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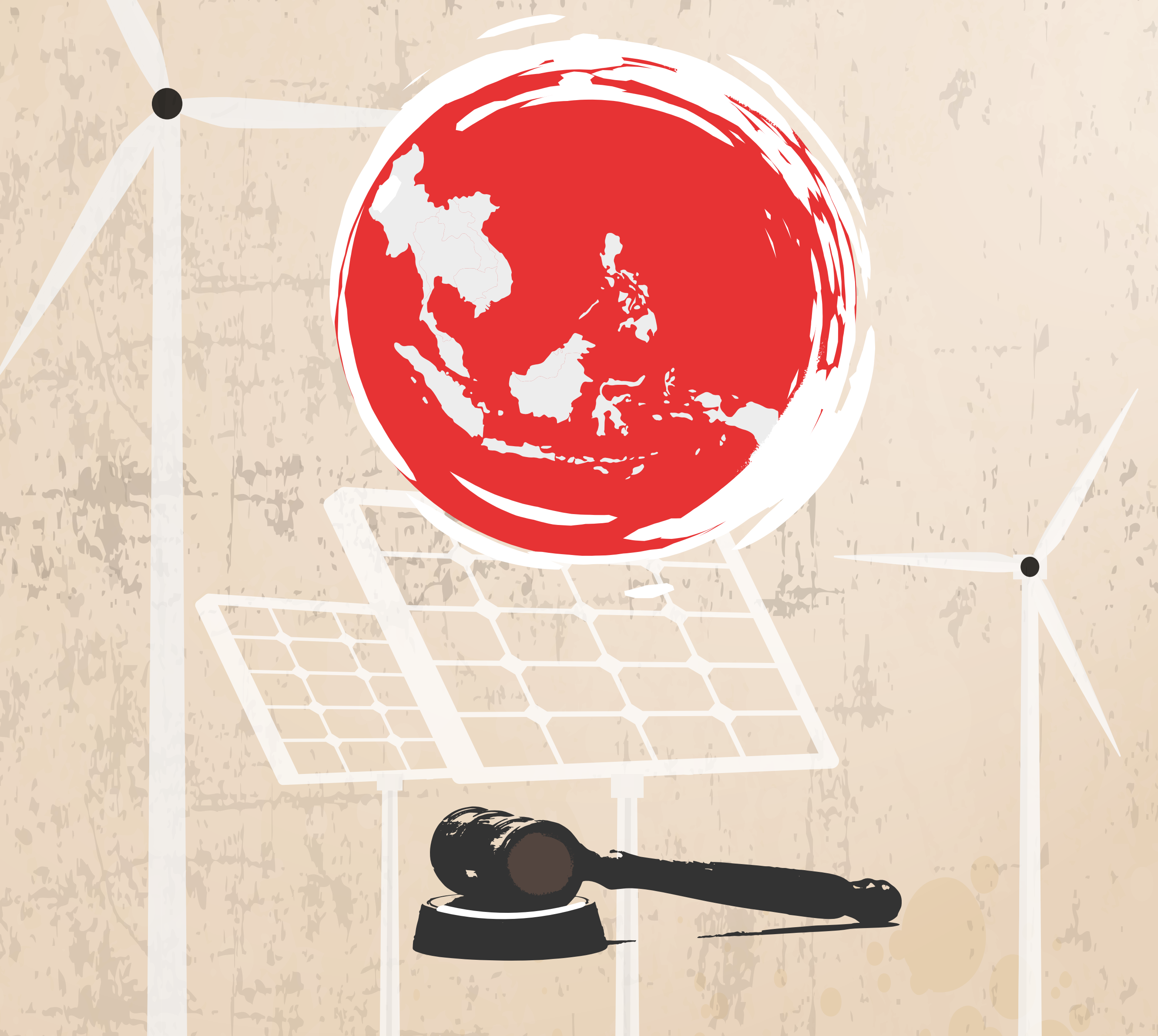
# Renewable energy auctions Southeast Asia



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## About IRENA

The International Renewable Energy Agency (IRENA) is an intergovernmental organisation that supports countries in their transition to a sustainable energy future and serves as the principal platform for international co-operation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy. IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy, in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity. **www.irena.org**

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## Disclaimer

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# ABBREVIATIONS

| | |
|---|---|
| **AGP** | annual generation profile (Malaysia) |
| **APAEC** | ASEAN Plan of Action for Energy Co-operation |
| **ASEAN** | Association of Southeast Asian Nations |
| **BOI** | Board of Investment (Thailand) |
| **BOO** | build, own and operate |
| **BOOT** | build, own, operate, transfer |
| **BOT** | build-operate-transfer |
| **COD** | commercial operation date |
| **DOE** | Department of Energy (the Philippines) |
| **EC** | Energy Commission (Malaysia) |
| **EDB** | Economic Development Board (Singapore) |
| **EDL** | Lao Electricity (Électricité du Laos) |
| **EER** | excess energy rate (Malaysia) |
| **EGAT** | Electricity Generating Authority of Thailand |
| **EPC** | engineering, procurement, and construction |
| **ERC** | Energy Regulatory Commission (the Philippines) |
| **ESS** | energy storage system |
| **FiT** | feed-in tariff |
| **GEAC** | Green Energy Auction Committee (the Philippines) |
| **GETP** | Abbreviations |
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| **ESS** | energy storage system |
| **FiT** | feed-in tariff |
| **GEAC** | Green Energy Auction Committee (the Philippines) |
| **GETP** | Green Energy Tariff Programme (the Philippines) |
| **GHG** | greenhouse gas |
| **GSO** | grid system operator |
| **GTP** | Green Towns Programme (Singapore) |
| **GW** | gigawatt |
| **HDB** | Housing and Development Department (Singapore) |
| **IPP** | independent power producer |
| **kWh** | kilowatt hour |
| **kV** | kilovolt |
| **LCR** | local content requirement |
| **MAAQ** | maximum annual allowable quantity (Malaysia) |
| **MEMR** | Ministry of Energy and Mineral Resources (Indonesia) |
| **Meralco** | Manila Electric Railroad and Light Company |
| **MIR** | Ministry of Industry Regulation (Indonesia) |
| **MOU** | memorandum of understanding |
| **MW** | megawatt |
| **MWac** | megawatt alternating current |
| **MWh** | megawatt hour |
| **MWp** | megawatts peak |
| **NDA** | non-disclosure agreement |
| **OERC** | Office of the Energy Regulation Commission (Thailand) |
| **PEA** | Provincial Electricity Authority (Thailand) |
| **PLN** | State Electricity Company (Perusahaan Listrik Negara) (Indonesia) |
| **PPA** | power purchase agreement |
| **PPP** | public private partnership |
| **PUB** | Public Utilities Board (Singapore) |
| **PV** | photovoltaic |
| **RFP** | request for proposal |
| **RFQ** | request for quotation |
| **RPS** | renewable portfolio standard |
| **RUPTL** | Electricity Business Plan (Rencana Usaha Penyediaan Tenaga Listrik) (Indonesia) |
| **SESB** | Sabah Electricity Sdn. Bhd. (Malaysia) |
| **TNB** | National Electricity Ltd. (Tenaga Nasional Berhad) (Malaysia) |
| **TransCo** | National Transmission Company (Philippines) |
| **VSPP** | very small power producers |

# 1 REGIONAL CONTEXT FOR RENEWABLE ENERGY AUCTIONS

In recent decades, Southeast Asia[1] has been undergoing rapid economic growth and development. At the same time, expanding populations, falling poverty rates, rising incomes, increasing urbanisation and industrialisation have been propelling regional energy consumption upwards. Indeed, energy demand has almost doubled since the mid-1990s and is expected to grow 60% by 2040.

Yet, over 40% of the energy in the region is imported, highlighting the urgent need for Southeast Asia to transition to a more sustainable energy system (Tachev, 2022). Almost all members of the Association of Southeast Asian Nations (ASEAN) have made net-zero pledges and, in 2020, the ASEAN ministers of energy endorsed the ASEAN Plan of Action for Energy Co-operation (APAEC) Phase II, 2021-2025. At the same time, they endorsed a continuation of the theme of the APAEC Phase I, 2016-2020, namely: "Enhancing Energy Connectivity and Market Integration in ASEAN to Achieve Energy Security, Accessibility, Affordability and Sustainability for All". Under this framework, ASEAN will increase efforts to accommodate higher shares of renewable energy with a regional target of 23% RE share in total primary energy supply (TPES) and 35% in installed power capacity, and build an ASEAN Power Grid by expanding multilateral electricity trading, strengthening grid resilience and modernisation, and promoting clean and renewable energy integration.

Yet, while every country in the region has set national targets for renewable energy, more effort is needed to establish investment frameworks for its development. Most Southeast Asian states have introduced technology-specific feed-in tariffs (FiTs), often combined with other deployment policies, such as net metering, a scheme Malaysia has for roof-top solar power generation. Auctions, the focus of this study, have been introduced to supplement the traditional instruments that have driven the region's renewable energy growth (IRENA, 2018).

This study analyses auction design elements and outcomes in the countries of the region that had conducted auctions up to June 2022, namely: Cambodia, Indonesia, Malaysia, Myanmar, the Philippines and Thailand. It also includes a brief introduction to plans to conduct auctions in the Lao People's Democratic Republic (Lao PDR).

Even within the same region, the starting point for auction design in each country – as well as the context – is different. While **Indonesia**, for example, has announced several solar PV and geothermal auctions, only a few have resulted in awarded bids. Renewable energy auctions in that country are also only one of three procurement mechanisms, the other two being direct appointment and direct

[1] *This report covers the member states of the Association of Southeast Asian Nations (ASEAN): Brunei Darussalam, Cambodia, Indonesia, the Lao People's Democratic Republic (Lao PDR), Malaysia, Myanmar, the Philippines, Singapore, Thailand and Viet Nam. The terms 'ASEAN' and 'Southeast Asia' are used interchangeably to refer to this set of countries, unless otherwise stated.*

selection.[2] The latter two provide the State Electricity Company (Perusahaan Listrik Negara – PLN) and the Ministry of Energy and Mineral Resources (MEMR) with the discretionary ability to choose projects (or firms) to contract new capacity, which discourages many stakeholders. In addition, auctions compete with the FiT scheme, which so far has been the instrument of choice (Hamdi, 2020; Keating, 2020; IESR, 2019). The introduction of local content requirements (LCRs) has also been controversial, resulting sometimes in lawsuits, intervention by the country's supreme court and ultimately, the cancellation of auctions. These challenges are described in detail in Chapter 2.

In **Malaysia**, meanwhile, the growth of electricity consumption has threatened energy security. The country's longstanding reliance on fossil fuels and its dwindling oil reserves, coupled with the volatility and uncertainty of global fuel markets, is making the diversification of its energy mix imperative. Moreover, coal accounts for more than 50% of Malaysia's power generation mix, resulting in high greenhouse gas (GHG) emissions. Moving towards sustainable sources of electricity presents Malaysia with the opportunity to reach its stated goal of reducing emissions intensity[3] by 45% by 2030, compared to 2005 levels (UNFCCC, 2015). As of May 2021, Malaysia had conducted four large-scale solar (LSS) photovoltaic (PV) auctions. The last round was held as part of an economic recovery plan in the context of the COVID-19 pandemic (Petrova, 2020). All four LSS rounds attracted a large number of participants.

The **Philippines** is a net importer of energy, with its power system depending on imported coal and oil. These fossil fuel imports have helped make the Philippines' electricity tariffs the second most expensive in Southeast Asia, with an average retail rate of USD 161/megawatt hour (MWh) (BNEF, 2019). In addition, the Manila Electric Railroad and Light Company (Meralco) had historically contracted electricity at higher prices from its sister companies, until the Supreme Court ordered distribution utilities to contract electricity using a least-cost approach through a competitive selection process (Lopez, 2019).

[2] *Direct appointment is a process in which a developer presents an unsolicited proposal and feasibility study to the Ministry of Energy and Mineral Resources (MEMR) and if it is approved after an evaluation, it becomes part of the country's Electricity Business Plan (Rencana Usaha Penyediaan Tenaga Listrik – RUPTL). After a due diligence process undertaken by MEMR and the State Electricity Company (Perusahaan Listrik Negara – PLN), if all the developer's qualification documents are approved, a power purchase agreement (PPA) is signed. Direct selection involves a project already listed in the RUPTL. A due diligence invitation goes out to independent power producers (IPPs) already, for the selection of qualified developers. PLN selects the winner based on technical capabilities and a financial proposal. After that, a PPA is finalised and signed with PLN.*

[3] *Defined as the ratio of emissions of carbon dioxide ($CO_2$) (in kg) to GDP.*

Most of the Philippines' auctions so far have been for gas and coal-fired power plants, but Meralco has also conducted renewable energy auctions. One of these saw solar PV prices as low as PHP 2.34 (Philippines pesos), or USD 0.044,[4] per kilowatt hour (kWh) for a 50 megawatt (MW) PV plant. This was offered by the local PV module manufacturer and project developer Solar Philippines (Jäger-Waldau, 2019) for a project completed in 2021 (Crismundo, 2021). Unfortunately, public information regarding these auctions is scarce.[5] A systematic annual auction programme has been established, however, through the Green Energy Tariff Programme (GETP) (DOE, 2020). The first round of this awarded around 2 GW of renewables, mainly consisting of solar, with additional wind, biomass and small hydropower (DOE, 2022a).

