Chapter 11
Toward a Coherent Policy Approach to Solar Uptake in Southeast Asia: Insight from Indonesia and Vietnam

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Abstract This chapter examines Indonesia and Vietnam's experiences with adopting utility-scale solar power, finding that despite landscape pressures, such as the need to address energy security concerns and policy commitments to emissions reduction, challenges in local contexts and incumbent electricity regime often hindering translating these pressures into action. It also highlights the need for a coherent policy framework that can address both the emergence and wider adoption of niche electricity technologies and reconfigure the incumbent regime. Developing such a framework requires careful planning and consideration of cross-cutting issues, however, which can take time. A key strategy to reconcile the need for rapid transitioning to address the climate crisis with the usually prolonged transition process is to focus initial efforts on promoting clean technologies that already play a significant role in the energy mix, which could reduce immediate demand for major regime change and ensure a quick start to the transition, while buying time to plan to reconfigure the incumbent regime for a clean electricity future.

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1 Introduction

Southeast Asia is one of the fastest growing and economically dynamic regions of the world. From 2010 to 2020, before the COVID-19 pandemic, it sustained strong annual per capita GDP growth of approximately 3.7%, outperforming many other parts of the world (ADB 2022). In tandem, its demand for electricity, much of which comes from fossil fuels, especially coal, surged by an annual average of almost 6% (Foong 2022), resulting in a substantial rise in carbon emissions from the electricity sector. According to ACE (2022), these emissions reached 1815 Mt $CO_{2\text{-eq}}$ in 2020, up from 1039 Mt $CO_{2\text{-eq}}$ in 2005. Southeast Asia has thus become the world's fourth largest emitter, ranking behind only China, at 10,707 Mt, the United States, at 4817 Mt) and India, at 2456 Mt (World Bank 2022a).

With electricity demand recovering as economic recovery takes hold, Southeast Asia faces a challenge in balancing its need to secure electricity supply to support economic expansion with the imperative to carry out decarbonization. At the core of this challenge is the uptake of solar power, particularly utility-scale solar power, which is considered a crucial element of a clean electricity supply, per Fig. 1. Despite its importance, solar power uptake has been negligible in most Southeast Asian countries, accounting for only some 2% of the region's electricity in 2020 (Handayani et al. 2022). Progress has recently stalled even in Vietnam, which is often cited as a solar uptake success story in the broader Southeast Asian context (Asia News Network 2022).

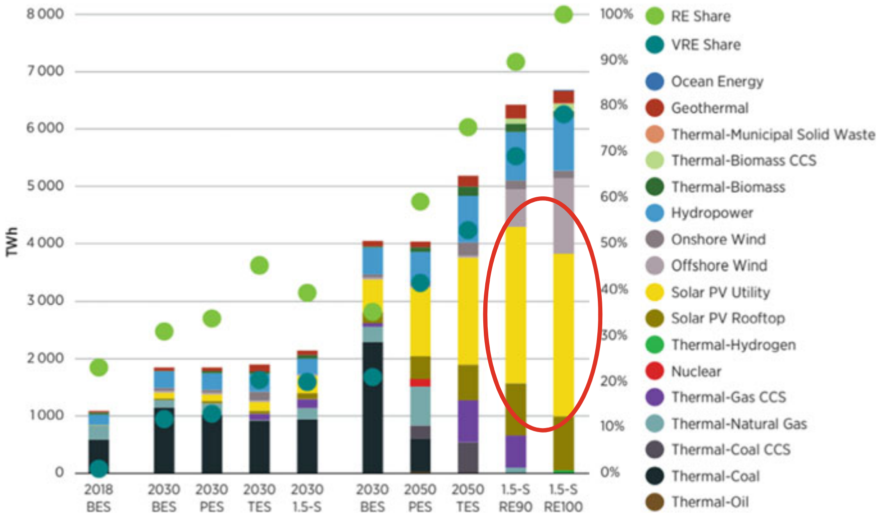

Fig. 1 Electricity generation and renewables share, 2018–2050. *BES* Baseline Energy Scenario; *PES* Planned Energy Scenario; *TES* Transforming Energy Scenario; *1.5-S* 1.5°C-aligned energy pathways for Southeast Asia; *RE90* 90% renewable generation; *RE100* 100% renewable generation. *Source* IRENA (2022a, b)

There is significant commentary on possible reasons for the slow progress of solar uptake in Southeast Asia, ranging from insufficient network infrastructure (Do et al. 2021) to complex administrative procedures (Do et al. 2020a, b), high upfront costs (Jayaraman et al. 2017; Setyawati 2020), uncertain financial support (Barroco and Herrera 2019; Koerner et al. 2022; Rababah et al. 2021), and incumbent resistance (Fathoni et al. 2021). By implication, this suggests that solar power uptake is a complex phenomenon requiring multiple inputs, such as the aforementioned network infrastructure, regulatory reform, financial support, and socio-political acceptance. A coherent policy framework, able to drive these factors in a concerted manner, is therefore essential for solar uptake progress. Despite some credible initiatives and programs introduced in the past few years, however, Southeast Asian countries have largely failed to develop such a framework, which also helps explain the region's slow solar uptake progress.

