building new coal plants by 2023 and to phase out fossil fuels by 2060 to achieve carbon neutrality.[68] Yet, beyond the lack of price incentives as mentioned above, coal lock-in provides a powerful incentive for PLN to continue its coal investments. According to research by the IESR, current transition efforts under the RUPTL could lead to US$34.7 billion worth of coal-fired power plants becoming stranded assets, and this number will only grow as renewable energy technology becomes more efficient.[69] Already, observers such as Dadan Kusdiana, the Director-General of Renewable Energy under MEMR, have cast doubt on PLN's willingness to adopt renewable energy.[70] Moreover, it is noteworthy that of 75 renewable energy power purchasing agreements signed by PLN between 2017-2018, 36% have yet to reach financial closure, and close to 7% have been terminated.[71] The newest revision of the RUPTL appears to acknowledge this issue by increasing the long-term share of coal-based electricity generation.[72]

As such, there is a significant "chicken-and-egg" dilemma for Indonesia's energy pricing situation. To make PV projects profitable for IPPs and less expensive for small scale users, there needs to be higher investment into domestic PV technology to make cheaper equipment. While there are bright spots like the announcement that IPPs will be able to participate in an Indonesian carbon market[73], reports point out that the market size is kept small due to prevailing conditions such as high costs, while PLN's investments into coal deter it from

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using state power to divert supplies back, barring exports. This has led to unhappiness from coal importing countries, including the Philippines and Japan, and also possible future lack of trust in Indonesia as a reliable energy supplier. See, for example, Japan Times, "Japan presses Indonesia to lift coal export ban," *Japan Times*, 11 Jan 2022.

[66] Suharsono, Anissa, Lucky Lontoh and Martha Maulidia, "Indonesia's Energy Policy Briefing," *IISD*, Feb 2021. https://iisd.org/system/files/2021-03/indonesia-energy-policy-briefing-february-2021-en.pdf, pp.11.

[67] ADB, "Renewable Energy Tariffs and Incentives in Indonesia: Review and Recommendations," pp.5.

[68] Setyowati, Abidah. "Commentary: Is Carbon Neutrality Possible for Coal-Addicted Indonesia?" *Channel NewsAsia*, 22 Jul 2021. https://www.channelnewsasia.com/commentary/indonesia-coal-pln-carbon-net-zero-renewable-climate-change-2040561. The 2023 date has sometimes been changed to 2028, and it is unclear which is more precise.

[69] IESR, "Coal as Stranded Assets: Potential Climate-Related Transition Risk and Its Financial Impacts to Indonesia Banking Sector," *Institute for Essential Services Reform*, May 2021, pp.23-24.

[70] Coca, Nithin. "King Coal: How Indonesia Become the Fossil Fuel's Final Frontier," *Mongabay*, 17 Mar 2021. https://mongabay.com/2021/03/king-coal-how-indonesia-became-the-fossil-fuels-final-frontier/.

[71] Suharsono, Lontoh and Maulidia, "Indonesia's Energy Policy Briefing," pp.9.

[72] Suharsono, Lontoh and Maulidia, "Indonesia's Energy Policy Briefing," pp.6.

[73] The Straits Times, "Coal-dependent Indonesia starts tapping huge solar power potential," *The Straits Times*, 6 Jan 2022. https://www.straitstimes.com/asia/se-asia/coal-dependent-indonesia-starts-tapping-huge-solar-power-potential

pushing for change.[74] As research by the Institute for Energy Economics and Financial Analysis (IEEFA) points out, the resulting lack of bankable renewable energy projects deters financial institutions from investing in the Indonesian energy market, creating a vicious cycle.[75]

c. Policy Uncertainty

The above issues could be addressed through policy reforms into issues such as pricing and market structure to make the market more attractive to foreign investors; yet Indonesian government policies tend to exacerbate energy transition challenges rather than address them. While MEMR created a specific Directorate to address renewable energy in 2009, and despite numerous national energy and electricity roadmaps, the government has yet to formulate a consistent policy approach to develop the renewable energy sector.

Policies appear to change without warning, denting investor confidence. MEMR Regulation No.17/2013 established a price cap for solar energy from IPPs at US$0.25 per kWh if using less than 40% local content, or a higher cap of US$0.30 per kWh for those using more than 40%. Yet MEMR Regulation No.19/2016 changed the basis for pricing to geographic location instead, while regulations in 2017 and 2018 established the 85% BPP rule.[76] For small-scale rooftop PV systems, the practice between 2013 and 2018 was for households to accumulate credits that could be used to deduct from their regular electricity usage, as PLN could not "pay" its customers for excess electricity that they generated. This was already an unpopular arrangement, but MEMR Regulation No.49/2018 went further to reduce the lifespan of these credits from one year to three months, while also reducing the value of exported electricity credits from 100% to 65% of the PLN tariff.[77] Not only were consumers frustrated by inconsistent PV policies, but developers have been deterred from investing in such a volatile policy space due to the risk of lining up a project under one set of rules only to find their bankability significantly affected by a new set of regulations.[78]

Policy uncertainty also stems from a lack of institutional synchronicity. Evidence of a misalignment between the goals of different ministries can be found in Indonesia's setting of its 2060 net-zero emissions target. During the calculation stage, the Ministry of National Development Planning calculated four different year scenarios (2045, 2050, 2060, and 2070), while the Ministry for Environment only set one for 2070. This coordination received backlash and criticism from stakeholders, which compelled a revision of the targets and the final settlement of the 2060 target.[79] It has been suggested that this institutional conflict is rooted in the different goals of the ministries of trade and environment.

This is by no an exhaustive presentation or analysis of the different issues that may impact Indonesia's renewable energy policy, as it does not fully tackle the issue of climate

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[74] ADB, "Renewable Energy Tariffs and Incentives in Indonesia: Review and Recommendations," pp.43-44.
[75] Hamdi, "Indonesia's Solar Policies: Designed to Fail?" pp.18.
[76] Hamdi, "Indonesia's Solar Policies: Designed to Fail?" pp.6-8.
[77] Hamdi, "Indonesia's Solar Policies: Designed to Fail?" pp.10-11.
[78] International Institute for Sustainable Development, "Missing the 23 Percent Target: Roadblocks to the Development of Renewable Energy in Indonesia," *International Institute for Sustainable Development, GSI Report*. Feb 2018, pp. 9. https://www.iisd.org/system/files/publications/roadblocks-indonesia-renewable-energy.pdf.
[79] Suoneto, Noto. "Indonesia's Climate Commitments Ahead of the COP26 Summit." *The Diplomat*, 14 October 2021. https://thediplomat.com/2021/10/indonesias-climate-commitments-ahead-of-the-cop-26-summit/

finance.[80] Nevertheless, it finds that key challenges can be located in the ability for Indonesia to attract investment into its renewable energy sector, underpinned by issues including the market structure and policy uncertainty.