Elsewhere, **Thailand** is connected and has trading operations with neighbouring countries, importing and exporting electricity from Lao PDR and Malaysia, while also exporting to Cambodia (ADB, 2017; DBS Group Research, 2017). The country can also feasibly increase its renewable energy share while reducing costs. This would bring major socio-economic benefits, saving around USD 8 billion per year when the environmental and health-related costs of fossil fuels are considered (IRENA, 2017).

Historically, projects in Thailand had been procured on a first come, first served basis, but that was then replaced by auctions. In these, participants submitted a discount to the FiT (Norton Rose Fulbright, 2019a).

As of May 2021, Thailand had organised two bidding rounds: in 2016 for biogas and biomass projects; and in 2017 for these two technologies plus solar projects, with two of the proposed initiatives in the latter year using hybrid technologies (ERC, 2018).

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*[4] USD 1.00 = PHP 53.2 in August 2018.*

*[5] Energy auctions in the Philippines are conducted mostly for fossil fuel technologies, especially gas and coal fired power plants. Their main objective has been price reduction. In the context of energy transitions and the introduction of other instruments, such as renewable portfolio standards (RPS), these can be re-thought.*

**Lao PDR**, meanwhile, is a net exporter of energy, due to cheap and abundant electricity generation from its hydro power plants, along with a large coal-fired plant. Lao PDR exports most of its energy to Thailand and Viet Nam, while Cambodia and Myanmar are also export markets.

Currently, Lao PDR does not have an auction programme in place. Instead, contracts are negotiated between investors and the state utility, Lao Electricity *(Électricité du Laos* – EDL), on a project basis. This lack of a framework to procure electricity has hindered investments in renewable projects (ADB, 2019). In this context, Lao PDR did start discussions among local stakeholders and development banks on conducting a solar PV pilot auction (USAID, 2018; USAID, 2020) and began designing this auction in 2017, while holding workshops up to 2018 to discuss policy goals, analyse regulatory challenges and establish a working committee. Between 2018 and 2020 a series of meetings were organised to finalise the design and preparation of documentation. However, as of July 2022, neither auction documents nor contract templates had been disclosed.

In **Singapore**, the last 50 years have seen the country move from oil to natural gas power generation, with the latter now responsible for about 95% of Singapore's electricity (Energy Market Authority of Singapore, n.d.). The city state has also increased its use of solar energy, particularly on rooftops and reservoirs.

In 2014, Singapore launched the SolarNova programme, which is led by the Economic Development Board (EDB) and the Housing and Development Department (HDB). This targets an acceleration of the deployment of solar PV systems and is an integral part of the HDB Green Towns Programme (GTP). This is a scheme that aims to bring sustainable living to all existing HDB towns by 2030.

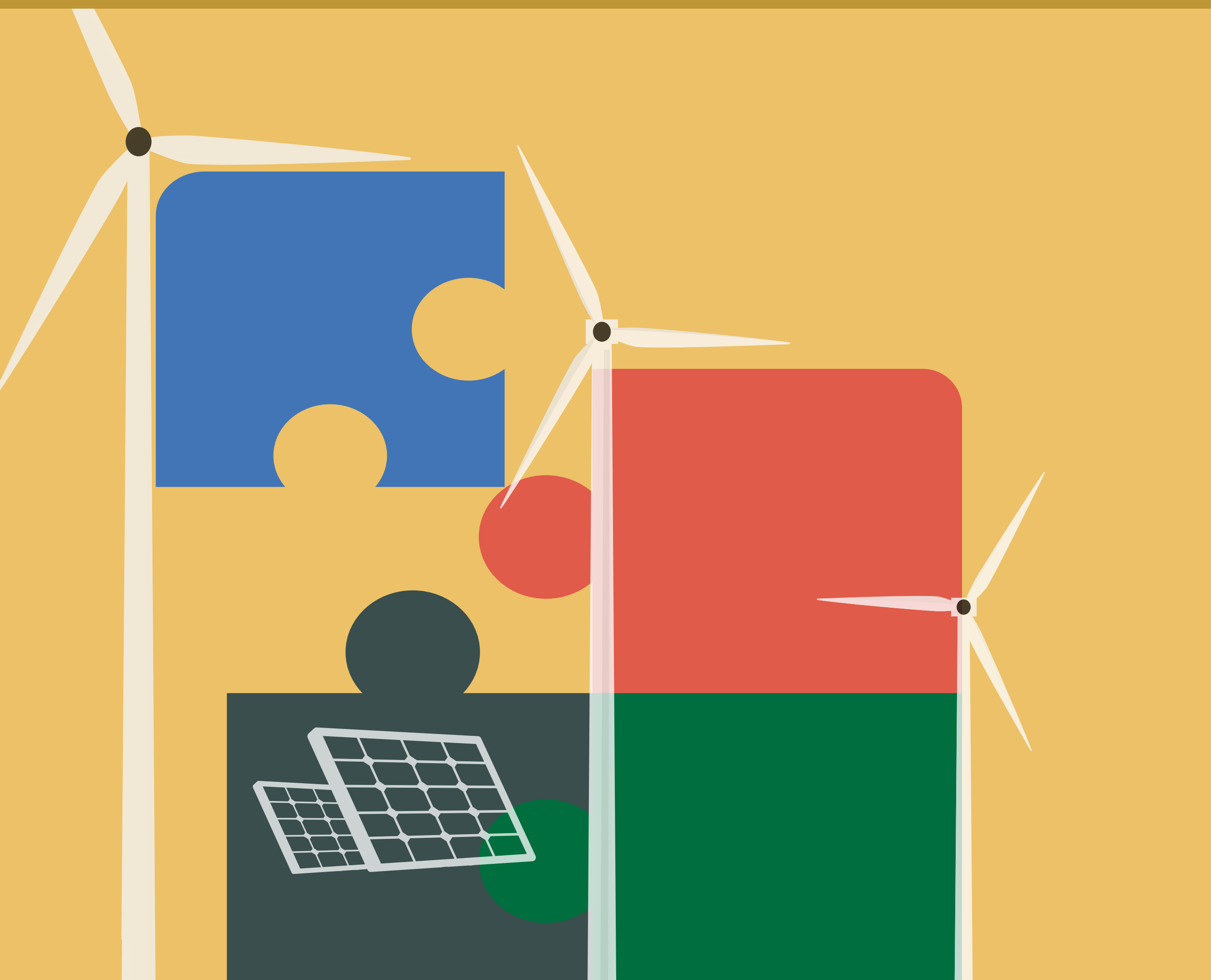
To date, HDB has auctioned 405 megawatts peak (MWp) of solar rooftop capacity in seven rounds and has awarded a total solar rooftop capacity of 366 MWp. In June 2019, the Public Utilities Board (PUB) launched a request for proposal (RFP) for private sector companies to design, build, own and operate a large-scale floating solar PV system on Tengeh Reservoir for 25 years. The RFP was awarded to Sembcorp Floating Solar Singapore in February 2020. Construction work started in August 2020, with the project officially launched in July 2021 (Singapore's National Water Agency, n.d.).

Taking into account the fact that each country's context is different, auctions nonetheless have the potential to support diverse objectives, given their following strengths:

- Through a power purchase agreement (PPA), auctions can provide stable revenues for developers and thus certainty regarding price – as a FiT does – while also committing quantities to help policy makers achieve renewable targets. This is comparable to a renewable portfolio standard (RPS).
- Auctions provide the ability to discover real prices – if designed to achieve that objective – and can thus help the deployment of renewables in a cost-effective fashion.
- Auctions are flexible in design and can help achieve broader policy objectives. Indeed, renewable energy auctions are increasingly being used around the world to achieve objectives beyond price. These include: timely project completion; the integration of variable renewable energy; and support for a just and inclusive energy transition. IRENA's study, *Renewable energy auctions: Status and trends beyond price*, highlights design elements that can support such objectives (IRENA, 2019a).

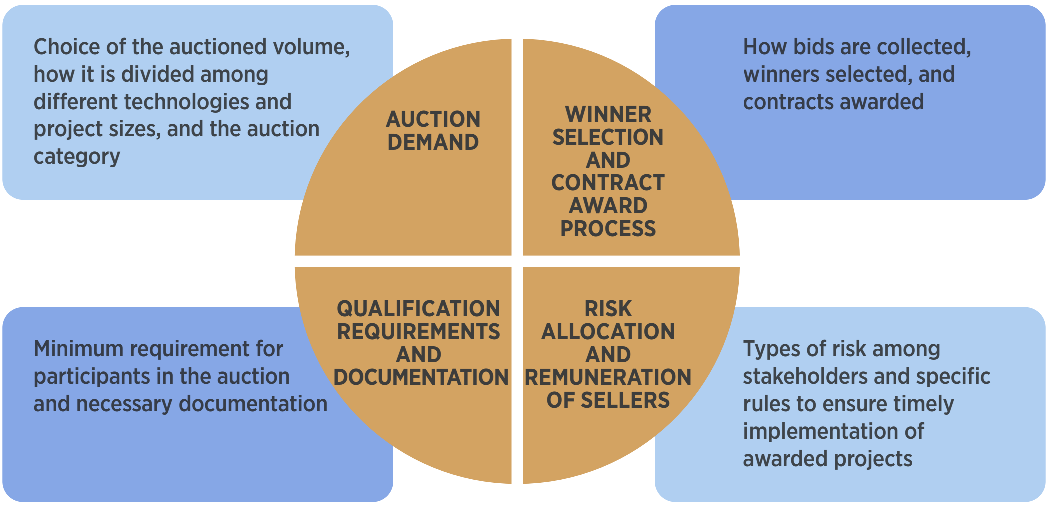
The following chapter analyses the different auction design elements adopted in Indonesia, Malaysia, the Philippines and Thailand.

# 2 RENEWABLE ENERGY AUCTION DESIGN



The analysis of auctions in Southeast Asia follows IRENA's framework (IRENA, 2019a; IRENA and CEM, 2015), which classifies design elements into four main categories: 1) auction demand; 2) qualification requirements and documentation; 3) winner selection and contract award process; and 4) risk allocation and remuneration of sellers (see Figure 1).

**FIGURE 1** The IRENA framework for auction design




Source: IRENA, 2019a; IRENA and CEM, 2015.

## 2.1 AUCTION DEMAND

### Periodicity of auctions

Regarding periodicity, systematic auctions – or a commitment to a long-term schedule of quantities to be awarded over an extended period – may attract a larger number of bidders. This is because they provide long-term visibility and attract market players in various segments of the value chain (IRENA and CEM, 2015). Systematic auctions decrease planning risk and this predictability can have positive effects on the cost of equity, cost of debt and debt terms (Đukan and Kitzing, 2021).

So far, no country has a systematic auction scheme in place and all auctions have occurred on a stand-alone basis. In **Indonesia**, to add new capacity across the country, auctions have depended on requisitions from the central and provincial governments, guided by the RUPTL. In **Malaysia**, the auctioneer – the Energy Commission (EC) – announces a preliminary schedule for annual tenders.

Auctions were held in 2016, 2017, 2019 and 2020. While Malaysia did not have previous experience with large scale renewable auctions before launching its LSS programme, it did have auction experience with thermal power plants for specific projects. The **Philippines** has announced plans to have a systematic auction programme and launch auctions every year (DOE, 2020), and has held its first auction in 2022.

## Products auctioned

The product auctioned in Cambodia, Indonesia, Malaysia, Myanmar the Philippines, Singapore and Thailand has been power in the form of installed capacity in MW. Lao PDR is expected to auction electricity in MWh.[6] This will allow Lao PDR to develop auctions for export-driven projects, given the better financial conditions of neighbouring utilities, especially the Electricity Generating Authority of Thailand (EGAT). The Philippines introduced demand bands for technologies, in consideration of the three main grid areas in the country, namely Luzon, Visayas and Mindanao.

## Technology specificity

Technology-specific auctions are the region's preferred choice. They enable the introduction of chosen technologies to benefit from the available resources while serving the system's needs. They also ensure diversification of the energy mix and support the development of a local industry for given technologies.

Solar PV auctions are the most popular, being held in Cambodia (60 MW and 40 MW in 2019 and 2021, respectively), Indonesia (in 2013 and 2017), Malaysia's LSS programme (in 2016, 2017, 2020 and 2021), Myanmar (1.06 GW and 480 MW in 2020 and 2021, respectively), the Philippines' Private Solar PV Auction (50 MW in 2018) and Singapore (the SolarNova Programme and Floating Solar Systems).

In addition to other factors, policies such as auctions and FiTs, which aim to support solar power, have led some Chinese manufacturers to base themselves in Southeast Asia (IRENA, 2018). This, in turn, has helped the development of a solar industry in the region. **Malaysia**, for example, has emerged as a manufacturing hub for solar PV cells, wafers and modules, with US-based market leaders First Solar and SunPower, along with the South Korean/German Hanwha Q Cells, establishing manufacturing facilities in the country. Other market-leading manufacturers, including China's JA Solar and Jinko Solar, also have major manufacturing operations in the country (Solar Magazine, 2019).