In this context, the first essential step to rectify the slow progress of utility-scale solar power uptake is gaining insight into how coherent and effective policy frameworks can be developed to drive necessary changes to support utility-scale solar power expansion. The need for such insight is heightened by the region's growing net-zero energy commitments and the role of utility-scale solar power in achieving these commitments. This chapter attempts to fulfil this need by analyzing Indonesia and Vietnam's experiences with solar uptake. Both countries have extensive solar resources and have introduced various policy measures in recent years to support the solar uptake, with varying degrees of success. An analysis of the dynamics and outcomes of solar uptake in these countries would indeed provide valuable insight for other Southeast Asian countries seeking to improve their solar uptake promotion policies. This analysis focuses on utility-scale solar power, in contrast to many other studies analyzing rooftop solar PV in the region (Fathoni et al. 2021; Jayaraman et al. 2017; Potisat et al. 2017; Rababah et al. 2021; Setyawati 2020; Tongsopit et al. 2016).

This chapter is organized as follows: Sect. 2 provides an overview of Indonesia and Vietnam's electricity sectors for context, emphasizing key initiatives and programs that have been implemented in these countries to support the renewable energy expansion, including utility-scale solar power. Section 3 outlines the interview-based approach adopted in this chapter to identify key issues affecting utility-scale solar power uptake in Indonesia and Vietnam. Section 4 presents empirical results of these interviews, which are discussed in Sect. 5 to draw some general insight into factors affecting utility-scale solar power deployment. Section 6 draws key conclusions, including messages for Southeast Asian policymakers as they endeavor to attain net-zero by mid-century.

2 Context

This section provides a brief introduction to the electricity sectors of Indonesia and Vietnam, as well as their recent initiatives and programs to support renewable generation, including utility-scale solar power. The information presented here aims to enhance the reader's understanding of the nuances of the arguments presented in this chapter.

2.1 Indonesia

Indonesia nationalized all electricity assets in the 1950s into Perusahaan Listrik Negara (PLN) (McCawley, 1971). It initiated market reform of its electricity sector in the early 1990s, emphasizing a greater role for the private sector in the generation business in the form of Independent Power Producers (IPP). Notwithstanding, PLN continues to dominate the sector, which acts as a single buyer, purchasing electricity from IPPs under long-term contracts. It also owns and operates approximately 70% of the country's generating capacity and maintains an effective monopoly over network businesses (PLN 2022).

Coal-fired power has been the mainstay of Indonesia's energy mix. As shown in Fig. 2, its share has increased in recent years from some 45% in 2011 to more than 60% in 2021. The renewables share has also been rising since the mid-2010s, especially after the release of the National Energy Policy that stipulated a structural shift in primary energy mix to at least 23% of renewable energy by 2025 (IEA 2015). To implement this policy, the draft National Electricity Plan (RUKN) 2015–2034 included a target of 25% renewable energy by 2025, necessitating a more than fivefold increase in renewable capacity to 45 GW from 8.7 GW in 2015 (IRENA 2017).

To support the expansion of renewable capacity, the Ministry of Energy and Mineral Resources (MEMR), Indonesia's main energy sector governing body, introduced several regulatory changes between 2014 and 2016, to promote uptake of small-scale renewable projects by providing technology-specific feed-in-tariff (FiT) schemes for project developers. Large-scale solar projects were, however, not included (Kennedy 2018). The Indonesian government also launched other initiatives during this period to complement the FiT schemes, including establishing a task force for renewable energy development, creating the Centre of Excellence on Clean Energy, and initiating the Bright Indonesia program (Maulidia et al. 2019).