4. Renewable Energy in Malaysia: Overcoming Decentralisation?

Malaysia's greenhouse gases (GHG) emissions was 316.83 metric tonne of CO_2eq, far below Indonesia at 1,457.77 metric tonne of CO_2eq in 2016. However, absolute emissions do not portray the accurate picture as it scales according to population size and nature of the economy. Using emission intensity instead, Malaysia had the highest emissions intensity, recorded at 10.01 metric tonne CO_2eq per capita in 2016. This was the second highest emissions intensity value among ASEAN after Brunei, 2.5 times higher than the global average of 4 metric tonne CO_2eq per capita; 1.6 times higher than the ASEAN average of 6 metric tonne CO_2eq per capita.[81] Accordingly, the energy sector contributed more than three quarters of the country's total emissions with two highest energy subsectors being the electricity generation and transport industries (65% and 17% respectively within the energy sector itself).[82] This indicates that the energy sector is the priority for decarbonisation. Like many other ASEAN countries, the energy mix in Malaysia relies heavily on fossil fuels which is unsustainable in the long-run. To future-proof against this, the government has announced the Renewable Energy Target 2035 which aims to have 31% of renewable capacity mix by 2025, and scaling to 40% by 2035.[83]

In 2021, Malaysia updated its Nationally Determined Contribution (NDC) target to only have an unconditional 45% GHG intensity per GDP against 2005 levels without international support. As of 2016, the country has achieved 23.32% (approximately half of the progress) avoidance against its business-as-usual (BAU) level. Just before COP26, the Prime Minister announced a carbon neutrality plan under the 12th Malaysia Plan to make Malaysia a carbon neutral country by 2050 "at the earliest". Doubts over the clause "at the earliest" notwithstanding, some have touted this the most ambitious carbon neutrality pledge in Southeast Asia.[84] Its long-term strategy is set to be outlined in 2022, but the initially announced plan includes halting of coal power plants licensing, introducing carbon price, developing EV technology, and expanding its "blue economy". To achieve these goals, the country must overcome its existing challenges, especially those stemming from its highly decentralised governance structure.

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[80] See Setyowati, Abidah B. "Governing sustainable finance: insights from Indonesia," *Climate Policy* (2020). 10.1080/14693062.2020.1858741; Setyowati, Abidah B. "No more dark days: Why Indonesia needs climate finance for its energy transition." *East Asia Forum*, 7 August 2019. https://www.eastasiaforum.org/2019/08/07/no-more-dark-days-why-indonesia-needs-climate-finance-for-its-energy-transition/

[81] Data was analysed and adapted from each individual ASEAN country's Biennial Update Report (BUR) with the latest emissions declaration up to 2016.

[82] Government of Malaysia, *Third Biennial Update Report To The UNFCCC*. Putrajaya, December 2020. https://unfccc.int/sites/default/files/resource/MALAYSIA_BUR3-UNFCCC_Submission.pdf

[83] Ibid.

[84] Channel News Asia. "12th Malaysia Plan: What you need to know about the 2050 carbon neutral goal and other green measures," *Channel NewsAsia*, September 28, 2021, https://www.channelnewsasia.com/asia/malaysia-12th-plan-carbon-neutrality-2050-green-growth-ismail-sabri-2206756.

3.1 Malaysia's Energy Landscape

Statistically, Malaysia is a net importer of two key fuels – coal and piped natural gas (see area covered by the red curve in Figures 10a and 10b, which is much higher than the area covered by the blue curve).[85] The declining of local gas supplies and large quantities of coal import puts Malaysia's energy security in risk. In 2018, Malaysia was one of the largest global coal importers. Coal translated to 43% of power generation in 2018 and has become more economically competitive than natural gas in recent years. This is despite Malaysia's limited domestic coal reserves – in 2018, the country produced about 3 million tons of coal, or about 8% of its total coal consumption. The shortage becomes 38 million in 2019, the bulk of imports coming from Indonesia and Australia.[86]

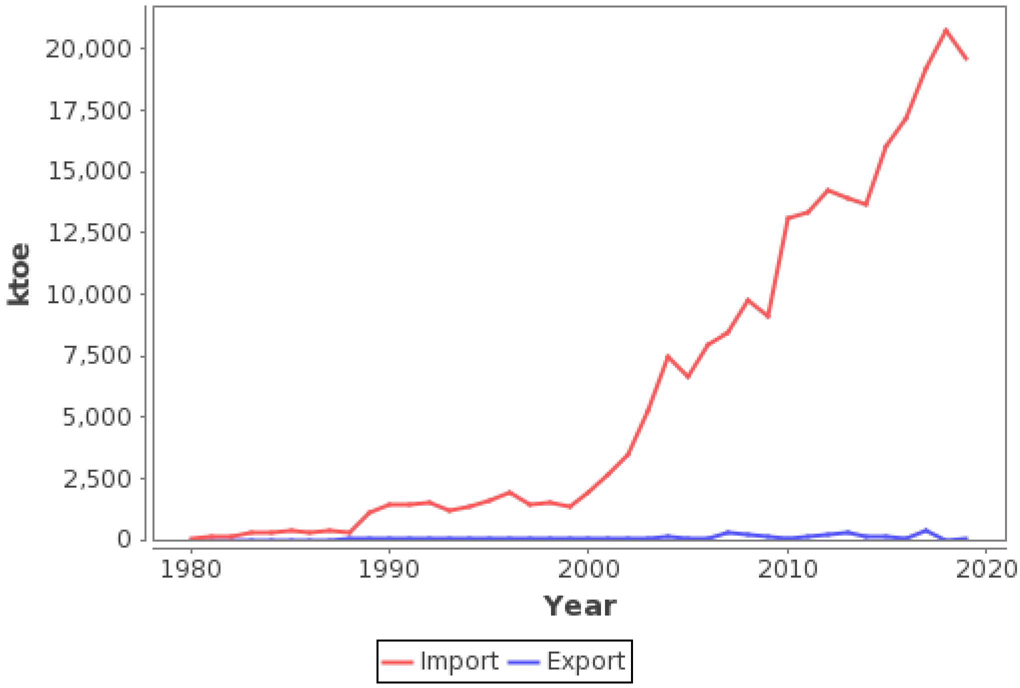

Figure 10a: Malaysia Coal Imports. Source: Energy Commission, coal import[87]