**Indonesia** has the second-largest geothermal resource in the world, representing around 29 GW of potential power generation (PWC, 2018). The country has therefore conducted both geothermal and solar PV auctions. Municipal waste-to-energy can also be contracted through auction, but so far, this technology has only been procured under engineering, procurement and construction (EPC) contracts (Atika, 2019). A plan to auction 12 waste-to-energy projects, producing a total 234 MW of electricity with a completion date of 2022, was postponed due to the COVID-19 crisis (Dhavilla, 2021; Pinsent Masons, 2020). The 12 projects were also expected to bring socio-economic benefits, as they were intended to be developed by regionally-owned enterprises or private business entities (PWC, 2018; Asian Power, 2019).

[6] *As of September 2022, Lao PDR solar auction design elements are being discused and the auction is not yet launched.*

The **Philippines'** 2022 auction was split into demand bands by technology and region (see Table 1).

TABLE 1 Volume auctioned in the Philippines in 2022, by demand band (technology and region)

| | Luzon | Visayas | Mindanao |
|---|---|---|---|
| | Target capacity (MW) | | |
| Hydro | 80 | | 50 |
| Biomass | 60 | 120 | 50 |
| Solar | 900 | 260 | 100 |
| **Total** | **1400** | **400** | **200** |

Source: DOE, 2022b.

In **Thailand**, the first auction in 2016 was specific for biogas (based on waste) and biomass power from very small power producers (VSPP) (USAID, 2017). Less technology-specific auctions were held in following rounds as priorities changed. The second auction in 2017 allowed participation from small hydro (0.1 MW to 1 MW), wind, solar PV and hybrid projects using at least one of the following technologies: biomass, biogas from sewage and waste, and energy crops (USAID, 2017; Krungsri Research, 2019). This hybrid approach had a firm operational target and allowed fossil fuel to be used only for start-up. Energy storage systems (ESSs) could also be installed for firm generation. Additionally, in 2021, the country held a special auction, named 'Energy for All', designed for private investors to co-invest with communities in renewable power. This initial bid round awarded approximately 150 MW, to be produced in equal amounts from biomass and biogas resources. Biomass power plants under this scheme cannot be larger than 6 MW, and biogas plants may not exceed 3 MW (Mori Hamada and Matsumoto, 2021).

## Volumes auctioned

**Malaysia** has auctioned the greatest volume so far, totalling 2.26 gigawatts (GW) of solar PV capacity through four rounds: 300 MW in the first round (2016); 460 MW in the second (2017); 500 MW in the third (2019); and 1 GW in the fourth (2021). The last auction was conducted as part of an economic recovery plan amid the COVID-19 pandemic (EC, 2021a; Nair, 2021; EC, 2020).

The **Philippines** auctioned around 2 GW in its June 2022 auction (see Table 1). Before that, 50 MW of solar PV and 150 MW of wind onshore had been offered in private auctions, for which public information is lacking.

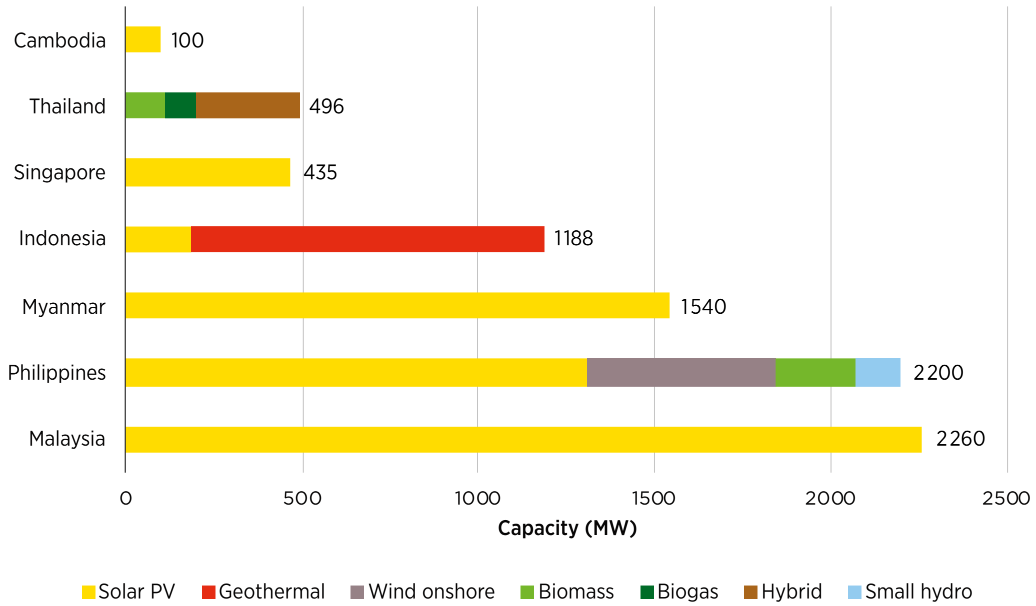
**Indonesia** has also auctioned high volumes, but for both solar and geothermal auctions, the contracted capacities have been significantly below the auctioned capacities (see Chapter 3). In its first solar PV auction, in 2013, 172.5 MW were offered (Oettinger, 2013), while in June 2017, 168 MW of solar capacity was put up for auction in the Sumatra region (PWC, 2017; Ariyanti, 2017; Petrova, 2017). Similarly, the MEMR auctioned 1 GW of geothermal capacity through 15 rounds between 2015 and 2019.

**Thailand's** first auction, held in 2016, had two demand bands: 10 MW for biogas from wastewater/waste; and 36 MW for biomass deriving from organic substances. The latter included fast-growing crops, energy crops, residues from processing agricultural products or from harvesting, and residues from industrial manufacturing processes such as chaff, bagasse, and corncobs (USAID, 2017). The second auction, which was exclusively for renewables, saw 300 MW auctioned for solar, wind, biogas, biomass and hybrid projects. Additionally, as part of the implementation of Thailand's 'Energy for All' renewable power scheme, the first phase of the Community-based renewable energy projects auctioned approximately 150 MW, comprising 16 biomass and 17 biogas power projects (Mori Hamada and Matsumoto, 2021).

**Singapore** has auctioned seven rounds of rooftop solar PV, amounting to a total capacity of 405 MWp, under the SolarNova programme. The first round was in 2015 and the most recent was in 2022. In 2019, Singapore also auctioned 60 MW of floating solar systems. **Cambodia** had two solar auctions, one in 2019 (for 60 MW) and another in 2021 (for 40 MW). **Myanmar** also had two solar auctions, one in 2020 (for 1.06 GW) and another in 2021 (for 480 MW).

Solar PV was the most auctioned technology in the region (see Figure 2).

FIGURE 2 Volumes auctioned in Southeast Asia, up to July 2022




Source: IRENA, 2022.

## Demand bands: Limits on project size and zone, site and project specificity

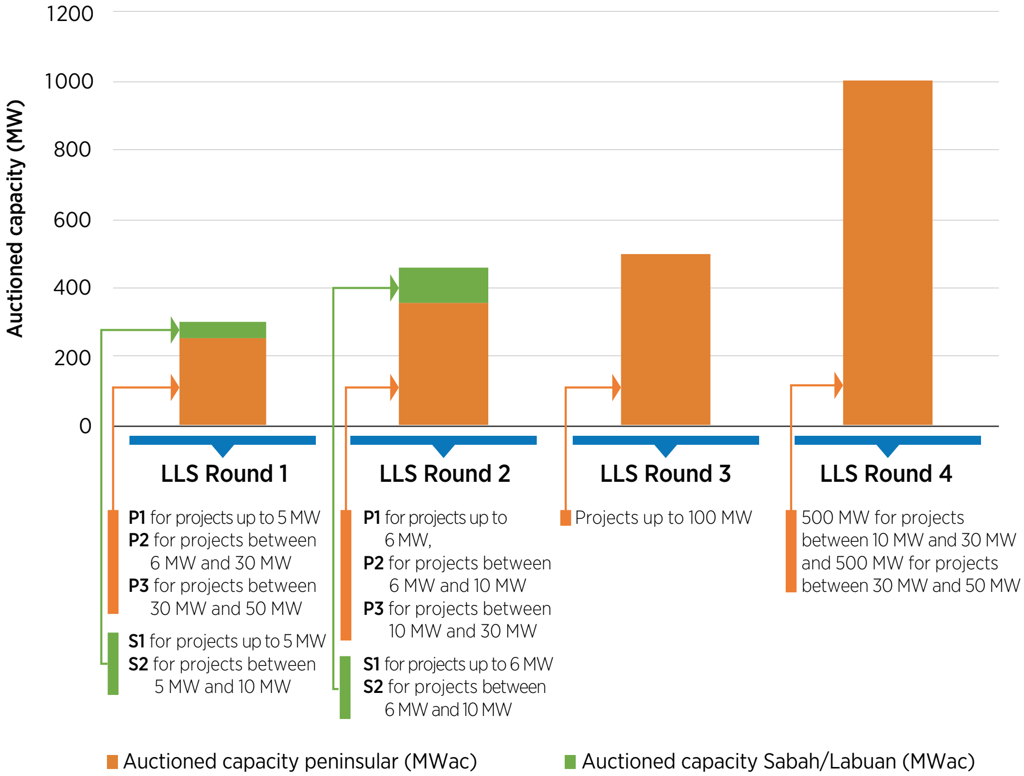
Renewable energy auctions in Southeast Asia have seen different combinations of project size limit and location specificity. Demand bands by regions, or zone-specific auctions, can be used to accommodate concerns regarding transmission and distribution grids, especially given the variable geographical characteristics of the countries analysed, most of them being or having different islands. Demand bands by project size can direct projects to areas with limited space that cannot accommodate large projects. This is especially relevant for solar PV. Limits on project size also encourage the participation of small and new players, given that they would be shielded from competition against larger ones.

The **Philippines** demand bands by technology and region are presented in Table 1.

**Malaysia's** LSSs had demand bands based on project size and location. In the first round, out of the 300 MW auctioned, 250 MW were reserved for the western region (Peninsular Malaysia) and the remaining 50 MW for the east (Sabah/Labuan). In the second round, the 460 MW were split between 360 MW for Peninsular Malaysia and 100 MW for Sabah/Labuan. The Peninsula was split into three subregions (P1-P3) and Sabah/Labuan into two (S1-S2) to accommodate different project sizes. Between the first and second rounds, P2 and P3's project size limits shrunk significantly: P2 went from 6-30 MW in round 1 to 6-10 MW in round 2, while P3 went from 30-50 MW to 10-30 MW. Project size demand bands in Sabah/Labuan remained largely unchanged.

The third and fourth rounds only auctioned capacity in Peninsular Malaysia (see Figure 3). In the fourth round, 500 MW were dedicated for projects between 10 MW and 30 MW in size, with another 500 MW for projects between 30 MW and 50 MW. These demand bands sought to protect smaller local players in the context of post COVID-19 recovery (EC, 2020).

FIGURE 3 Auctioned capacity per region in the four rounds of large-scale solar (LLS) auctions in Malaysia, divided by project size limit




Sources: EC, 2016a; 2016b; 2016c; 2017a; 2017b; 2017c; 2019a; 2019b; 2021a; 2021b.
Note: MWac = megawatt alternating current.

In the first two rounds more volume was auctioned in the Peninsula than in Sabah/Labuan. There were several reasons for this allocation, primarily the Peninsula having a demand capacity that is 17 times higher than Sabah's (17.79 GW compared to 938 MW), larger transmission capacity and better performance of the distribution system (EC, 2019d).

**Thailand** has also conducted auctions with regional demand bands and project size limits. In its second auction, for example, there were nine regional demand bands (see Table 2) for projects between 10 MW and 50 MW (ERC, 2017). The regional demand bands could be adjusted, depending on the offers; if the capacity, wholly or partly, in any region was not allocated, it could be rolled over to another region, given a competitive price and available grid capacity. For example, if the capacity in Phuket or Samui Island was not allocated, the remainder could be allocated to the Southern region (ERC, 2018).

TABLE 2 Demand bands in Thailand's second auction

| Region | Capacity (MW) |
|---|---|
| Northern | 65 |
| North Eastern | 60 |
| Central | 20 |
| Eastern | 20 |
| Western | 20 |
| Bangkok | 15 |
| Samui Island | 15 |
| Southern | 65 |
| Phuket | 20 |

Source: Watson Farley and Williams (2017).

Due to constrained grid capacity, solar PV auctions in **Lao PDR** are expected to be zone-specific and closer to load centres. Hydro power auctions, by definition, are project-specific and they tend to be developed under a build-operate-transfer (BOT) framework.

**Indonesian** solar PV auctions have also been zone-specific. In 2013, seven solar PV auctions were awarded in the provinces of East Nusa Tenggara (five locations), Gorantalo (one location) and South Kalimantan (one location) (Susanto, 2015; (Oettinger, 2013). The solar PV auction held in June 2017 was also zone-specific, with a focus on the Sumatra region (PWC, 2017; Ariyanti, 2017; Petrova, 2017). These solar PV auctions had a size requirement of between 1 MW and 6 MW, but since the auction framework has not been consolidated in the country, this criterion is still under evaluation (USAID, 2017).