Following changes in MEMR leadership in 2016, renewable energy policy support shifted toward reducing renewable project costs. In 2017, MEMR Decree No. 12 established a new FiT scheme for all renewable projects. This scheme, later revised by MEMR Decree No. 50, included a cap on tariffs for renewable projects of 85% of the average cost of generation for the local grid, or 100% if said average cost was lower than the national average (IRENA 2017). This new scheme was considered

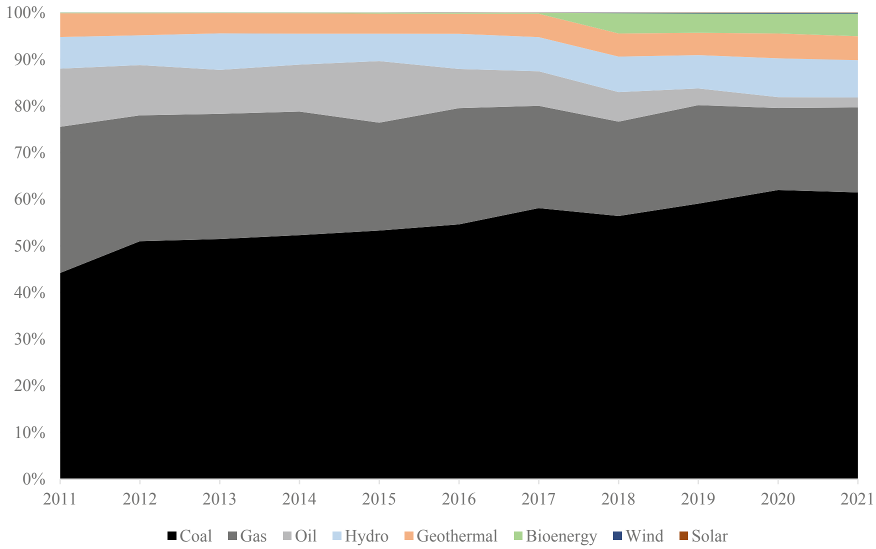

Fig. 2 Energy mix in Indonesia, 2011–2021. *Source* MEMR (2022)

unattractive to private investors, particularly for large-scale solar projects, which are more expensive than other renewable projects in Indonesia. As a result, compared to other renewable energy sources, solar power has seen the smallest expansion between 2015 and 2021, with only 132 MW added. By contrast, wind power saw an increases of 153 MW, bioenergy 178 MW, geothermal 839 MW, and hydro 1280 MW (IRENA 2022a).

Renewable energy expansion has gained momentum in recent years. In September 2022, Presidential Regulation No. 112 (PR 112/2022) was enacted to promote renewable investment and to expedite phasing out coal-fired power plants. Later that year, the government launched the Just Energy Transition Partnership (JETP), with Indonesia committing to peak carbon emissions from electricity generation by 2030. The agreement emphasizes generating at least 34% of electricity from renewable energy sources by 2030 (The White House 2022). A new energy and renewable energy bill (*Rancangan Undang Undang tentang Energi Baru dan Terbarukan*) is currently under discussion in Indonesia to support the renewable energy expansion. How to translate this rising momentum into concrete action and progress is therefore a priority.

2.2 Vietnam

In 1986, Vietnam initiated the Đổi Mới reform, with the objective of transitioning the country's economy from centrally planned to market-oriented. The transition gained further impetus in 1993, when concessional international financing became accessible, and the trade embargo was lifted. Vietnam subsequently gained membership in several international and regional organizations, including the Association of Southeast Asian Nations (ASEAN) in 1995, the Asia–Pacific Economic Cooperation (APEC) in 1998, and the World Trade Organization (WTO) in 2007. These developments have significantly affected the country's economic growth, lifting it from one of the world's poorest nations to a middle-income economy in one generation (World Bank 2022b).

Vietnam's impressive economic growth has led to a significant surge in electricity demand, making supply capacity expansion a priority. Between 2010 and 2020, electricity demand grew at an average annual rate of 15%, primarily driven by an industrial boom (IEA 2022). Supply capacity did not keep up with demand, however, causing widespread security concerns. It was reported that the Ministry of Industry and Trade (MOIT), the governmental body responsible for managing Vietnam's energy sector, expected power shortages to occur as early as 2020, especially in the manufacturing hub of Ho Chi Minh City (Do et al. 2020a, b). By 2030, Vietnam's generation capacity shortfall is projected to exceed 10GW (International Trade Administration 2022), roughly equivalent to 13% of the country's total installed capacity in 2021.