[85] Energy Commission. "Natural Gas - Import & Export". https://meih.st.gov.my/statistics. Accessed 15 November 2021; Energy Commission. "Coal - Import & Export". https://meih.st.gov.my/statistics. Accessed 15 November 2021.
[86] US Energy Information Administration. "Malaysia." https://www.eia.gov/international/analysis/country/MYS. Accessed 15 November 2021.
[87] Energy Commission. "Coal - Import & Export". https://meih.st.gov.my/statistics. Accessed 15 November 2021.

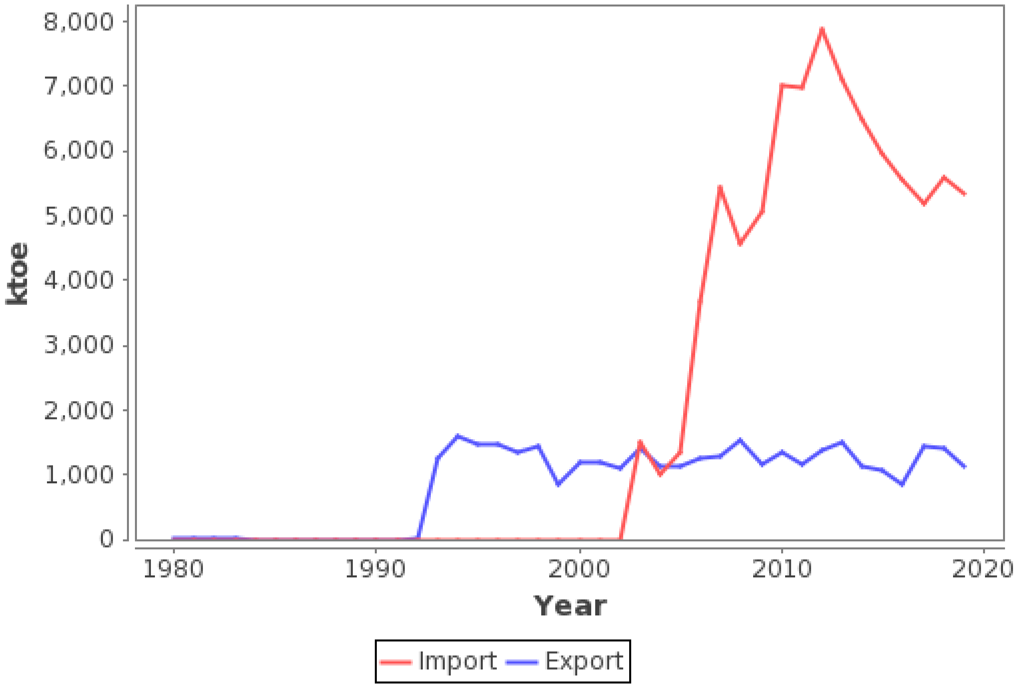

Figure 10b: Malaysia's natural gas imports. Source: Energy Commission, natural gas import[88]

From 1980 – 2019, the GDP per capita of Malaysia grew at a 3.75% year-on-year rate (RM43,794 per capita, 2019) while the electricity demand per capita grew at a 5.40% year-on-year rate (4,877 kWh per capita, 2019).[89] The historical growth trends suggest that electricity demand has been growing faster than the GDP productivity, and the government will therefore need to procure more electricity generation by 2050 for sustained economic growth. This is due to how energy access correlates highly with economic growth. In fact, the UN model shows that Affordable and Clean Energy access (SDG 7) correlates with 13 other development goals such as safety, clean water access, climate change mitigation.[90] Assuming that business continues as per usual, in 2050, ERIA expects power generation mix to grow 2.5 times from 2020 to about 431 terrawatt-hours (TWh) and be dominated by natural gas with a 48.0% share, followed by coal (42.7%), hydropower (7.5%), other renewables (1.1%) and oil (0.6%).[91] As of 2019, the total installed capacity was about 36GW, of which fossil fuels accounted for 78%, as well as 83.5% of the country's electricity output, whereas renewables including hydro accounted for almost 22% of capacity mix and 16.5% of the country's electricity output. In

[88] Energy Commission. "Natural Gas - Import & Export". https://meih.st.gov.my/statistics. Accessed 15 November 2021.
[89] Energy Commission. "Economic Indicator - GDP per Capita". https://meih.st.gov.my/statistics. Accessed 15 November 2021; Energy Commission. "Energy Indicator - Energy Intensity per Capita (kWh/person)". https://meih.st.gov.my/statistics. Accessed 15 November 2021
[90] United Nations ESCAP. *Visualisation map of the interlinkages between SDG 7 and other SDGs.* Bangkok: UNESCAP, 2018. https://www.unescap.org/sites/default/files/Visualisation%20of%20interlinkages%20for%20SDG%207_new.pdf.
[91] Economic Research Institute for ASEAN and East Asia. *Malaysia Country Report.* Jakarta: ERIA, 2021, pp. 181. https://www.eria.org/uploads/media/Books/2021-Energy-Outlook-and-Saving-Potential-East-Asia-2020/18_Ch.11-Malaysia.pdf

2019, the country's net electricity generation was about 175GWh.[92] Figures 11a, and 11b show the electricity generation mix and electricity generation from renewables in Malaysia.