Technological requirements can also call for project-specific auctions. Indonesia's geothermal auctions, for example, have been project-specific, as thorough and reliable site studies are needed to prove the economic viability of a project before an auction takes place. The location of the project is indicated by the MEMR and/or PLN. An IPP may present an alternate location to build a project at a different point in the grid system, but this is subject to PLN's approval (PWC, 2018). Given that the geothermal auctions are project-specific, the project size is determined by MEMR, after considering the technical data for the site and the grid capacity.

## 2.2 QUALIFICATION REQUIREMENTS AND DOCUMENTATION

Strict or overcomplicated qualification requirements and documentation can reduce investors' interest in participating in an auction. If requirements are too lax, however, project completion and performance can be compromised (IRENA, 2019a).

### Registration, documentation, reputational and technical requirements

**Malaysian** auctions have had comprehensive and clear registration, documentation, reputational and technical requirements. With the help of other electricity authorities, the auctioneer, the EC, created a website where all the documentation and essential information for the auction could be found, including the guidelines for the whole process. For interested bidders to qualify, they had first to purchase a request for quotation (RFQ). The RFQ documents cost MYR 500[7] (Malaysian ringgits) or around USD 128.36)[8] in the first round and MYR 2 000 (USD 449.20)[9] in the second and third rounds, with the payment having to be made by cheque. Due to COVID-19 social distancing restrictions, the fourth auction allowed the RFQ to be bought online. In the RFQ stage bidders presented their documentation and bids, but needed to wait until the EC issued a notification of the bidder being short-listed. Only then could bidders move on to the RFP stage, in which they received documents such as the PPA draft, LSS guidelines and a non-disclosure agreement (NDA) form. The documentation and technical requirements included proof of previous experience, land usage agreements, ownership structure and a selected connection point to the transmission grid. In addition, the bidders had to demonstrate experience in operating solar PV facilities equal to or greater than 1 MW and with a voltage level of not less than 11 kilovolts (kV). When the bidder was a consortium, at least one company needed to prove this experience requirement (EC, 2016d; TNB, 2016).

In **Thailand**, technical requirements included documents to demonstrate bioenergy availability, land readiness, identification of a feeder interconnection, an electrical system diagram and a statement of financial support issued by a financial institution, as well as the amount of registered capital. The latter varied according to the project size, but was at least THB 2 million (Thai baht)/MW (around USD 56 012/MW).[10] These requirements were evaluated using pass/fail criteria, without specific scores being given (USAID, 2017). Moreover, to participate in the auctions, the projects could not be an improvement, amendment or extension of an existing power plant that already had a PPA signed with the Provincial Electricity Authority (PEA) or EGAT (USAID, 2017; ERC, 2017).

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*[7] The Malaysian ringgit code is MYR but it is also sometimes referred to as RM.*

*[8] USD 1.00 = MYR 3.8953 in March 2016.*

*[9] USD 1.00 = MYR 4.4523 in February 2017.*

*[10] USD 1.00 = THB 35.7066 in January 2016.*

For **Indonesian** geothermal auctions, the process has been more complex. Developers register for the auctions and then express an interest in participating. The auctions only take place if at least three companies demonstrate interest in the project (PWC, 2018; IEA, 2017). If this occurs, the auctioneer analyses each candidate's documentation and if at least two companies technically qualify, the auction goes to the second stage, namely, the bidding. Naturally, if only one company is technically qualified, the second stage does not take place and the process moves to direct selection.

Because these are project-specific auctions, the technical requirements focus on the bidder's experience and the qualifications of the staff. Regarding the first of these areas, participants must present previous experience in, for example, developing geothermal projects or in activities related to mining. More detailed project-specific technical elements are assessed at the winner selection stage (see Section 2.3). The financial and technical components are assessed based on weighted averages, where the score must be at least 70 out of 100 (UMBRA, 2018). The financial requirements (and their weights) are: 1) the financial soundness of the bidder and its affiliate (10%); and 2) the ability to fund the development of the geothermal working areas of the bidder and its affiliate (90%). The technical requirements are: 1) the experience of the bidder and its affiliate (50%); and 2) qualification of personnel and experts (50%) (MEMR, 2020a).

The **Philippines** has established the Green Energy Auction Committee (GEAC) to support auction organisation and undertake all key related activities. The GEAC and a technical working group oversee the evaluation of all bid documents for each auction round. This includes registration, evaluation of qualified bidders, and analysis of bids to support the Department of Energy (DOE) in awarding the projects. The registration process comprises: 1) a letter of intent signed by the bidder's authorised representative; 2) a work program for the project; 3) payment of a registration and processing fee. Evaluation of qualified bidders includes an assessment of their technical knowledge, legal and financial robustness. Bid analysis aims to ensure that the bidders follow all the auction guidelines and procedures in their bid submissions, especially in terms of price (PHP/kWh), capacity and commercial operation date (COD) (DOE, 2021).

### Requirements for socio-economic development

Requirements for socio-economic development have been a common design element in Southeast Asian auctions. In **Indonesia**, the use of local content for products and services is prioritised not only in auctions, but in the broader electricity sector and general investments.[11] Table 3 summarises the LCRs for geothermal and on-grid solar, but there are also requirements for coal, gas, hydro and community solar.

[11] *See Electricity Law of 2009, Ministry of Industry Regulation (MIR) N# 54/M-IND/OER3/2012, MIR N# 5/M-IND/PER/2/2017, and Law # 25/2007.*

**TABLE 3** Local content requirements for geothermal and solar PV in Indonesia

| Technology | Capacity | Local content requirement |
|---|---|---|
| Geothermal | Up to 5 MW | 31% for goods, 89% for services, 42% for goods and services combined |
| | > 5 MW to 10 MW | 21% for goods, 82% for services, 40% for goods and services combined |
| | > 10 MW to 60 MW | 16% for goods, 74% for services, 33% for goods and services combined |
| | > 60 MW to 110 MW | 16% for goods, 60% for services, 29% for goods and services combined |
| | Above 110 MW | 16% for goods, 58% for services, 29% for goods and services combined |
| On-grid solar | Per project | 37% for goods, 100% for services, 44% for goods and services combined |

Source: PWC, 2018.

For solar PV, the level of domestic components for modules had to be at least 50% by 2018 and 60% by 2019.[12] In addition to these rules, geothermal power plants up to 60 MW and solar PV plants must include a national EPC company (PWC, 2018).

In 2015, LCRs in solar auctions led to legal disputes in Indonesia, with the Supreme Court requiring MEMR to roll back its auction that year after the Indonesian Solar Module Association filed a lawsuit arguing that selected bidders were not meeting the LCRs. Developers, on the other hand, argued that the auctions' LCRs lacked clarity (Kenning, 2016). Stakeholders have also complained about LCRs being too stringent. One example sometimes cited of this is the 100% LCR requirement for services for on-grid solar projects shown in Table 3, a particular complaint if the local industry and services are not mature (Donker & Tilburg, 2019).

In **Malaysia**, requirements had been limited to the bidder being a local company with Malaysian equity of at least 51%, or a consortium of legal entities including a minimum of one local company, in which the Malaysian equity must also be at least 51% (EC, 2019c). However, the country's fourth auction went further, as only companies that were 100% Malaysian-owned were allowed to take part, in addition to companies listed on the Malaysia stock exchange with at least 75% of their shares held by local people or companies.

**Thailand** does not directly establish LCRs, but they do play a role in the auctions. For example, while a foreign shareholder can hold up to 100% of the shares in a generation company, a foreign company cannot, on paper, own land and must apply for a Board of Investment (BOI) Promotion Certificate to develop the project (Boonsanong & Charoonchitsathian, 2020). That said, any company may build, own, and operate renewable energy power projects in the range of 10 MW to 90 MW (Small Power Producer; SPP) to enter a PPA with EGAT.

[12] *See MIR # 5/M-IND/PER/2/2017.*

Thailand has also leaned towards bioenergy auctions for their socio-economic benefits, based on the use of domestic resources as well as technological, environmental and community benefits. Although the prices of solar and wind technologies have significantly fallen in recent years, the country still relies heavily on imports for the components of these two technologies. Furthermore, in the Thai context, biomass and biogas generate greater local employment opportunities and economic benefits, mainly in the agricultural sector. As a result, bioenergy has been prioritised when setting renewable targets (USAID, 2017). For the Thai Community-based renewable energy auction, the selected bidders are to have a Memorandum of Understanding (MOU) regarding the joint investment between the project company and local communities, set at a ratio of 90:10. Under the MOU, local communities will be entitled to preferential shares of 10% in the project company and other social and welfare development benefits for the community located near the project, such as those related to public health, utilities and education (Mori Hamada and Matsumoto, 2021).

## Requirements regarding grid access

Requirements regarding grid access can take the following forms: 1) no access permit is required to qualify, allowing auction winners to obtain the necessary permits only after the auction; 2) an access permit is required before the auction, but projects that necessitate grid expansion or grid enforcements are allowed to participate; and 3) an access permit must be obtained before the auction, and only projects that do not necessitate grid expansion or strengthening are allowed to participate (IRENA, 2019a). Southeast Asian auctions have seen a combination of all three options.

In **Indonesia**, because geothermal auctions are project-specific, the site includes grid access. In solar PV auctions, bidders need an analysis from PLN, in which the utility assesses grid capacity to connect the new projects, in addition to assisting the auctioneer in establishing regional demand bands. The developer is responsible not only for acquiring the land, but also for constructing transmission lines to connect to the grid, using the substation indicated by PLN. After building the transmission connecting facility, the ownership of these transmission lines is transferred to PLN at the COD (Norton Rose Fulbright, 2019b).

In **Malaysia**, before each auction, the auctioneer analysed potential connection points to the transmission and distribution networks with the National Electricity Ltd. (*Tenaga Nasional Berhad* – TNB) and Sabah Electricity Sdn Bhd (SESB). In their RFP documents, bidders were then supplied with a list of connection (nodal) points from which to choose. Developers were responsible for conducting the connection study and had to assume all the costs associated with grid connection. Alternative connection points could be proposed, but they needed approval from the EC and the system operators.

In accordance with the grid rules for the LSS auctions, projects larger than 30 MW had to connect to the transmission grid, while the smaller ones had to connect to the distribution network. Because the bidders selected their connection point from the list, an awarded project should therefore not face major issues in connecting to the grid. The EC also published its *Guidelines on Large Scale Solar Photovoltaic Plant for Connection to Electricity Networks* (EC, 2016d), which detailed step-by-step the technical and regulatory qualification processes for large-scale PV projects to connect. Nevertheless, the nodes identified could also require the acquisition of additional land by the developer to facilitate busbar extension. All costs associated with the connection of solar PV projects are also borne by the developer. In addition to land, too, extensions to connect at a substation, interconnectors between two substations and an interconnector for distribution levels could also have to be built by the developer and handed over to the TNB or a distribution company if capacity was lower than 30 MW (EC, 2016d).

In the **Philippines** the legal auction framework mainly allocated responsibilities regarding grid reliability to the transmission and distribution network providers. These companies have to process and conduct system tests to allow commercial operation of awarded projects, indicating adjustments to the DOE in order to avoid system problems and delays in connection. Moreover, the transmission network provider has to review, update and submit to the DOE's approval the necessary grid expansion, improvements and ancillary service requirements. Meanwhile, distribution companies also need to review and analyse their low-tension grids and inform the DOE about any need for improvements in order to receive power generated by the awarded projects (DOE, 2021).

## 2.3 WINNER SELECTION AND CONTRACT AWARD PROCESS

### Bidding procedure

Up to now, the bidding procedure for all auctions conducted in Southeast Asia has been sealed-bid. Compared with an iterative or a hybrid process, this simple method is more commonly implemented around the world. One weakness, however, is that once bidders have disclosed their bid price, they cannot revise it, taking away their ability to react to market dynamics and adjust their bid accordingly (IRENA and CEM, 2015).

### Winner selection criteria

In Southeast Asia, winner selection criteria have varied from country to country and across technologies within the same country.

In **Indonesia**, until 2018 geothermal auctions used a multi-criteria approach that combined technical criteria with price. MERM and PLN analysed whether the bids met the administrative and technical requirements and then selected the winners from the pool of qualified bids. After 2018, the criteria changed, focusing instead on: 1) the highest exploration commitment amount, with this ranging from USD 5 million for capacities smaller than 10 MW to USD 10 million for capacities greater or equal (UMBRA, 2018);[13] and then 2) the probability of success in generating electricity. Now, if two bidders submit the same exploration commitment, the winner is chosen based on a project weighted score.

[13] *See MEMR # 37/2018.*

This score is based on the probability of success in generating electricity, and the weights are different for new projects and those which already have exploration data. Working areas with exploration well data prioritise the exploitation strategy and plan for utilisation criteria, while for new projects, the technical assessment of geothermal reserves and the exploration strategy plan is more relevant. This is due to uncertainties regarding an area's potential for generating electricity (see Table 4). Solar PV auctions have been simpler, adopting minimum price selection.