To address these concerns, Vietnam embarked on an ambitious plan to expand its coal-fired power capacity in the mid-2010s, as outlined in the National Power Development Plan (PDP) 7 (Gallagher et al. 2021), making coal the country's primary source of electricity in 2016, surpassing hydropower. Vietnam ratified the Paris Agreement the same year, signaling the Vietnamese government's intention to prioritize addressing climate change. Since then, policy machinery has been attuned to promoting renewable energy as the means of satisfying the country's rising appetite for electricity, with the government adopting several initiatives and programs to support renewable energy uptake, including utility-scale solar power. In 2017, the Vietnamese government introduced highly favorable FiTs, where utility-scale solar plants commissioned before June 30, 2019, would be eligible for a 20-year preferential FiT, selling electricity to the grid at US$93.5/MWh. In April 2020, said FiTs were reduced to between US$70.9 and $83.8 per MWh (Do et al. 2020a, b). Notwithstanding, investors still had ample profit potential, especially considering that the levelized cost of energy (LCOE) for solar PV in Vietnam was in the range US$66 to US$76 per MWh between 2019 and 2020 and is expected to fall further as technology advances (Do et al. 2021). The government has also offered a range of incentives to solar project developers, including tax breaks and equipment import tariff exemptions.

Such policy support has driven a solar boom. Between 2017 and 2021, Vietnam's solar generation rose from practically nothing to nearly 26 TWh, accounting for approximately 11% of total electricity, per Fig. 3, and making Vietnam the world's tenth-largest solar power producer. Its expansion of renewable generation is likely to accelerate in coming years, as it endeavors to further wean itself off fossil fuel-based electricity. As part of the JETP, it has committed to peak carbon electricity emission by 2030, as well as peak coal of 30.2 GW, down from 37 GW contemplated in the current (PDP), and at least 47% electricity from renewable sources by 2030.

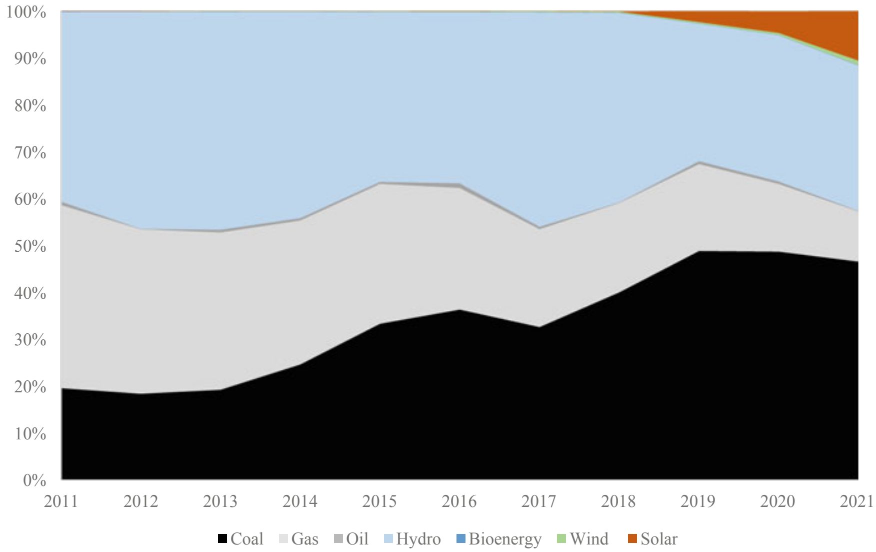

Fig. 3 Energy mix in Vietnam, 2011–2021. *Source* IEA (2022)

The role of utility-scale solar power in Vietnam's future expansion of renewable generation will be negotiated in the context of growing grid constraints to integrated variable solar generation, however. More than 16 GW solar capacity came online between 2018 and 2020 alone, overwhelming grids and forcing EVN, the national utility, to curtail solar generation in order to maintain system reliability and stability. In 2021, plans called for approximately 500 GWh of solar power to be curtailed in Vietnam (Sang 2021), with the curtailment rate at the country's largest solar power plant in Thuan Nam, with a capacity of 450 MW, in the range of 40% (Vu 2022).

3 Interview-Based Methodology

To gain a more nuanced understanding of solar uptake and factors influencing same in Indonesia and Vietnam, we conducted semi-structured interviews with relevant experts between September and December 2022. Sixteen experts, selected for their deep involvement in solar power development in Indonesia and Vietnam, participated online in sessions lasting between 30 min and an hour. They included specialists in Indonesia and Vietnam's electricity sectors, domain experts from leading local and regional think tanks, senior managers from local solar companies and industry associations, and former officials with first-hand knowledge of their country's power sectors.