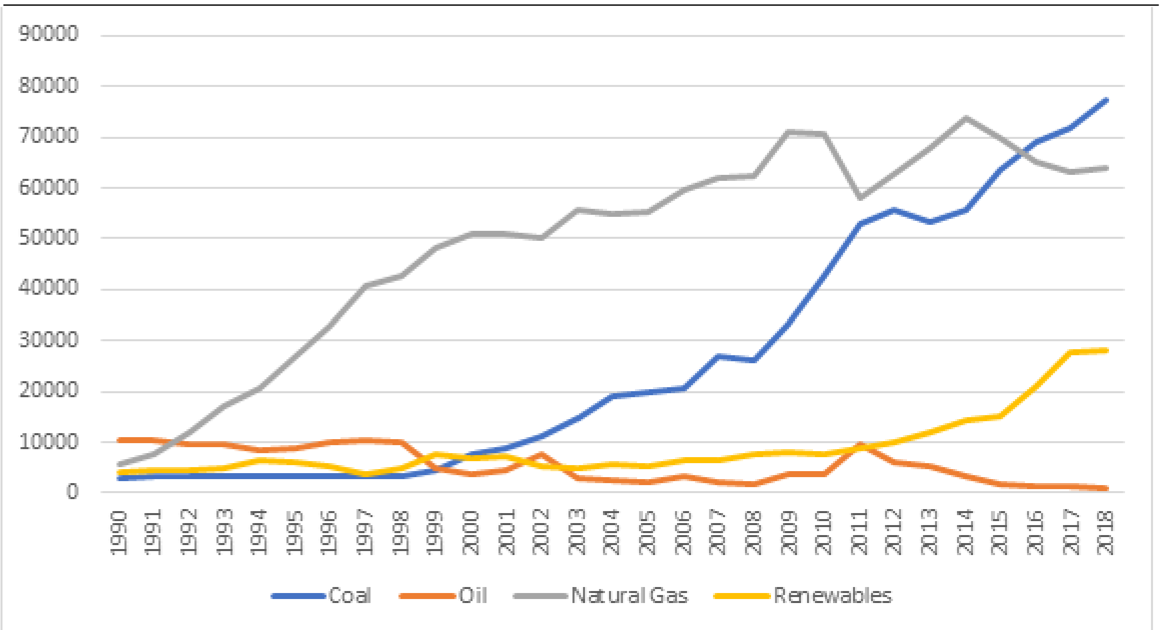

Figure 11a: Total Electricity Generation in Malaysia by Source, 1990-2018 (GWh/time).

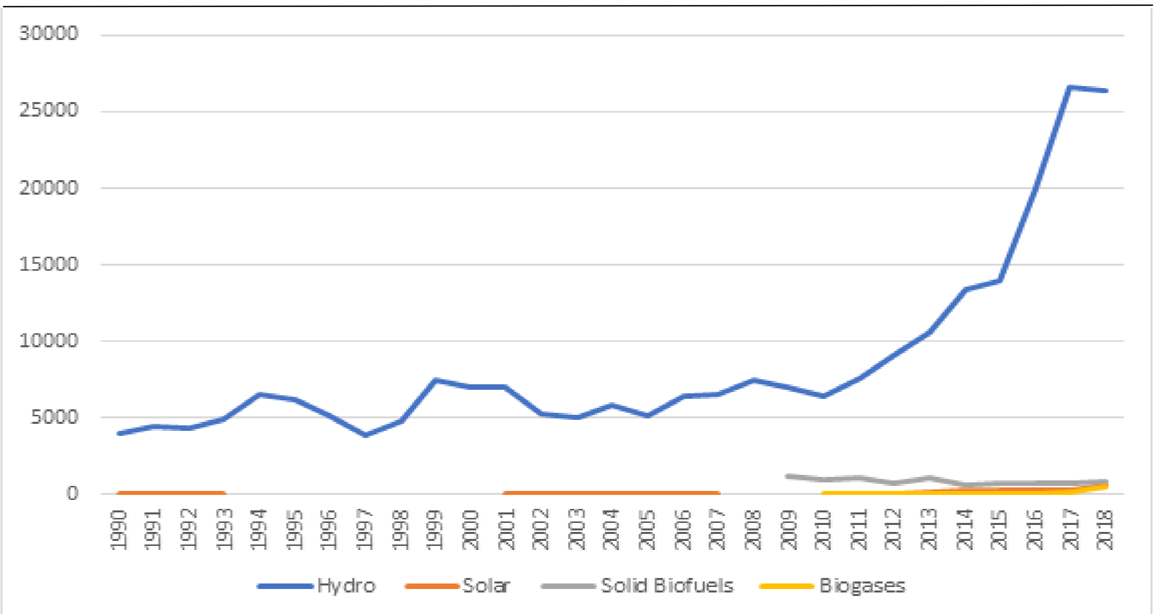

Figure 11b: Total Electricity Generation from Renewable Sources in Malaysia, 1990-2018 (GWh/time). Source: IEA Country Profile on Malaysia[93]

In 2018, the Malaysian government announced a target to achieve 20% of renewable energy share in the national capacity mix by 2025. This target was part of Malaysia's commitment to GHG emissions reduction under the Paris Agreement led by the UNFCCC. In

[92] Energy Commission. *Malaysia Energy Statistics Handbook 2020.* Putrajaya: EC, 2021. https://meih.st.gov.my/documents/10620/23817e60-6b26-4dab-9b82-2c106a661aeb.
[93] International Energy Agency. "Malaysia" https://www.iea.org/countries/malaysia. Accessed 15 November 2021.

2021, the Malaysian government has updated their renewable energy target to have 31% of renewable share in capacity mix by 2025, and 40% by 2035. The NDC has also updated to unconditional 45% reduction against 2005's BAU level without international support. As of 2021, nationwide installed renewables including hydro stands at 7,995MW accounted for approximately 22% of total installed capacity. The renewable energy capacity is set to increase to 18,000MW by 2035.[94]

While Malaysia started off as one of the pioneers of renewable energy in the region (as early as 2001), their first-mover advantage did not persist for long. Malaysia currently ranks 39th globally in terms of energy transition readiness. The findings of the WEF show that Malaysia is the only ASEAN country which has experienced negative growth from 2015 – 2020 in terms of its energy transition competence.[95] An advantage of renewable energy (particularly solar PV) is energy access to marginalised groups like those living in rural or mountainous areas that are far away from the grid. The Ministry of Rural Development via its flagship programme of Rural Electricity Supply (BELB) is currently working with the utility to provide energy access to the marginalised groups.[96] As of 2020, 291 households have benefitted from the programme.[97] There are also other programmes such as installations of solar PV streetlight and energy access rewiring.[98] Overall, energy access is more than 99% in Peninsular Malaysia, however, in Sabah and Sarawak, the energy access is lower with big projects are still being developed to improve the electrification rate.[99]

3.2 Malaysia's Renewable Energy Policies

As mentioned, Malaysia was one of the pioneers of renewable energy in the region, its first policy was introduced two decades ago during the 8th Malaysia Plan (2001 – 2005) with a target of 500MW on-grid renewable energy projects by the end of 2005. There were two programmes introduced to facilitate the projects uptake, namely the Small Renewable Energy Power (SREP) in 2001 and Biogen Full Scale Model Demonstration Project in 2002 which was internationally supported by the United Nations Development Programme (UNDP) to promote biomass projects.