### TABLE 4 Weighting score in the second stage, first envelope

| Aspect | New projects | Working areas with exploration well data |
|---|---|---|
| Technical assessment of geothermal reserves | 25% | 10% |
| Exploration strategy and plan | 25% | 15% |
| Exploitation strategy and plan, and utilisation | 20% | 40% |
| Investment plan | 20% | 25% |
| Innovation | 5% | 5% |
| Commercial operation date target met | 5% | 5% |

Source: UMBRA, 2018.

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In **Malaysia**, the LSS' winner selection relies on a multicriteria score that considers four different elements: 1) connection site, voltage and size of the project; 2) land usage; 3) local content; and 4) social benefits (see Table 5).

**TABLE 5** Merit Score for LSS auction

| Element | Description | Merit point | Comments |
|---|---|---|---|
| **Connection site, voltage and size of projects** | For Peninsular Malaysia and Sabah/Labuan: (1) 1 MW to 5 MW connecting at ≤ 11 kV; or (2) 6 MW to 29 MW connecting at ≤ 33 kV | 1 | Smaller capacity with connection at lower voltage is preferred. |
| | For Sabah/Labuan: Labuan projects located in the East Coast | +1 | Additional point for projects on East Cost of Sabah |
| **Land usage** | (1) the project will be developed on a bidders' existing land/structure; (b) the project will be developed on land with no or little economic value such as landfill site, deserted mining land, pond, etc. or; (c) the land under the solar PV panels is also used for other economic activities. | 1 | |
| **Local content** | 100% locally manufactured/assembled PV modules or inverters | 1 | |
| **Social benefits** | The project includes community services or public amenities such as place of worship, non-profit welfare service, education institution, or stadiums | 2 | |

Source: EC, 2016e.

Connections at a lower voltage and with smaller capacities are prioritised in the selection criteria. Moreover, the additional point awarded to projects in the East of Labuan (see Table 5) reflects their contribution to the objective to not leave any less developed or less endowed region behind. Similarly, as land can be scarce in Malaysia, the auctioneer gives a higher score to projects that make smart use of this scarce resource. The auction bid evaluation criteria also included social benefits, prioritising projects that take advantage of already built structures to maximise social benefits through the generation of greater or additional rents and leasing incomes. Finally, the local content criterion can help develop or strengthen a local supply chain.

The higher the total merit score, the more competitive the bid. However, since price is also a criterion, the auctioneer selects the lowest scored offers based on the following formula:

**Score = price offered x (100 – total merit score)/100**

Beyond the scores, the auctioneer limits the aggregate capacity that a single bidder can be awarded to 50 megawatt alternating current (MWac) in the first two LSSs (EC, 2016d; TNB, 2016). In the third auction this criterion was removed, as an objective was to attract large players to exploit economies of scale. The fourth auction, however, is expected to bring this criterion back with slight modifications. These include bidders being able to submit for up to three projects with a total cap of 50 MWac, as the first two LSSs did not have any limits on the number of bids (EC, 2020).

The **Thai** auctions were all held on a minimum price basis, with the auctioneer ranking the bids according to the highest discount offered to the fixed FiT, as a percentage (USAID, 2017).

The **Philippines** conducted minimum price auctions, observing all bids ranking from the lowest to the highest price, and stacking the ranked offers to respective technologies until the demand was met (DOE, 2022b).

## Payment to the winner

Regarding the payment to the winner, Malaysia, Thailand and the Philippines have followed pay-as-bid schemes, which are common in other auctions around the world. Pay-as-bid pricing schemes tend to be more cost-effective than marginal bidding (when every bidder is paid according to the last accepted bid), and more attractive to bidders (in cases where marginal pricing is based on the lowest bid), and as such more transparent and binding than non-standard pricing schemes, and therefore more politically and socially acceptable (see IRENA and CEM, 2015). Marginal pricing has been used in **Indonesia**, where there has been a price negotiation window between the buyer (PLN) and the short-listed bidders (PWC, 2018).

## Ceiling prices

Ceiling prices prevent the contracting of capacity at a price that is higher than a given threshold. In **Indonesia**, and just as for the FiT scheme, the disclosed ceiling price for solar PV auctions was the electricity supply cost of the region where the project was to be developed. In regions where the regional tariff was higher than the national tariff, the price was capped at 85% of the regional price. In the regions where the price was lower than the national price, the price could be freely negotiated between the buyer (mostly PLN) and the IPP, but in any case, the bid had to be below the national average. The difference between the FiT scheme and auctions was that participants in the latter bid received a percentage 'discount' from the 85% cap. In the 2013 auction, the ceiling price was USD 250/ MWh, but if a project used a PV module with a domestic component level of at least 40%, the ceiling price increased to USD 300/MWh (MEMR, 2013).

**Thailand** used different ceiling prices for different technologies and project sizes in its first auction round. These ranged from THB 3.76/kWh (USD 110/MWh)[14] for biogas to THB 5.34/kWh (USD 150/MWh) for biomass projects of less than 1 MW (USAID, 2017). In the country's second round, the Thai authorities set a ceiling price of THB 3.66/kWh (USD 112.6/MWh)[15] for the whole auction (ERC, 2017).

**Malaysia** did not officially disclose a ceiling price, but provided a reference price of MYR 0.41/kWh (USD 105.3/MWh).[16] This was based on a market estimate for the technology, including connection costs. Bidders could submit any price, but the auctioneer reserved the right not to accept any bid above the reference price. In other words, the auctioneer used the reference price as an anchor, but did not formally establish a ceiling price (USAID, 2017). The reference price in the third auction was MYR 0.324/kWh (USD 77.5/MWh),[17] 21% lower than in the previous round.

[14] *USD 1.00 = THB 35 in August 2016.*

[15] *USD 1.00 = THB 32.5 in December 2017.*

[16] *USD 1.00 = MYR 3.8953 in March 2016.*

[17] *USD 1.00 = MYR 4.183 in August 2019.*

The **Philippines** disclosed celling prices per technology, with these set by the Energy Regulatory Commission (ERC). The cap price for solar PV technology was set at PHP 3.628/kWh (USD 0.069/ kWh), while that for wind power was assigned a ceiling rate of PHP 5.2887/kWh. Furthermore, the authority said that the offered price for biomass and run-of-river hydro projects must not exceed PHP 5.548/kWh or PHP 5.8705/kWh, respectively (Bellini, 2022).

## Clearing mechanisms

Different clearing mechanisms have also been observed across the region.

In **Thailand**, marginal bids could be contracted to meet demand (ERC, 2017; ERC, 2018). For this, bidders had to specify in their bid the maximum capacity reduction they were able to accept at the offered price. This allowed the auctioneer and system operator to assess the maximum capacity that a zone in the electrical system could receive (USAID, 2017).

In **Indonesia**, the clearing mechanism for the zone-specific solar PV auctions is unclear. So is Malaysia's, as more volume has been awarded than initially planned (see chapter 3).

In the **Philippines**, if the quantity offered by the marginal bidder is up to 20% greater than the demand, the project is fully awarded. However, if the quantity required to contract the marginal bidder overshoots this threshold, the bidder may opt to agree to reduce the awarded capacity without changing the price, or to withdraw from the auction without any penalty. In the event of a withdrawal, the next bidder is called on, subject to the same conditions (DOE, 2022c).

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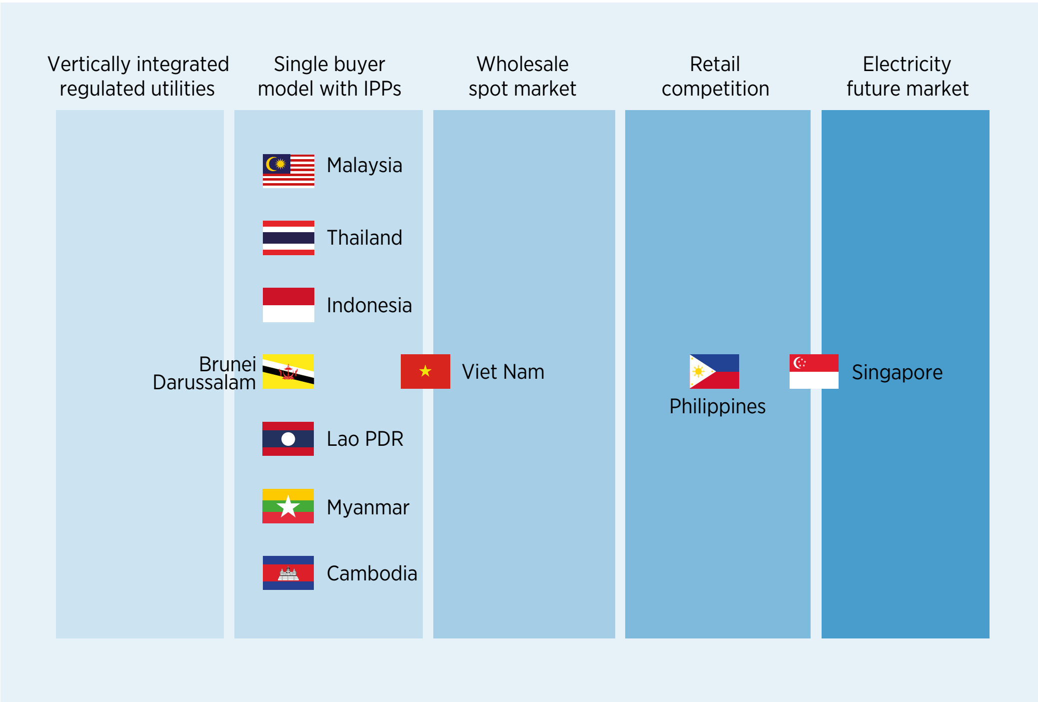
## 2.4 RISK ALLOCATION AND REMUNERATION OF SELLERS

### Counterparty off-take risks

Payment certainty and clear demand-side responsibilities are crucial in increasing renewable energy developers' confidence. The counterparty risk – namely the risk that developers face when engaging with off-takers – varies depending on the utility's balance sheet, but also, the market structure. In Southeast Asia, only the Philippines and Singapore have a liberalised electricity market. The rest operate under a single buyer model, with Viet Nam also having a spot market (see Figure 4).

**FIGURE 4 Structure of electricity markets in Southeast Asia**




Source: based on KPMG, 2015.

In **Thailand**, utilities perform well in terms of transparency and monitoring. Standard PPAs are bankable, even though there is no government guarantee to ensure credit worthiness (World Bank and ESMAP, 2020). In the country's first auction, the off-taker was the PEA and in the second, EGAT (USAID, 2017; ERC, 2017).

**Malaysian** utilities are also creditworthy. The country has three state-owned utilities, namely TNB, Sarawak Energy and Sabah Electricity, that have monopolies in distribution and transmission in their concession areas. TNB and Sabah electricity have so far been the auctions' off-takers. TNB serves 9.2 million consumers, mostly in Peninsular Malaysia, but also some in Sabah and Labuan. It is a company listed on the Malaysian stock exchange and has a local AAA credit risk issued by RAM Rating Services Ltd. (Bhd.) and the Malaysian Rating Corporation. At the international level, it has a

BBB+ rating issued by Standard & Poor's Rating (S&P), and an A3 rating issued by Moody's Investors Service. The company also owns 80% of Sabah Electricity, and the remaining 20% is owned by the government of Sabah province.

In **Indonesia**, counterparty risk has improved, but sellers still face some offtake risks with the utility (World Bank and ESMAP, 2020). The utility operates under a cost recovery plus regulated profit (cost-plus) regulatory approach. Under this, the government reimburses any shortfall – which often occurs, due to high retail tariff subsidies. In this context, some concerns exist regarding the delay in compensation payments from the government, lower electricity demand and delayed collection from retail customers amid the COVID-19 pandemic (Fitch Ratings, 2020). Indonesia provides government guarantees to ensure credit worthiness, but these are at times not enough to increase investors' confidence.

In the **Philippines**, the structure of regulated auctions minimises default risks, due to the administration of the auction programme by the National Transmission Company (TransCo) and a payment made by all distribution companies who collect surcharges from consumers (DOE, 2022c). In **Lao PDR**, there are no guarantees in place and the PPAs are not bankable. In addition, projects face a high risk of curtailment (World Bank and ESMAP, 2020).

## Financial risks

Financial risks are important considerations for any contract. Those associated with currency exchange rates and inflation can be particularly significant for project developers, as these can have a considerable impact on the viability of a business plan that spans several decades.

While geothermal auctions in **Indonesia** award contracts in US dollars, payments are made in the local currency, the Indonesian rupiah (IDR), unless an exemption has been approved by the Central Bank of Indonesia.[18] The exchange rate used is the Jakarta Interbank Spot Dollar Rate. This procedure has sometimes been a matter of concern for investors, as they are uncertain whether or not the government will expand this rule to other procurement mechanisms. They are also uncertain if this rule will be implemented retroactively for contracts already signed, and for how long a period of the PPA it will last. These factors are particularly important for those projects with loans denominated in US dollars (PWC, 2018).

In **Malaysia**, contracts are denominated in the local currency, the Malaysian ringgit (MYR), and are not indexed to inflation (TNB, 2017). In **Thailand**, contracts are also denominated in the local currency, the Thai baht (THB). These contracts have fixed and variable payment terms, in order to accommodate cost fluctuations, such as fuel and inflation (USAID, 2017). In the **Philippines**, the contracts have also been, and are expected to continue being, denominated in the Philippine peso (PHP), but the ERC adopts a formula to annually adjust rates, observing a weight for local and foreign components and consequently, local inflation and exchange rates.