The interviews were exploratory, with participants asked to share their opinions and viewpoints on issues influencing utility-scale solar power development in Indonesia and Vietnam. We chose this methodology because it facilitated flexible conversations between interviewers and participants, allowing us to obtain more in-depth information. This posed the challenge of managing subjective bias introduced by participants' personal feelings and opinions, however. We addressed this challenge and enhanced the validity of our analysis by comparing and linking information obtained from the interviews with secondary data collected from a review of publicly available documents from a variety of sources (Huang 2021; Wang et al. 2021). To maintain data accuracy and authenticity, we gave higher priority to sources from national governments and regional organizations, multilateral development agencies including the Asian Development Bank (ADB) and the World Bank, and peer-reviewed journals.

4 Empirical Results: Issues Affecting Utility-Scale Solar Uptake

4.1 Indonesia

Most participants agreed that lack of competitiveness is the main factor impeding solar uptake in Indonesia. One interviewee from the power sector noted that "in 2013, the Ministry of Energy and Mineral Resources (MEMR) conducted a bidding process that procured several solar projects in Kupang, Gorontalo, and Sumba. The contracted prices for these projects were very high. Later, PLN directly procured two solar PV projects in Lombok and Likupang. These two projects have lower costs than the earlier ones but are still more expensive than coal power."

As the former MEMR Minister mentioned in 2016, "the government supports (the change in) energy fuel mix in a bid to address climate change issues. However, the price must be affordable" (Kennedy 2018). As previously mentioned, MEMR Decree No. 12 was issued in 2017, introducing a new FiT program for all renewable projects, later revised by MEMR Decree No. 50. A key aspect is that it caps prices paid to renewable generators based on PLN's average costs of electricity provision (i.e., Biaya Pokok Penyediaan, BPP) rather than on generators' cost of production (IRENA 2017). As one interviewee noted, this tariff restriction is a major obstacle to renewable energy development, including solar, because "it makes renewable energy unattractive in regions that heavily reply on cheap coal for power generation. A clear example of this is that only one solar project has passed PLN's bidding process from 2017 until more recent times." It is, however, anticipated that the Presidential Regulation (PR 112/2022) enacted in 2022 will create more space for renewable energy uptake by, for example, replacing the BPP with a ceiling price-based scheme, as well as streamlining the renewable project procurement process.

We asked participants why solar power is as expensive as it is in Indonesia. Several interviewees noted that a significant contributing factor is the local content requirement, which mandates that project developers must procure certain amounts of materials and services used in the project from local sources, increasing renewable project costs. This is particularly challenging in the context of solar PV, where Indonesia's small domestic manufacturing base means that solar panels produced locally are often of lower quality and significantly more expensive than those available in international markets (IESR 2023). One interviewee noted that "the local content requirement was introduced by the Ministry of Industry with good intention of reducing import dependency. But the Ministry of Industry did not fully understand the solar development issues; therefore, this regulation also affects the progress of solar deployment in the country."

Two interviewees from private utility companies cited land procurement as another factor contributing to the high cost of solar power in Indonesia. As one explained, "Large-scale solar projects require significant amounts of land. At least one hectare of land is needed for every one MW solar capacity. There is currently no incentive to support land acquisition." The other argued that "if incentives to address these issues are not available, the acceleration of solar uptake in Indonesia will be challenging."

Interviewees also mentioned the procurement process as another key factor, with one noting that "in some cases, addressing social and environmental considerations causes significant delays in the permitting process and makes solar investment less attractive." Another issue associated with the procurement process, as some interviewees mentioned, is that "only companies included in the so-called selected supplier list can join the auction process led by PLN and this potentially reduces the scope for private participation." One interviewee, however, pointed out that "this is because PLN learned from its experience that there were some companies that act as intermediaries and obtained PLN's quote for a solar project and sold it to another company, which sometimes did not have sufficient capacity for project development."

According to one interviewee from the power sector, another important obstacle to solar uptake in Indonesia is unfavorable power purchase agreements (PPA) with investors forced to take excessive risk. This interviewee explained that "the PPAs sometime allow PLN to not take the electricity from solar project for any days in a month without the need to provide a reason. PLN can default for maximum of two days a month." Another issue with the PPAs, according to this interviewee, is that "only PLN can claim carbon credit from the solar projects. This affected a recent solar bidding. About 120 companies showed their interest in joining the bidding, but only four joined in the end. In another bidding to acquire solar projects to replace diesel power plants, over 100 companies showed interest, but only three companies in Java and one company in Kalimantan finally joined the bidding process."