Later, the Malaysian Building Integrated Photovoltaic (MBIPV) project with the support of UNDP was introduced during the 9th Malaysia Plan (2006 – 2010). The objective of this programme was to kickstart the solar market in Malaysia. Back then, buildings were

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94 Malaysian Investment Development Authority. "Malaysia aims 31% RE capacity by 2025". https://www.mida.gov.my/mida-news/malaysia-aims-31-re-capacity-by-2025/

95 World Economic Forum. *Fostering Effective Energy Transition 2020 edition.* Geneva: WEF, 2020. https://www3.weforum.org/docs/WEF_Fostering_Effective_Energy_Transition_2020_Edition.pdf. 1

96 United Nations ESCAP. *Rural Electricity Supply (BELB).* Bangkok: UNESCAP, 2016. https://policy.asiapacificenergy.org/sites/default/files/BELB%20Programme.pdf.

97 Tenaga National Berhad. *Integrated Annual Report 2020.* Kuala Lumpur: TNB, 2021. https://www.tnb.com.my/assets/annual_report/TNB_IAR_2020.pdf.

98 Ibid.

99 World Bank. "Access to electricity (% of population) - Malaysia" Accessed 15 November 2021. https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=MY ; Malay Mail. "Federal govt spent RM26.4b to improve Sabah's electricity supply, says minister," *MM*, August 22, 2021, https://www.malaymail.com/news/malaysia/2020/08/22/federal-govt-spent-rm26.4b-to-improve-sabahs-electricity-supply-says-minist/1896218; Wong, Jack. "Sarawak to electrify Sabah from end-2023," *The Star*, August 9, 2021, https://www.thestar.com.my/business/business-news/2021/08/09/sarawak-to-electrify-sabah-from-end-2023

encouraged to integrate solar panels into their design, and one of the most successful buildings is still operating until today, with an annual avoidance of 360 tonnes of CO_2.[100] The learning experience of the MBIPV project led to the development of the country's National Renewable Energy Policy and Action Plan (NREPAP). In April 2010, the Malaysian Cabinet approved the NREPAP which leads to the creation of Feed-in Tariff (FiT) scheme in the next Malaysia Plan. During this decade (2001 – 2010), the government achieved approximately one-tenth (50MW) of its intended target capacity of 500MW.[101]

In the 10th Malaysia Plan (2011 – 2015), the FiT scheme was introduced, provisioned by the Renewable Energy Act 2011 (Act 725). The FiT scheme was a subsidy-based scheme that pays energy premium to developers based on determined tariff rate, contract tenure, and electricity that is successfully exported to the grid.[102] The FiT scheme has created a robust renewable energy market in Malaysia, not only benefitting the solar players but developers of other renewable energy resources as well. All indigenous resources such as biogas, biomass, solar PV, small hydro, and geothermal can be accepted under the scheme. The government imposes a 1.6% surcharge on electricity consumers to fund the premium pay-out to developers. This was also a precursor to the upcoming carbon tax as large power consumers have to pay more than the average consumers. To further encourage localisation of this new market, developers who use locally manufactured parts or fulfil certain utilisation conditions such as putting solar panels on rooftops of farms are entitled to bonus tariff premiums.[103] The FiT scheme has brought several social benefits to the country; first, grid-connected renewables have increased; second, the costs of solar PV systems have reduced; third, there is an increase in green jobs and professionals; and fourth, there is greater maturity in the supply chain.

Since then, the renewable energy schemes in Malaysia have progressed organically beyond the government subsidy, especially for solar energy under the 11th Malaysia Plan (2016 – 2020). The solar programmes were extended to include large scale solar (LSS) auctions, net energy metering (NEM) whereby consumers can export extra energy generated from solar panels to the grid, and self-consumption (SELCO) schemes whereby solar panels can be installed to offset some of the daily energy demand especially for industrial consumers. Renewable energy capacity target during this period was set to achieve a 7.8% share of total installed capacity in Peninsular Malaysia and Sabah or equivalent to 2,080 MW.[104]

Relatedly**,** due to its ease of deployment, solar PV has also been used to help households to generate side income from electricity that is sold to the grid. In 2016, the government attempted to ease the living costs of rural demographic groups by incentivizing the MySuria programme whereby solar PV installations were provided for free for households in the bottom

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[100] Malaysian Green Technology and Climate Change Corporation. "Green Energy Office Building". https://www.mgtc.gov.my/about-us/green-energy-office-building/. Accessed 15 November 2021

[101] Shadman, Saleh, Christina Chin M.M, and Novita Sakundarini. "Energy security in Malaysia: Current and future scenarios," *Asia Research Institute*, December 11, 2018. https://theasiadialogue.com/2018/12/11/energy-security-in-malaysia-current-and-future-scenarios/.

[102] Sustainable Energy Development Authority. "Feed-In Tariff (FIT)" Accessed 15 November 2021. http://www.seda.gov.my/reportal/fit/

[103] Sustainable Energy Development Authority. "FIT Rates" Accessed 15 November 2021. http://www3.seda.gov.my/iframe/

[104] Chan, Julia. "Minister: Malaysia's first geothermal plant to be operational by 2018," *Malay Mail*, August 5, 2016. https://www.malaymail.com/news/malaysia/2016/08/05/minister-malaysias-first-geothermal-plant-to-be-operational-by-2018/1177031.