[18] *See MEMR Regulation #10/2017.*

## Risks associated with production and curtailment

Risks associated with production and curtailment are important factors for renewable energy developers. In some cases, as in **Lao PDR**, some points of the grid might not be able to receive variable renewable generation at any given hour. The integration of variable generation can be eased, however, through auction design that allocates risks fairly.

In **Thailand**, the PPA requires the generator to deliver between 98% and 102% of the capacity during peak periods (currently between 9:00 a.m. and 10:00 p.m. from Monday to Friday) and limits power output at all other times to 66.3% of the PPA capacity. The hybrid PPA scheme does not require a minimum power output during off-peak periods. During peak periods, the generators receive a variable FiT, if the generation is up to 102% of the contracted amount. If the actual output is between 102% and 105% of the contracted amount, the generator receives 50% of the variable FiT. Above 105%, the generator will not receive any variable FiT for the surplus generation. During off-peak periods, the generators do not receive a fixed FiT for any generation surplus (ERC, 2017).

In **Malaysia**, the contracted capacity is fixed to that awarded in the auction, with increments or decrements not allowed under the PPA commercial structure. Under a build, own and operate (BOO) concession scheme, energy contracts are take-and-pay, with the LSS developer paid an energy rate up to the LSS power plant's maximum annual allowable quantity (MAAQ). Any energy beyond the MAAQ, if accepted by TNB or SESB, is paid at the excess energy rate (EER). This was set at a symbolic MYR 0.01/kWh (USD 2.57/MWh)[19] for the first auction (EC 2016d, TNB 2016) and MYR 0.08/kWh (USD 18/MWh)[20] from the second auction onwards (TNB, 2017).

The LSS generator must also submit an annual generation profile (AGP) and maintenance programmes (subject to the grid system operator approval) to assist the utility and grid system operator in planning and scheduling dispatch, and to minimise deviations. TNB, as a buyer which also manages the grid, has the right to request generation interruption of up to 168 hours a year, in case an emergency condition occurs within the grid system, without any payment obligation. The buyer can also request interruptions of up to 42 hours a year for grid maintenance between 10:00 a.m. and 4:00 p.m. and 126 hours a year for procedures outside those times, in both cases providing advance notice of at least 72 hours has been given. Only if the buyer refuses to accept electricity outside the cases described above must it pay for the energy at a reference price based on the average generation of the last 30 days, considering a thirty-minute interval (TNB, 2017). Singapore plans to import renewable generation from Malaysia; future LSSs could leverage this opportunity to diversify production risks (Yeap, 2021).

For geothermal auctions, risks are different from the above. Geothermal auctions, in fact, rather resemble oil area auctions. The government (MEMR) provides an indicative figure of possible reserves to be exploited for electricity generation. Then, the awarded bidders must explore the area and drill wells afterwards. Thus, and in general, the risks are mainly in the exploration phase.

[19] *USD 1.00 = MYR 3.8953 in March 2016.*

[20] *USD 1.00 = MYR 4.4523 in February 2017.*

The **Indonesian** government is studying alternatives to run the exploration phase after confirming the potential of the area, rather than just providing indicative figures. In any case, developers can participate as IPPs or through a public private partnership (PPP) (PWC, 2018). PLN, however, usually has its subsidiaries take ownership shares in selected IPP projects in a build, own, operate, transfer (BOOT) scheme, where the ownership of the power plants initially built and owned by the IPP is transferred to PLN upon the expiration of the PPA. This limits the project's revenue stream to the length of the PPA (Hamdi, 2020). EPCs are also present in Indonesian auctions. For instance, PLN often procures the engineering and construction services when developing projects.

Geothermal contracts are take-or-pay, unlike those in solar PV, which are take-and-pay contracts for the length of the PPA. Thus, if everything else remains constant, geothermal developers face lower generation risks when compared to solar PV (Hamdi, 2020).

Regardless of the procurement method, PLN must pay for the electricity in full, except in cases of force majeure (Bernarto , 2017). Thus, the perception of curtailment risk is low in Indonesia. In the 2013 solar PV auction, the monthly payment considered the generated electricity in the month up to 110% of the declared monthly amount. Generation above this 110% threshold was valued at 50% of the auction price, and the same price was applied for generation deficits, which are annually verified (MEMR, 2013).

In the **Philippines**, the private auctions held by Meralco in 2019 stipulated soft penalties regarding replacements for the power not delivered by the generator, and in the event of forced outages, the seller would provide the energy at the awarded price. If there was a scheduled, major maintenance outage, Meralco would also pay for the agreed electricity at the awarded price. In other cases of failure, however, Meralco would also pay for the agreed electricity at the awarded price, while in yet other cases, Meralco would pay for the electricity at a lower price between the spot price and the contract (Meralco, 2019). This followed the typical merchant approach adopted in international wholesale electricity auctions.

For public renewable energy auctions, the Philippines follows the FiT rule framework in terms of contract obligations. The generator has strict rules in terms of COD, but in terms of generation, there is not a penalty, although the actual generation is valued at the contract price.

## Liabilities related to grid connection

The liabilities related to grid connection are a concern for generators, globally (IRENA, 2019a).

In **Malaysia**, the auctioneer (EC) together with the buyer (TNB) are responsible for providing a list of all the available connecting points to developers. These nodal points are issued as part of the auction documentation. Then, bidders must perform a power system study on connection to the potential nodal points. Any alternative connection point may be proposed, but its acceptance rests at the EC's discretion after consultation with the grid system operator and the distribution system operator (in general, in both cases TNB). All costs associated with the connection of the power plant and the power system studies must be borne by the bidder (TNB, 2017). Projects that require an expansion of the transmission grid cannot participate in the auction and no provisions for transmission delays exist in Malaysian auctions. In other words, the LSSs are conducted based on the existing transmission capacity.

In **Indonesian** geothermal auctions, PLN pays back the IPP if the latter cannot conduct a commissioning test due to PLN's actions, except when there is a justifiable cause or political or natural force majeure affecting the grid. Solar PV awarded firms, however, are not entitled to this protection and they assume all risks for transmission-generation mismatches (Norton Rose Fulbright, 2019b).

## Commitment bonds

Guarantees in the form of commitment bonds minimise the incidence of under-contracting and underbidding (see Chapter 2 of IRENA, 2019a), with Southeast Asian auctions being no exception to this rule. Yet, while a commitment bond may be crucial in ensuring an auction's success and discouraging the underperformance of a project, if its terms are too strict, the bond requirement may also discourage some potential participants from taking part.

Commitment bonds normally include bid bonds and project completion bonds, also called performance bonds.

In Indonesia's solar PV auctions, the bidders had to deposit a bid bond equivalent to 2% of project cost. The completion bond was 20% of the investment value, which had to be deposited in an escrow account at a state-owned bank within 15 days of the announcement of the auction results. The developers could use the deposit for project development only after achieving financial close (MEMR, 2013; USAID, 2017). In the geothermal auctions, the bid bonds had to be deposited in favour of the auction committee, and their validity needed to be long enough to cover the financing period.

For the three auctions announced in 2019, the bid bond range was between IDR 1 billion and IDR 2 billion (USD 71 942 and USD 143 885),[21] depending on the type of reserve or working area (see Table 6).

**TABLE 6** Bid bonds

| Minimum auction bond | Project characteristics |
|---|---|
| IDR 2 billion (USD 143 885) | For auctions with unexpected reserves or proven reserves greater than or equal to 100 MW |
| IDR 1 billion (USD 71 942) | For auctions with unexpected reserves or proven reserves less than 100 MW |
| IDR 1 billion (USD 71 942) | If the working area is in East Nusa Tenggara, Maluku, North Maluku, Papua or West Papua |

Source: UMBRA, 2018[22].

[21] *USD 1.00 = IDR 13 900 in 2019.*

[22] *See MEMR # 37/2018 (2018).*

In addition, Indonesia's geothermal auctions have an exploration bond of a minimum USD 10 million for capacities greater than or equal to 10 MW, or a minimum USD 5 million for capacities smaller than 10 MW.[23] Although this may seem a high value, these commitment bonds seem not to discourage participation in auctions (USAID, 2017). Rather, stakeholders have concerns regarding tariffs, BOOT and overlapping regulations (PWC, 2018; Norton Rose Fulbright, 2019b).

In **Malaysia's** first two LSSs, bidders had to deposit a bid bond valid for six months, with different values depending on the project region and size. In addition, shortlisted bidders had to present a completion bond valid for up to one month after the financial close of the project. The completion bond also depended on the project's regional demand band, and was 10 times higher than the bid bond (see Table 7).

TABLE 7 Bonds for Malaysia's first two LSS auctions

| Area | Bid bond | Completion bond |
|---|---|---|
| **P1 (Peninsular)** | MYR 100 000 (USD 24 155)[24] | MYR 1 000 000 (USD 241 546) |
| **P2 (Peninsular)** | MYR 500 000 (USD 120 773) | MYR 5 000 000 (USD 1 207 730) |
| **P3 (Peninsular)** | MYR 1 000 000 (USD 241 546) | MYR 10 000 000 (USD 2 415 459) |
| **S1 (Sabah/Labuan)** | MYR 100 000 (USD 24 155) | MYR 1 000 000 (USD 241 546) |
| **S2 (Sabah/Labuan)** | MYR 200 000 (USD 48 309) | MYR 2 000 000 (USD 483 092) |

Source: EC, 2016e.

In **Thailand**, bidders had to present a letter from a financial institution that supported the development of the project (USAID, 2017; ERC, 2017) in addition to a bid bond for THB 500/kW (USD 14.29/kW).[25] The completion bond was THB 8 000/kW (USD 228.6/kW) and there was an additional financial guarantee for the contract signing equal to THB 4 000/kW (USD 114.3/kW) (ERC, 2017).

In the **Philippines**, bidders were required to submit bid bonds and performance bonds. Qualified bidders participating in the auction had to present bid bonds valid for the duration of the auction process, with these also valid for 90 days to provide time for the GEAC to analyse all the results and procedures. These bonds were returned right after the performance bond was deposited, or if the bidder was not awarded in the auction. Awarded bidders needed to present a performance bond which could be drawn in full if there was a COD delay of more than one year.

*[23] See item 11, article 1 of MEMR # 37/2018 which defines "Exploration Commitments are implementation guarantee funds for exploration of well drilling".*

*[24] USD 1.00 = MYR 4.14 in 2016.*

*[25] USD 1.00 = THB 35 in August 2016.*

## Delay risks and penalties

The awarded developers also had to factor in delay risks and penalties. In general, delays could be penalised in three ways: 1) through a one-time financial penalty – *i.e.* confiscation of a fraction of the project's completion bond in proportion to the delay observed; 2) reduction of the project's contractual remuneration (a recurring cost) or duration; or 3) contract cancellation, if the delay extended beyond a defined deadline (see Chapter 2 of IRENA, 2019a).

In **Malaysia**, if the scheduled COD was not met, the developer had to pay the buyer a sum equal to the capacity awarded multiplied by MYR 5 000 (USD 1 284)[26] in the first auction, and MYR 1 000 (USD 225)[27] in the second and third auctions. This was for each day of delay until either of the following four events were reached: 1) the plant started operating; 2) a 180-day delay, which effectively terminated the contract; 3) the date at which the PPA could be terminated by the buyer in accordance with the provisions of the PPA, which included missing the financial closing date and the EPC contract date; or 4) if the seller decided to abandon the project. In the latter case, the seller had to pay the buyer the penalty described above, multiplied by 180 (EC 2016d, TNB 2016). Thus, the 180-day delay sets the threshold for penalties and contract termination. When the contract is terminated, no other project is selected to replace it.

In addition, if a power plant delivered less than 70% of the declared annual quantity, it had to pay a penalty calculated based on the price of the contract – namely the energy rate – multiplied by the deficit in kWh. The declared annual quantity (in MWh) is a generation forecast from a solar PV facility to be delivered to the grid at the connection point indicated in the auction process. This amount also observes the MAAQ for that facility. In addition, there is a declared daily quantity (in MWac) to be shared with the utility and the grid system operator (GSO), which is a projection of the facility's output for every 15 minute interval for the next day to be generated and delivered to the grid at the connection point indicated in the PPA (EC 2016d, TNB 2016). There is not an explicit penalty for generation deviations from declared daily quantity in the PPA, but the clause "right to claim compensation" (19.2 of the PPA, valid from February 10, 2017) mentions that if the power plant fails to comply with or operate in conformity with any operating standard, compensation will be paid to TNB equivalent to MYR 10 000 (USD 2 246)[28] per failure. This penalty can be disputed (TNB, 2017).