Some interviewees cited excessive supply capacity as another obstacle to solar uptake in Indonesia. This is understandable if one notes that in 2015, the Jokowi administration introduced the 35 GW program to increase supply capacity, offering private investors long-term PPAs with take-or-pay and guaranteed rate-of-return clauses (Hamdi 2021). The program and less-than-expected demand growth resulted, however, in PLN, having excess supply capacity supported by expensive take-or-pay PPAs, imposing payment obligations PLN whether it needs electricity or not. This also explains, as one interviewee noted, why PLN has opposed a new regulation introduced in 2021 to give incentives to investment in commercial and industrial rooftop solar PV. According to this interviewee, this regulation enables solar owners to sell all excessive electricity generated to the grid, which could cause PLN significant financial losses given the existing market glut. The amount of surplus electricity that could be sold was later reduced to a mere 15%. Another interviewee added that this is because "PLN needs to gain a profit as a state-owned company, as required by the Ministry of State-Owned Enterprises."

4.2 Vietnam

As several participants indicated, the abovementioned concerns about electricity supply security were the main driver behind the Vietnamese government's support for solar power. One explained that "electricity is widely considered an important ingredient for economic growth, better living standards, and industrialization in Vietnam, and supply shortfall is therefore often perceived as a threat to the country's socio-economic progress." According to some interviewees, solar power was an attractive option for addressing Vietnam's looming power shortage, mainly due to it being inexpensive. One interviewee explicitly mentioned that "cost is not a problem…-solar power has already proven that it is cost comparable to coal and gas." Another interviewee added that "the recent surge in gas prices further enhance the cost competitiveness of solar power." The International Renewable Energy Agency (IRENA) conducted a study that supports this viewpoint, finding that solar PV projects in Vietnam have among the lowest average investment costs in the Southeast Asian region, at approximately US$690/kW, versus as much as US$2000/kW elsewhere in the area (IRENA 2022a). Another study found that the levelized costs for solar PV are also low in Vietnam, at approximately US$64/MWh, compared to US$80/MWh in Thailand and over US$200/MWh in Indonesia (Lee et al. 2020).

It came out during the interviews that short construction times are another contributing factor to the attractiveness of solar power as a quick fix to perceived supply shortfalls. One interviewee noted that "it takes roughly nine months or even less to complete a solar project in Vietnam…this is quick when compared to coal and hydro power plants." External influences are another important factor in solar's attractiveness in Vietnam. One interviewee noted, "International lenders have started to cease coal financing…this makes coal power less attractive." Another interviewee indicated that "large foreign companies have demanded to use more clean energy in their manufacturing factories in Vietnam."

One of the biggest challenges that several participants noted to solar uptake in Vietnam is complex administrative procedures that lack transparency. One interviewee, from a private solar company, explained that "investors need to clear several administrative steps, including environmental impact assessment, construction license, grid connection approval and so on…there are different governmental entities involved in the approval process…the procedures for obtaining these approvals are not clear and often lack details…the investors often doesn't know what procedures to follow."

This poses significant risks to solar investors. It also somewhat explains the provision of generous FiTs for solar power. To further reduce risks, one interviewee mentioned that "some investors sought to work with well-connected local partners and used low-quality materials." MOIT is currently investigating the policies that led to the 2019 Vietnamese solar power boom, which could lend credence to this claim. Another strategy for risk mitigation employed by some investors, as solar industry interviewees mentioned, was to build small-scale, less efficient solar projects that were easier to implement. As Do et al. (2020a, b) noted, only 12 out of 87 approved solar projects had capacities greater than 50 MW.

Another major challenge that some interviewees cited is limited grid capacity to handle increasing solar power, resulting in solar curtailments and significant delays in grid connections. One interviewee pointed out that "high FiT attract developers and make a lot of projects, but there are some problems on the transmission lines." Another suggested that "transmission system is not strong enough to deal with intermittency…investing in transmission or using battery storage could help."

According to one interviewee, planning inertia was the main cause of such grid constraints on solar uptake in Vietnam, stating, "Improper planning process is one of the main barriers for solar utility-scale uptake in Vietnam. The recent case of limited grid capacity is one of the examples, where in 2022 completed solar projects need to wait to come online until 2030 when the grid expansion is finished." This is partly due to "the lack of experience with managing new technologies, like solar power," as another interviewee noted, adding that "government needs to adapt…they need to learn how to deal with variable renewable energy, because previously the power sector is dominated by baseload coal and hydro power." This perspective is supported by the fact that Vietnam had a total solar capacity of 16.5 GW by the end of 2020, up from almost nothing in 2017 (IRENA 2021), exceeding its 2030 target for solar uptake a decade ahead of schedule. However, this surge in solar power had not been incorporated into the grid capacity expansion plan in time.