40% of monthly median income, and any power generated will be sold to the grid at a premium. The programme had a committed fund of RM45 million, aimed to benefit 1,620 households with an average promised income of more than RM250 per month for a period of 10 years. This initiative was a collaboration between the federal government and the state government whereby the latter was responsible in selecting the eligible participants. The federal government via its finance Ministry was responsible in granting the final approval, and its energy Ministry was the technical implementor.[105]

3.3 Solar PV Outlook in Malaysia

Among all the renewable energy resources, solar energy by far has the highest utilisable potential. It is estimated that in Peninsular Malaysia alone, there are over 4.12 million buildings with rooftop solar potential and capable to mount 34GW-worth of capacity.[106] As of 2019, the installed capacity of solar PV was about 1GW, with more in the pipeline from commercial operations.[107] The outlook for solar PV market is largely positive, for example market intelligence by IHS Markit estimates that Malaysia's installed solar capacity may see 7 times increase by 2030. In the long run, this could increase 30 times by 2050 to see solar dominate 90% of renewables in Malaysia.[108] Additionally, Fitch predicts that Malaysia's installed solar capacity may grow 4 times by 2030 to 4GW.[109]

The reason for this as IHS Markit points out is that Malaysia has been consistent in implementing large-scale tenders, and has been responsive in modifying said schemes to support the more rapid development of its solar capacity. Logistically, the strong local supply chain for solar and interest from foreign investors could help to spur its development as well.[110] Fitch also noted that the tender policy has been largely successful in introducing new financing incentives, leading to a rise in project announcements. There would be headwinds from COVID-19 and political uncertainties, but Fitch expects the sector to recover from 2021.[111] In fact, LSS@MEnTARI (1GW tender exercise) was an economic recovery stimulus given by the government to mitigate the market shock. It was estimated that the recent tender could unlock 4-billion-ringgit investment and create 12,000 green jobs.

[105] Sustainable Energy Development Authority. *Annual Report 2017.* Putrajaya: SEDA, 2018. http://www.seda.gov.my/pdfdownload/annual-report-2017/.

[106] Sustainable Energy Development Authority. "Malaysia Can Generate More Electricity If All Roofs Use Solar Panels, Says Yeo". Sustainable Energy Development Authority, May 2019. http://www.seda.gov.my/2019/05/malaysia-can-generate-more-electricity-if-all-roofs-use-solar-panels-says-yeo/

[107] Energy Commission. *Malaysia Energy Statistics Handbook 2020.* Putrajaya: EC, 2021. https://meih.st.gov.my/documents/10620/23817e60-6b26-4dab-9b82-2c106a661aeb.

[108] Lee, Bernadette. "Malaysia to rely on annual tenders to achieve 7 GW renewable target by 2025: consultant," *IHS Markit*, April 19, 2021, https://cleanenergynews.ihsmarkit.com/research-analysis/malaysia-to-rely-on-annual-tenders-to-achieve-7-gw-renewable-t.html.

[109] Fitch Solutions. "Growth Prospects for Solar Power in Malaysia Improving". Fitch Solutions, 19 March 2021. https://www.fitchsolutions.com/renewables/growth-prospects-solar-power-malaysia-improving-19-03-2021

[110] Lee, Bernadette. "Malaysia to rely on annual tenders to achieve 7 GW renewable target by 2025: consultant," *IHS Markit*, April 19, 2021, https://cleanenergynews.ihsmarkit.com/research-analysis/malaysia-to-rely-on-annual-tenders-to-achieve-7-gw-renewable-t.html. 1

[111] Fitch Solutions. "Growth Prospects for Solar Power in Malaysia Improving". Fitch Solutions, 19 March 2021. https://www.fitchsolutions.com/renewables/growth-prospects-solar-power-malaysia-improving-19-03-2021

In March 2021, the government shortlisted 30 winning bidders for a total combined capacity of 823MW.[112] Winning bid prices have also continued to register a slight decline from the previous auction, and ranged from as low as MYR0.1850/kWh for 10-30MW projects and MYR0.1768/kWh to MYR0.1970/kWh for 30-50MW projects.[113] These prices are already competitive with gas-fired power in Malaysia.[114] Outside of solar tenders, Johor also announced the development of a 450MW solar park in Pengerang, which will be the largest in the region upon fruition (estimated 2023). The project is part of the 2030 Johor Sus development plan, and marks its first investment into large-scale renewable energy.

If the government continues to be responsive to the price and market signals, then, in the future, the tender for solar PV may require innovative design following global practices such as battery storage integration to create solar-battery hybrid plants. As mentioned in Section 2, the energy storage technologies are needed to facilitate greater dispatchability of energy. Hybridised solar-battery plants may provide the flexibility needed. This would increase the effective capacity credit of solar-battery plants, limiting the need of additional gas fired plants for rapid ramping, thus enabling higher share of renewables in the capacity mix.

3.4 Policy Challenges for Malaysian Rollout of Renewable Energy

Earlier subsections in 3.1 and 3.2 illustrated the information on how Malaysia initially started strong as one of the regional pioneers but ended up underperforming, and how their Ministry of Finance has the final say in certain policy decisions. Despite some having a rosy outlook for solar energy in Malaysia, there are several key challenges that may block Malaysia from realising its goals. This subsection will discuss the policy challenges facing the country's rollout of policy, especially those rooted in its highly decentralised governance structures.

In 1990 to 2005, following the national privatisation policy, the power sector in Malaysia was separated into three governing regions: Peninsular Malaysia, Sabah, and Sarawak. The National Electricity Board was corporatized as Tenaga Nasional Berhad (TNB), the Sabah Electricity Board become Sabah Electricity Sdn. Bhd. (SESB) with TNB as the major shareholder, and lastly Perbadanan Pembekalan Letrik Sarawak (SESCO) has evolved to today's Sarawak Energy Berhad (SEB). Peninsular Malaysia and Sabah adhere to the Electricity Supply Act 1990, while Sarawak has its own Electricity Ordinance which provisioned the state to govern its own power-related affairs. This decentralisation of power allows Sarawak to set its own state-related target instead of following the federal target. As of 2019, Sarawak has only 0.1MW of solar PV capacity installed. Most of the renewable energy projects are situated in Peninsular Malaysia followed by Sabah, then lastly Sarawak.[115]

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[112] Energy Commission. *Request For Proposal (RFP) for the Development of Large Scale Solar Photovoltaic (LSSPV) Plants in Peninsular Malaysia for Commercial Operation in 2022/2023 (LSS@MEnTARI): Selection of Shortlisted Bidders*. Putrajaya: EC, 2021. https://www.st.gov.my/contents/2021/LSS/Announcement%20of%20the%20Selected%20Shortlisted%20Bidders%20for%20LSS%40MEnTARI.pdf.
[113] Ibid.
[114] Fitch Solutions. "Growth Prospects for Solar Power in Malaysia Improving". Fitch Solutions, 19 March 2021. https://www.fitchsolutions.com/renewables/growth-prospects-solar-power-malaysia-improving-19-03-2021
[115] Energy Commission. *Malaysia Energy Statistics Handbook 2020.* Putrajaya: EC, 2021. https://meih.st.gov.my/documents/10620/23817e60-6b26-4dab-9b82-2c106a661aeb.