In **Thailand**, when the COD is set before its maximum limit, delays result in a daily fine being deducted from the bond payment at the rate of 1.11% per day. When a project is unable to commence by the maximum COD, the remainder of the project bond is confiscated and the PPA is terminated (USAID, 2017; ERC, 2017). Thailand also has performance penalties. During peak times, generators are penalised if they supply less than 98% the contracted power quantity, at any 15-minute interval. The fixed FiT is then reduced at a 20% rate for the difference, up to the 98% of the electricity that the off taker should have received. If the seller terminates the PPA before the end of the contract, it has to pay to the off-taker (EGAT) the remaining electricity. This is calculated from the awarded energy multiplied by the number of remaining hours in the contract – limited to five years – multiplied by a capacity factor of 0.8 and the contracted amount in kW (ERC, 2017).

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*[26] USD 1.00 = MYR 3.8953 in March 2016.*

*[27] USD 1.00 = MYR 4.4523 in February 2017.*

*[28] USD 1.00 = MYR 4.4523 in February 2017.*

In **Indonesia's** solar PV auctions, projects that miss the COD are subject to a power purchase price reduction of 3% for a delay of up to three months, 5% for a delay of between three and six months, and 8% for a delay of between six and 12 months (MEMR, 2013; USAID, 2017).

In the **Philippines**' private auctions, if there is a delay, Meralco and the seller discuss the terms on which the PPA may continue. If an agreement is not reached within 60 days of the delay, the PPA may be terminated by Meralco and the performance bond may be cashed out. In addition, if the seller cannot provide replacement power when it fails to deliver, the seller pays a fine equivalent to PHP 908/MWh for every day for which the energy is not replaced. This penalty is used to reduce consumers' bills (Meralco, 2019).

As mentioned above, in the **Philippines**, performance bonds can be cashed out and a contract terminated if there is a COD delay longer than one year when compared to the committed contract date. If the delay is shorter than one year, the penalty imposed on the winning bidder is 0.10% of the project cost for every day of delay, limited to 10% of the total project cost (DOE, 2022d).

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## Contract duration and lead time

Predictable long-term revenues over the useful lifetime of a project improve developers' perceptions of risk. With the exception of geothermal auctions, the contract duration in the region is set at around 20 years, regardless of the technology. Lead times can vary from country to country, from technology to technology and from auction to auction to accommodate specific challenges and learning curves (see Figure 5).

In **Indonesia**, the contract duration for geothermal auction PPAs is 30 years, which is around the maximum period that a power plant can operate, depending on the type of fuel (PWC, 2018).[29] The lead time is long – at least seven years – but there are also tenders with a nine-year lead time. Ultimately, there is a long period between exploring the area and developing it to generate electricity.

In the country's solar PV auctions, the contract duration was 20 years. The lead time was 18 months and could be extended by a maximum of 12 months (MEMR, 2013; USAID, 2017). Because PLN and the IPP enter a BOOT scheme, contract extensions are not allowed, even if the power plant still has a long useful life (Hamdi, 2020). Municipal waste-to-energy power plants, however, can be granted a BOO license and thus, could potentially extend their contracts.

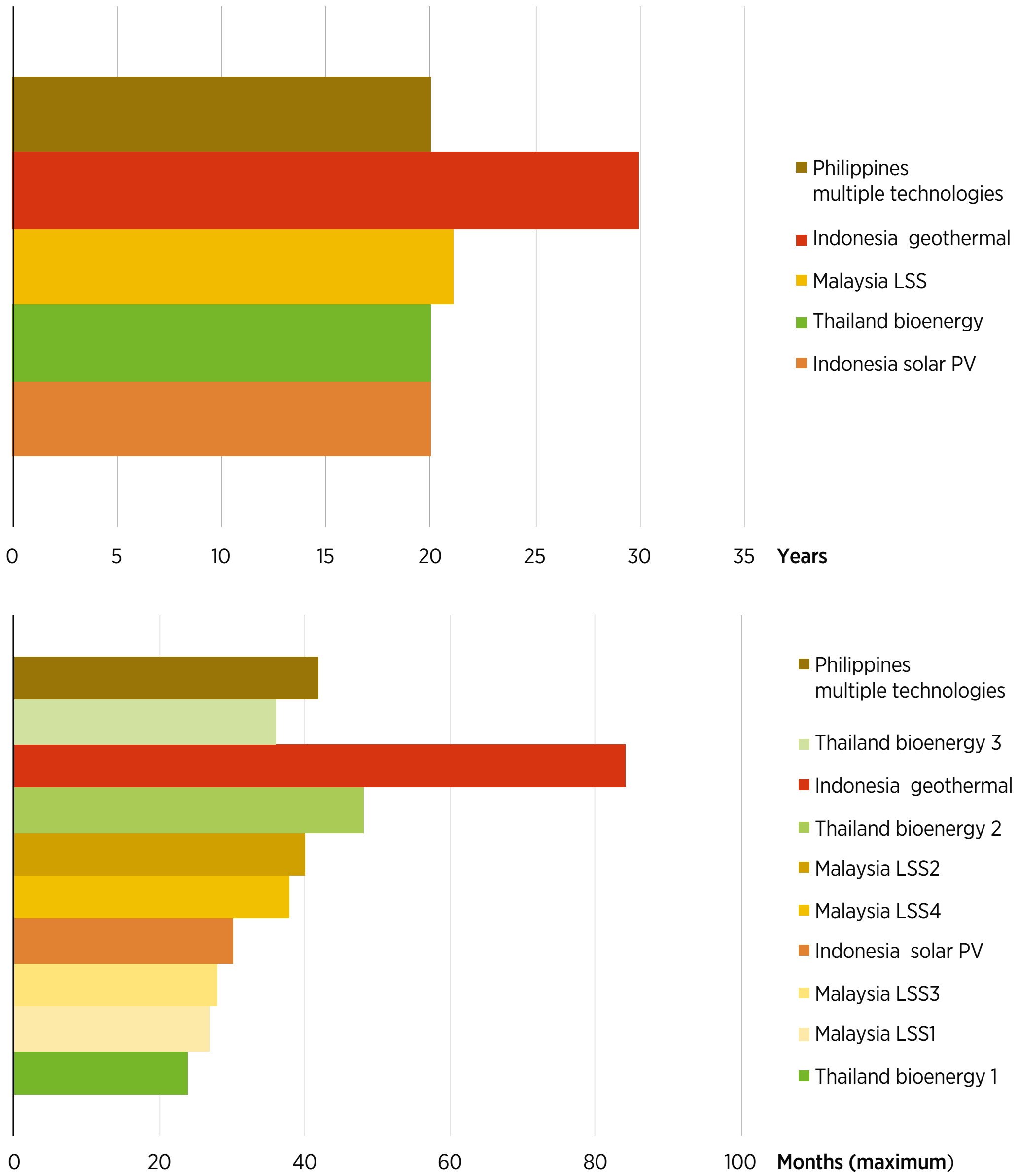
**Malaysia's** LSS PPAs have a duration of 21 years, but the lead time has changed from one auction to another. The first auction was held in September 2016 and the maximum COD was 31 December 2018 (a 27-month maximum lead time). The second auction was held in August 2017 with a COD limit of 31 December 2020 (a 40-month maximum lead time), while the third auction was held in August 2019 with a maximum date to start operation of 31 December 2021 (a 28-month maximum lead time). For the fourth auction, the limit was 31 December 2023 (about 38 months of maximum lead time).

In **Thailand**, contract duration has been 20 years. In the first auction, awarded projects had to sign a PPA with the PEA within 120 days of the winning bids being announced (USAID, 2017). In the second auction, with a different off-taker (EGAT), this period was longer: up to two years (ERC, 2017; ERC, 2018). Ultimately, the lead time of the first auction was about two years, given that the auction was held in 2016 and the limit to commence the operation was 31 December 2018. For the second auction, the lead time was between three and four years. Applications had to be lodged in October 2017 and the scheduled COD for each project was set between 1 January 2020 and 31 December 2021 (ERC, 2017). For the 'Energy for All' renewable energy auction, there was a maximum lead time of 36 months after the signature of the PPA (Mori Hamada and Matsumoto, 2021).

[29] *see MEMR Regulation No. 10/2017 (as amended by MEMR Regulation No. 49/2017 and No. 10/2018).*

In the **Philippines**, the contract duration from an auction has also been 20 years, with delivery commencement dates from between 26 December 2022 and 25 December 2025. If the auction was held in the first half of 2022, then the lead time varied depending on a date set at the discretion of the bidder, which mitigated COD risk (DOE, 2022b). It was expected that only existing projects, or almost built projects, would indicate close delivery dates.

FIGURE 5 Contract durations and lead times in Southeast Asian renewable energy auctions




Source: IRENA, 2022.

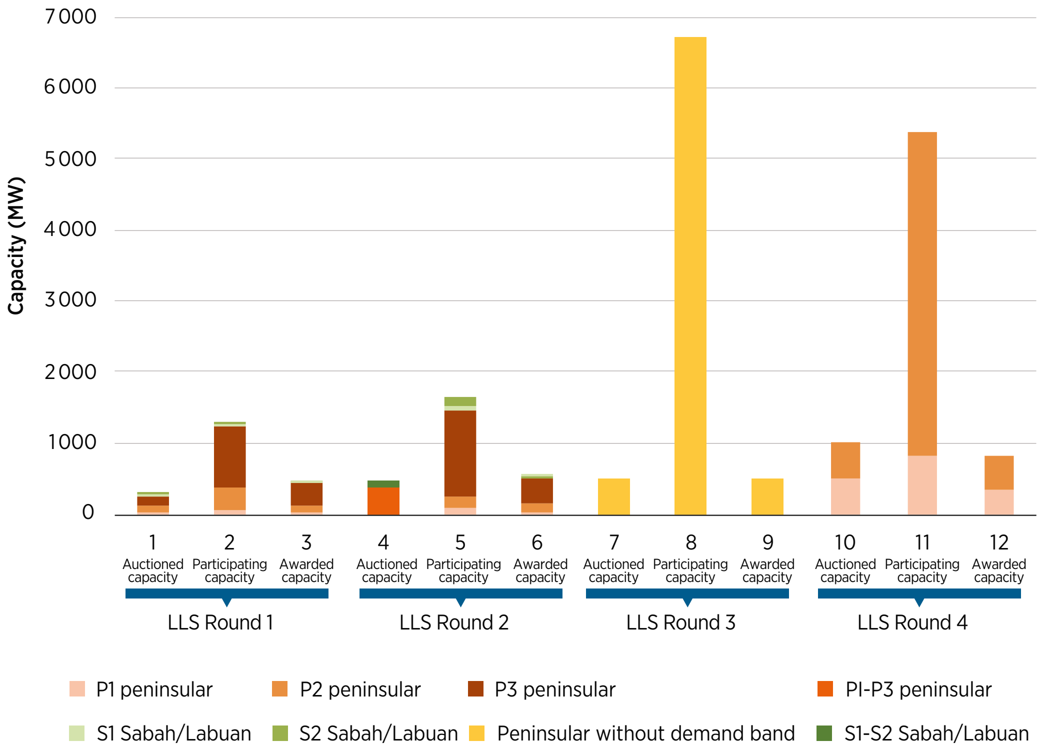
# 3 RENEWABLE ENERGY AUCTION RESULTS

Southeast Asian auctions have seen some diverse outcomes. Some have attracted great interest and awarded capacities beyond their targets. Others have attracted little interest and have even been cancelled.

## Malaysia

The four LSS rounds in Malaysia attracted a large number of participants, with 70, 116, 112 and 138 bids submitted, respectively. In each case, the total capacities bid (1 293 MW, 1 632 MW, 6 731 MW and 5 374 MW, respectively) exceeded the volumes auctioned (300 MW, 460 MW, 500 MW and 1 000 MW). As a result, the four rounds were oversubscribed and the auctioneer decided to award a different volume from that initially targeted. In the first two rounds, the volumes were increased to 451 MW and 562 MW, respectively, while in the third round, the volume awarded was slightly less (491 MW) than the capacity auctioned (500 MW), this was because despite the high participation rate, the auctioneer shortlisted only five bidders who met the requirements of the RFP (see Section 2.3). The fourth auction also awarded less capacity (823 MW) than auctioned (1 000 MW). That capacity was awarded in two demand bands: 323.06 MW in 20 bids for projects ranging from 10 MW to 30 MW in size and the rest in 10 projects with capacities between 30 MW and 50 MW. Because more volume was auctioned in the Peninsula than in Sabah/Labuan (see Section 2.1), it followed that more volume was awarded in the former region. That said, the number of participating bids across different project-size demand bands in the first two rounds was rather homogeneous, but ultimately, more bidders with larger projects were awarded in the Peninsula. This suggests that economies of scale do play a role in that region, but less so in Sabah/Labuan (Figures 6 and 7).

**FIGURE 6** Auctioned, participated and awarded capacity in Malaysian LSS




Sources: EC, 2016a; 2016b; 2016c; 2017a; 2017b; 2017c; 2019a; 2019b; 2021a; 2021b.