Several participants from the power sector highlighted land as an important factor contributing to Vietnamese solar grid constraints. One pointed out that "solar irradiation is high in central Vietnam, but the demand is in south and north…land is expensive, and developer sometimes face lengthy negotiations with local communities." Another added that "land clearing is an issue in grid expansion. Firstly, state project may not be able to pay above market prices. Secondly, most of the projects are in remote areas, and sometimes in forest areas." Addressing these issues will take significant time and effort, as one interviewee noted, which is why the Vietnamese government is now prioritizing offshore wind and rooftop solar PV. This interviewee explained that "the potential (for offshore wind) is more equally distributed in the north, central and south…on-site solar power, like rooftop solar, does not need much effort on grid augmentation."

5 Discussion

Section 2 discussed the electricity landscapes in Indonesia and Vietnam, and Sect. 4 gave an overview of key issues affecting utility-scale solar uptake in these countries. In this section, we extend the discussion, complemented by the transition literature, to find some general insight into factors affecting utility-scale solar deployment.

5.1 Landscape Pressures

In both Indonesia and Vietnam, landscape pressures, particularly the need to address perceived power shortages and growing public demand for decarbonization, created windows of opportunity for renewable energy the of, as discussed in Sect. 4. This aligns with the transition literature, which views the transition as a co-evolutionary process shaped by a myriad of context-specific interactions between technology niches, incumbent regimes, and changing landscapes (Geels 2002, 2005, 2018). In the context of electricity transition, these comprise niche electricity technologies, e.g., solar power, emerging in protected spaces, incumbent electricity regimes consisting of engineering practices, market rules, regulations, and planning processes that impose selection pressures on new technologies and other innovations, and landscape pressures involving sets of deep structural factors that create imputes for change (Geels 2002; Rip and Kemp 1998; Smith et al. 2010; Yang et al. 2022). Transition scholars find that transitions start when landscape pressures, e.g., public concern about climate change, create the aforementioned windows of opportunity for niche electricity technologies to thrive, facilitated by various policy measures Raimed at protecting these technologies from the selection pressures in the incumbent electricity regime, including &D support, FiTs, and tax benefits (Bergek et al. 2008).

5.2 Local Contexts

Despite facing similar landscape pressures, Indonesia and Vietnam have taken different approaches to exploiting renewable energy development opportunities, as discussed in Sect. 2. Indonesia devoted much attention to conventional renewables, such as hydro and geothermal, which already occupy an important place in the country's electricity technology mix. Between 2012 and 2021, total renewable capacity in Indonesia increased 30%, from 7489 MW in 2012 to 11,157 MW in 2021. More than 90% came from hydropower, at 67%, and geothermal, at 26%, with solar accounting for only approximately 5% (IRENA 2022b). By contrast, Vietnam took a different approach, emphasisizing utility-scale solar, leading to exceptional growth in this segment as part of an overall solar boom that saw it surpass Thailand in 2019 to achieve the largest solar capacity in Southeast Asia.

Local contextual factors could help explain these countries' divergent response to landscape pressures. One such factor is energy endowment. Indonesia has abundant low-cost coal reserves, especially in Kalimantan and Sumatra. Such availability, combined with coal price subsidies, e.g., a coal price cap for domestic users, has adversely affected competitiveness of solar there (Bridle et al. 2019). By contrast, rising demand and rapidly depleting indigenous resources in Vietnam have led to a widely held belief that the country is likely to become dependent on imports to satisfy its energy needs (Minh Do and Sharma 2011). Vietnam's imports of coal, the country's main source of electricity, have increased considerably since the mid-2010s, from 72 GJ in 2014 to 1211 GJ in 2020 (IEA 2022). The country's central leadership has acknowledged its growing dependence on coal imports as a strategic concern (Dorband et al. 2020), which helps explain its prioritizing solar power, as it provides Vietnam an opportunity to reduce said dependence on coal imports by taking advantage of its plentiful solar potential. It also suggests that local contextual factors could moderate landscape pressures on choices of generation technologies to clean up electricity sectors.