However, Sarawak has a large indigenous supply of renewable hydropower resources, and due to hydropower's high capacity factor, electricity tariffs in Sarawak remain cheaper than Peninsular Malaysia and Sabah. For example, domestic tariffs in Sarawak for 1 to 200 units are in the range of MYR0.18 – MYR0.22, against MYR0.218 in Peninsular Malaysia, and MYR0.24 for the first 40 units in Sabah.[116] If Sarawak is determined to keep the electricity tariff low, then the state will likely continue to expand on its large hydropower resources rather than other renewables. This in return, ostensibly gives Sarawak some technological edge, such as green hydrogen maturity which will soon being exported or piloted in refuel stations.[117] Yet, this does not mean achieving long term renewable energy target is now the policy direction of Peninsular Malaysia and Sabah. In 2017, SESB in Sabah was declared insolvent due to cashflow problems. It has been noted that the cost of supply in Sabah is high as the terrains are mostly hillsides, but tariffs have to kept at a minimum to ensure affordability.[118] Therefore, any renewable energy scheme that enables the offset of energy or is subsidy based will not be feasible as the utility will lose even more revenue by selling less units of electricity to the consumers. This leaves Peninsular Malaysia as the only region which can reasonably scale up its renewable energy installation to meet long-term targets, as pointed out by the Minister of Energy and Natural Resources.[119]

Within Peninsular Malaysia itself, energy mandates or energy governing structures are also decentralised into five different Ministries namely the Economic Planning Unit of the Prime Minister's Office (EPU), Ministry of International Trade and Industry (MITI), Ministry of Finance (MOF), Ministry of Energy and Natural Resources (KeTSA), and Ministry of Plantation Industries and Commodities (MPIC). The EPU and MITI look after the traditional energy mandate of oil and gas market activities, especially the issue of fossil fuel subsidies. The EPU in particular sets high level energy policy such as the Malaysia Plans. MITI can also set the policy direction for industrial activities such as corporate tax holidays, import tax reduction for certain preferred economic activities – for example manufacturing business of electric vehicles. MOF is the in-principle final approver for any scheme or programme that may disrupt the country's tax revenue. KeTSA is responsible for the regulation of power generation and tariffs for consumers in Peninsular Malaysia and Sabah. Lastly, MPIC is responsible for the regulation of biofuel operators, this is the ministry that regulates all palm oil firms in Malaysia.

The decentralised governance structures create decentralised approaches to renewable energy rollout in Malaysia. The pros and cons of decentralised approaches are apparent, as on

[116] Sarawak Energy Berhad. "Tariffs". Accessed 15 November 2021. https://www.sarawakenergy.com/customers/tariffs.; Tenaga Nasional Berhad. "Pricing & Tariffs". https://www.tnb.com.my/residential/pricing-tariffs.

[117] Malaysian Investment Development Authority. "Sarawak plans to export green hydrogen". Malaysian Investment Development Authority, 23 October 2020. https://www.mida.gov.my/mida-news/sarawak-plans-to-export-green-hydrogen/; Lim, Adrian. "Petros to launch Malaysia's first 3-in-1 multi-refuelling station in Darul Hana," *Dayak Daily*, October 20, 2020, https://dayakdaily.com/petros-to-launch-malaysias-first-3-in-1-multi-refuelling-station-in-darul-hana/.

[118] The Borneo Post. "Ongkili denies using 'bankruptcy' in statement on SESB," *The Borneo Post*, December 27, 2017. https://www.theborneopost.com/2017/12/27/ongkili-denies-using-bankruptcy-in-statement-on-sesb/.

[119] Malaysian Investment Development Authority. "Malaysia aims 31% RE capacity by 2025". Malaysian Investment Development Authority, 23 June 2021. https://www.mida.gov.my/mida-news/malaysia-aims-31-re-capacity-by-2025/

one hand, it favours individual speed and implementation, and on the other hand it may become a long-term policy challenge as the diverse stakeholders may fail to reach a consensus. For example, the empty fruit bunches (EFB) of palm oil waste have better financial value if sold as mulch than be used as a feedstock for biomass energy generation.[120] KeTSA cannot compel the palm oil millers to sell the EFB as feedstock, MPIC will have to make a policy decision on the use of EFB. For KeTSA, its key performance index is to achieve the long-term renewable energy target, therefore it appears rational for KeTSA to push for EFB biomass energy utilisation as part of their agenda. However, there is no incentive for MPIC to follow KeTSA's policy direction as the Ministry is expected to protect the interests of the palm oil millers. This is a classic example to illustrate that each Ministry behaves individually rationally, but collectively irrationally. This decentralised approach may only promote a culture of "business as usual" whereby nothing is expected to change, hence no addition of renewable capacity from biomass, leaving Malaysia to still emit as much emissions as previously estimated.

Moreover, decentralised approaches also mean that the energy mandates or broader climate change mitigation efforts are tied to local governments rather than to centralised institutions. Centralised goals themselves shift according to political winds, reflected by how Malaysia's renewable energy target itself has shifted as frequently as the changes in Cabinet.[121] Perhaps realising this institutional shortfall, the central government has sought to revive the drafting of the Climate Change Act.[122] Regionally, only the Philippines has the Climate Change Act 2009 which centralised climate change mitigation effort. The Act has "*mainstreamed climate change into government policy formulations, establishing the framework strategy and program on climate change, creating for this purpose the Climate Change Commission, and for other purposes*."[123] Predominantly, one of the most commendable mandates of the Climate Change Commission is to approve climate related budgets.[124] This feature has shifted the decision-making power from the Ministry of Finance to the Commission when it comes to climate change. The Commission is also able to "*exercise policy coordination to ensure the attainment of goals set in the framework strategy and programs on climate change*."[125] Malaysia could learn from these best practices and incorporate the relevant provisions into the new Act. Doing so may reduce the individual conflict between Ministries as mentioned in earlier paragraph. Currently, there is no framework details about the Climate Change Act, but

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120 Menon, Ravidranathan N. Narayana. "Empty fruit bunches evaluation – mulch in plantation vs. fuel for electricity generation". *Palm Oil Engineering Bulletin* 67 (Apr-June 2003): 11-14, 19-20. http://palmoilis.mpob.gov.my/POEB/index.php/2020/03/29/empty-fruit-bunches-evaluation-mulch-in-plantation-vs-fuel-for-electricity-generation/