5.3 Regime Inertia

Early transition studies were often challenged for viewing electricity transitions as an outcome of top-down landscape pressures and bottom-up development of niche electricity technologies, such as solar PV, while largely ignoring incumbent regimes (Turnheim and Sovacool 2020). In this view, as these niche technologies mature and become ready for wider adoption, they will start to challenge the dominant fossil fuel-based electricity regime, which will naturally lead to a gradual emergence of a new regime with clean technologies as its backbone that replaces the old one (Köhler et al. 2019). In recent years, some transition scholars have called for more attention to be paid to the incumbent regime, particularly how to facilitate regime change, the so-called 'flip side' of the transition (Steen and Weaver 2017; Turnheim and Geels 2013, 2012). In response, a growing body of studies has been undertaken that highlights the need to destabilize the regime by addressing lock-in factors (Smith and Raven 2012) and resistance from incumbent actors (Geels 2014; Roberts et al. 2018; Ting and Byrne 2020). Other studies also found that incumbent actors do not always resist change but may also pursue different strategies, leading to regime fragmentation that accelerates regime destabilization and decline (Steen and Weaver 2017; Turnheim and Geels 2013).

Indonesia's experience with solar power, as discussed in Sect. 4.1, highlights the importance of regime factors in shaping utility-scale solar uptake. BPP pricing that ties renewable prices to the average cost of electricity provision, often determined by subsidized coal prices, made large solar projects unattractive. Stringent local content requirements also affected the attractiveness of solar projects. PLN, the incumbent national utility, signed long-term supply contracts with excessive risk foisted off on solar project developers and opposed regulatory changes that would allow rooftop solar owners to sell all surplus electricity to the grid. In Vietnam, the absence of a strong incumbent utility with interests tied to the status quo has created room for rapid of solar deployment. When major regime changes are needed to further its progress, however, inertia becomes a major concern. An example is difficulties involved in acquiring enough land for grid expansion to accommodate greater solar penetration, as discussed in Sect. 4.2.

6 Conclusions and Policy Implications

In analyzing Indonesia and Vietnam's solar uptake experiences, this chapter showed that landscape pressures, such as the need to address energy security concerns and ambitious policy commitments to emissions reduction, could not always be translated into concrete action due to challenges posed by local contexts and incumbent electricity regimes. This highlights the need to create a coherent and effective policy framework capable of driving transitions toward a clean and more sustainable electricity future, in addition to raising the ambitions for such transitions. This is not to say that making more ambitious transition commitments is unimportant. Rather, these commitments, once made, are important steps in promoting electricity transitions. Their achievement, however, depends on whether effective policy frameworks can be developed to drive the transitions. The need for such frameworks is heightened if one notes that electricity transitions are gaining momentum across Southeast Asia, with most countries committing to becoming carbon–neutral between 2050 and 2065.

Such frameworks must address two dimensions of these transitions: (1) the emergence and wider adoption of niche electricity technologies and such supplementary innovations as battery storage; and (2) reconfiguring incumbent electricity regimes to be more accommodating to these technologies. As this chapter suggests, these dimensions are closely connected, particularly when the aforementioned niche technologies, such as utility-scale solar PV, are mature and ready for wider adoption. This presents additional challenges to policymaking, as policy support is needed to address techno-economic issues affecting the uptake of niche technologies, and to facilitate deep structural changes in incumbent regimes to create room for their penetration.

Incumbent electricity regimes have deep-rooted economic and socio-political influence (Yang and Sharma 2020). Major changes to the regime will therefore have widespread ramifications extend into these realms, affecting a diverse range of policy issues, such as energy security and affordability, industrialization, and social welfare. For example, while Vietnam needs grid expansion to further advance its solar uptake, project developers need to overcome issues that may conflict with extant rules governing public projects, such as land acquisition from local communities, deforestation caused by land clearing, and raising purchase prices.

Such major changes to incumbent regimes thus require careful planning and consideration of these cross-cutting issues. They cannot happen simply because of strong political will overcoming incumbent resistance. Given the substantial complexity involved in regime change, the transition process is often considered as "messy, conflictual, and highly disjointed" (Meadowcroft 2009), and developing coherent and effective policy frameworks to drive its progress, informed by an appreciation of the aforementioned underlying complexity, will take a long time. Addressing climate change, however, requires rapid transitions toward a clean electricity future in the next two or three decades, including considerable utility-scale solar expansion.

Transition policy framework thus should recognize the need to reconcile the dichotomy of a usually prolonged electricity transition and the present need to achieve rapid transitions to help save the world from the climate crisis. One way to achieve such a reconciliation is to focus initial efforts on promoting renewable energy technologies that already play an important role in the energy mix, which could reduce immediate demand for major changes to electricity regimes and hence ensure a quick start to transitions. It could also buy time for policymakers and energy planners to work out how to reconfigure incumbent regimes.

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