121 During the Pakatan Harapan government, renewable energy capacity target was 20% by 2025 excluding large hydropower.

122 Thomas, Jason. "Speed up tabling of Climate Change Act, says former minister." FreeMalaysiaToday, 10 December 2021. https://www.freemalaysiatoday.com/category/nation/2021/12/10/speed-up-tabling-of-climate-change-act-says-former-minister/

123 United Nations Information Portal on Multilateral Environmental Agreements. *Climate Change Act of 2009 (Republic Act No. 9729 of 2009)*. https://www.informea.org/en/legislation/climate-change-act-2009-republic-act-no-9729-2009

124 Philippine Climate Change Commission. *Filipino's Climate Budget Brief FY2021*. Department of Budget and Management. https://niccdies.climate.gov.ph/files/documents/Climate%20Budget%20Brief-GAA%20v2.1.pdf

125 United Nations Information Portal on Multilateral Environmental Agreements. *Climate Change Act of 2009 (Republic Act No. 9729 of 2009)*. https://www.informea.org/en/legislation/climate-change-act-2009-republic-act-no-9729-2009

its main objective is clear – which is to institutionalise climate change commitment regardless of the political climate in Malaysia.[126] The Act is expected to be tabled to the Parliament by 2025.[127]

5. Conclusion – recommendations for further research

This paper has delivered a policy analysis, providing an overview of the renewable energy policies and challenges in two neighbouring Southeast Asian states – Indonesia and Malaysia. These challenges are complex, but by focusing on domestic policies, this paper puts forward the challenges behind the deployment of renewable energy in both countries. In particular, it finds that issues in Indonesia coalesce around a failure to attract sufficient investment into its renewable energy sector, while for Malaysia, decentralisation throws up issues that creates institutional conflict or a lack of coordination.

This paper concludes by gesturing at the possible ways forward for future studies. While this paper has mostly concerned itself with *policy* analysis, given the topic at hand, future analyses can easily interact more deeply with the scholarly literature within fields like comparative *politics* and the political economy. This would entail looking more closely at the distribution of power allowing certain actors to be able to set the policies in the first place, and also the distribution of benefits of the policy, which would inevitable crate winners and losers. Subsequent attempts can perhaps base themselves in the rich literature that emphasise, broadly, that policy attempts and missteps are not merely technocratic failures, where policymakers are unable to pick the 'correct' policy (domestic or foreign) due to a lack of competence or foresight. In other words, the range of policy options as well as the eventual choices reflect the political divisions within the given society, where policies create winners and losers and powerful actors stop or push through policy that hurt or benefit their interests. Investigating energy policy as the result of "distributional conflict", a point emphasised by scholars against technocratic or collective action approaches, would be a way forward.[128] Approaching the issue from this angle opens up the possibility of explaining in an in-depth fashion the policy failures or success with reference to regulatory capture by powerful interests with a relevant stake in the policy. There is, for example, a rich literature on the Indonesian oligarchy, including the role of politically powerful elites linked to the coal industry.[129] The palm oil industry in both countries also remains pivotal, and is worth further investigation into how it intersects with the rollout of renewable energy.

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[126] ZICO Law. "Malaysia's Climate Change Act? What to Expect." ZICO Law: ASEAN Insiders. 10 December 2021. https://www.zicolaw.com/wp-content/uploads/2021/12/ZICO_1010_Dec-2021_Malaysia%E2%80%99s-Climate-Change-Act-What-to-Expect.pdf

[127] Thomas, Jason. "Speed up tabling of Climate Change Act, says former minister." FreeMalaysiaToday, 10 December 2021. https://www.freemalaysiatoday.com/category/nation/2021/12/10/speed-up-tabling-of-climate-change-act-says-former-minister/

[128] Aklin, Michaël, and Mildenberger Matto. "Prisoners of the Wrong Dilemma: Why Distributive Conflict, Not Collective Action, Characterizes the Politics of Climate Change". *Global Environmental Politics* 2020; 20 (4): 4–27. https://doi.org/10.1162/glep_a_00578

[129] Hadiz, Vedi R., and Robison, Richard. "The Political Economy of Oligarchy and the Reorganization of Power In." *Indonesia* 2013, 96: 35–57. https://doi.org/10.5728/indonesia.96.0033; Atteridge, A., Aung, M.T. and Nugroho, A. *Contemporary coal dynamics in Indonesia*. SEI working paper 2018-04, 2018. Stockholm Environment Institute, Stockholm.

Further analysis can also choose to remain within the policy angle, where moving forward, the next step would be for Indonesia and Malaysia to seek solutions by cooperating and leveraging on the strengths of external partners, especially ASEAN neighbours. Giving detailed recommendations on how Singapore could overcome its geographic limits by tapping on renewable energy sources in the large-sized Indonesia, for example, would be a possible policy avenue. This has already been occurring, with Singaporean companies being behind the construction of solar farms in Indonesia.[130] Similarly, Indonesia and Malaysia could overcome their issues by learning the governing techniques of Singapore, which has by most standards been remarkably successful in shaping and implementing policy. Detailed prescriptions of knowledge sharing platforms could be another possible policy avenue.

The ways forward charted here are by no means meant to be exhaustive of the options, and more attention might also be given to, for example, the role of climate financing through international institutions. Given the importance of renewable energy and the urgency to combat climate change in Southeast Asia, further research energies should be devoted to the topic.

[130] Yong, Jun Yuan. "Sembcorp to build integrated solar and energy storage systems with Indonesia's PLN Batam and Suryagen." *The Business Times*, 25 October 2021. https://www.businesstimes.com.sg/companies-markets/sembcorp-to-build-integrated-solar-and-energy-storage-systems-with-indonesias-pln

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Asian Development Bank, "Indonesia Energy Sector Assessment, Strategy, and Road Map," *Asian Development Bank*, December 2020. https://www.adb.org/sites/default/files/institutional-document/666741/indonesia-energy-asr-update.pdf.

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Energy Commission. “Coal - Import & Export”. https://meih.st.gov.my/statistics. Accessed 15 November 2021.

Energy Commission. “Natural Gas - Import & Export”. https://meih.st.gov.my/statistics. Accessed 15 November 2021.

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