Regarding price, Malaysia does not disclose winning bids and thus there is no official (weighted) average awarded price, as is common in other auctions around the world. The bids of prices of prequalified participants are disclosed, however. The first round's bids ranged between MYR 0.39/kWh and MYR 0.65/kWh (USD 86/MWh and USD 144/MWh),[30] the second round's between MYR 0.339/kWh and MYR 0.53/kWh (USD 83/MWh and USD 130/MWh).[31] The third round saw bids range between MYR 0.178/kWh and MYR 0.3240/kWh (USD 43/MWh and USD 79.1/MWh),[32] reflecting a downward trend across these three rounds. These ranges were also lower than the administratively set FiT (Kenning, Malaysia's 460MW solar auction heavily over-subscribed, 2017). In the fourth round, the first demand band saw prices range from MYR 0.1850/kWh (USD 44.9/MWh)[33] to MYR 0.2481/kWh (USD 60.22/MWh), while for the second, they ranged from MYR 0.1768/kWh (USD 42.9/MWh) to MYR 0.1970/kWh (USD 47.8/MWh) (EC, 2021a).

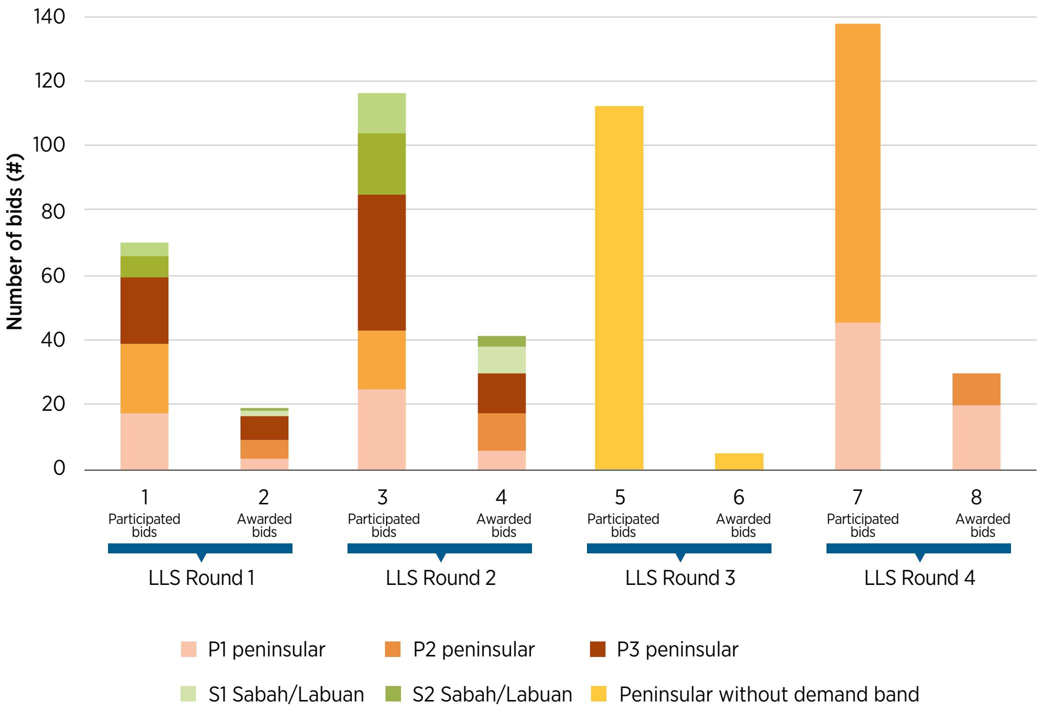
[30] *Note: 1 USD = MYR 4.50 in December 2016.*

[31] *Note: 1 USD = MYR 4.08 in December 2017.*

[32] *Note: 1 USD = MYR 4.10 in January 2020.*

[33] *Note: 1 USD = MYR 4.12 in March 2021.*

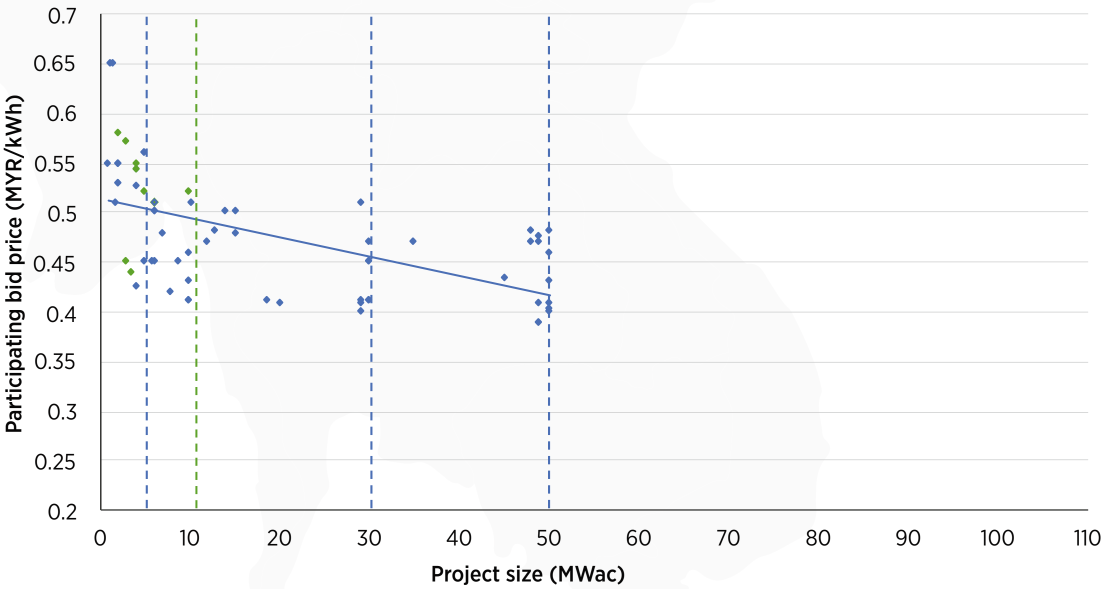
FIGURE 7 Participating and awarded bids in Malaysian LSS

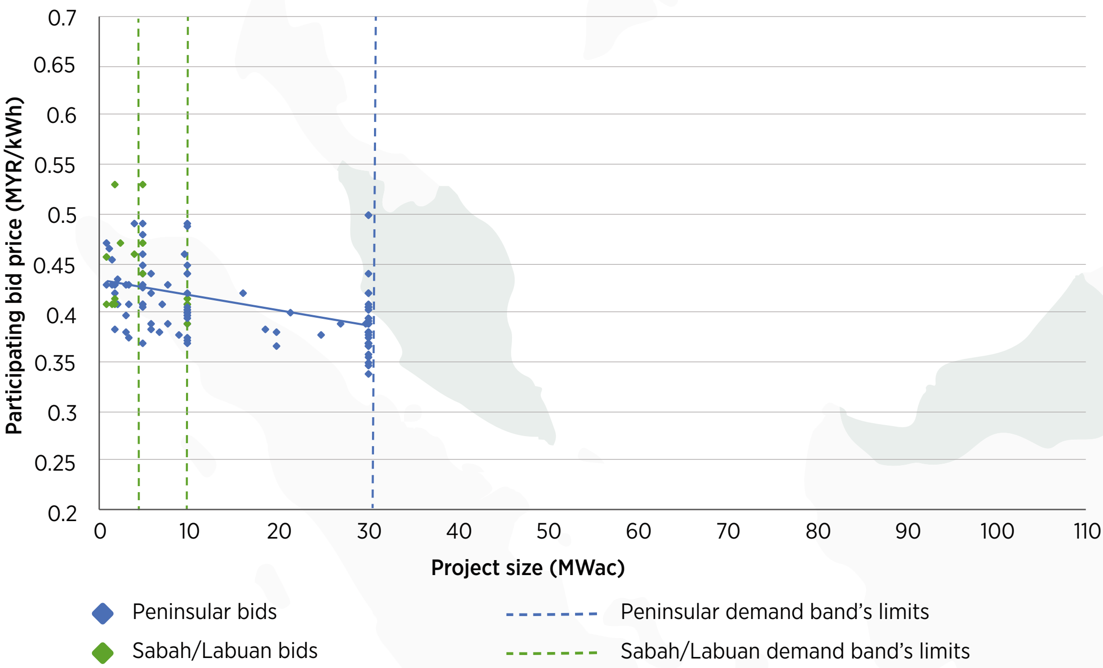


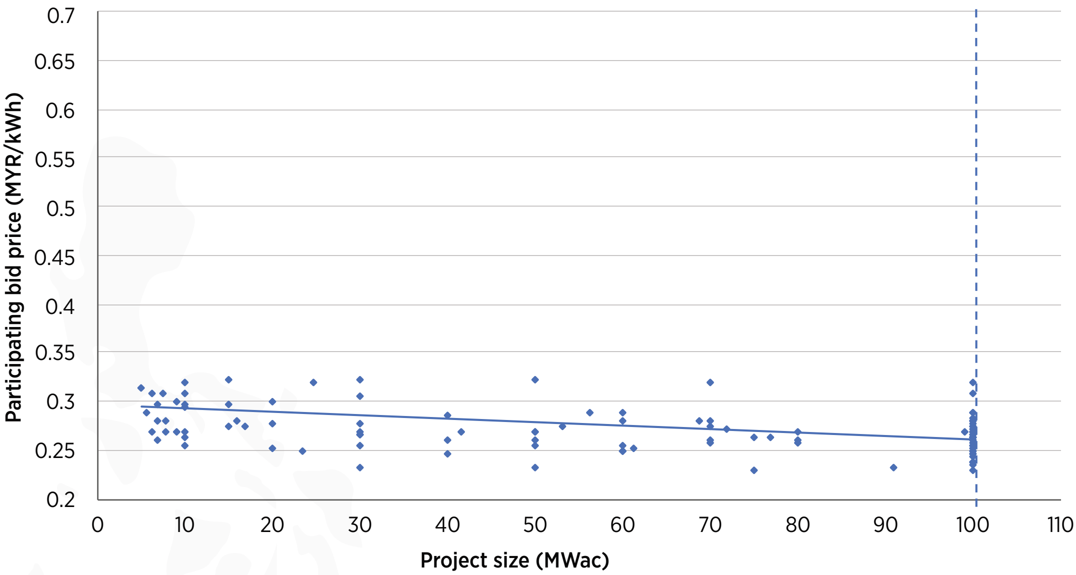

Sources: EC, 2016a; 2016b; 2016c; 2017a; 2017b; 2017c; 2019a; 2019b; 2021a; 2021b.

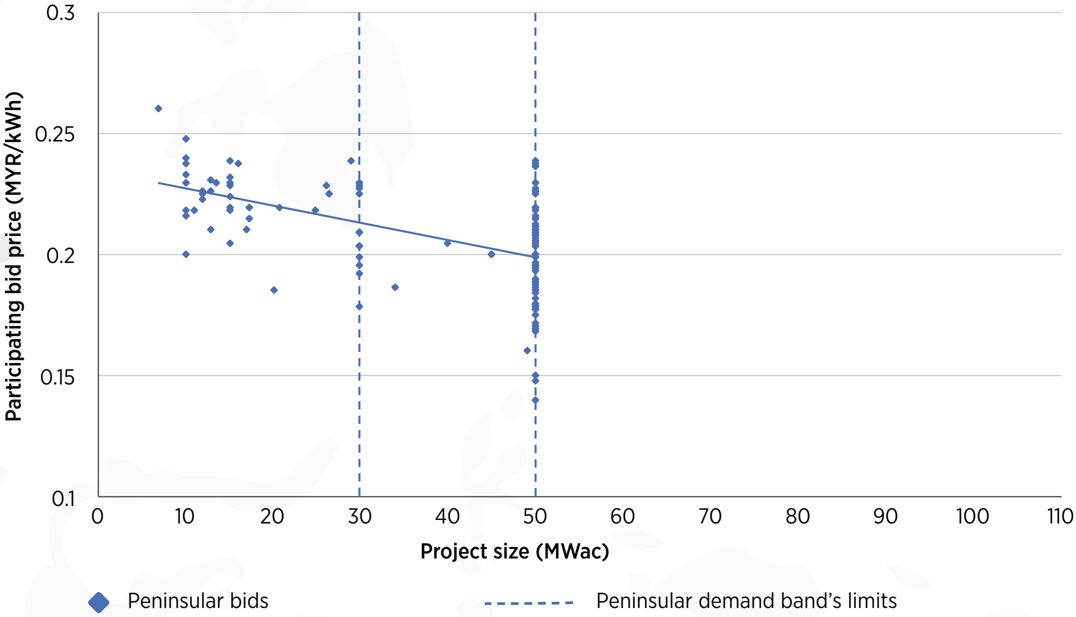
A deeper look at the bidding sheds light on the importance of economies of scale in Malaysia, with Figure 8 showing the project size and bid price of participating projects for each round. This demonstrates the role of such economies: the bigger the project, the lower the price. Moreover, the bids concentrate close to the different demand band limits (see Section 2.1), implying developers maximise their project size within a determined band. This was particularly true in the second auction, where 19 developers submitted bids for projects between 9 MW and 9.99 MW, so as to avoid competing in the next demand band that started at 10 MW. Similarly, while the third round's trendline is flatter, the concentration of bids at the project size upper limit in that round – 100 MW – can also be seen. In fact, all the awarded projects in the third round ranged between 90 MW and 100 MW.

FIGURE 8 Project size and bid price of participating projects in the four rounds of LSS






Sources: EC, 2016a; 2016b; 2016c; 2017a; 2017b; 2017c; 2019a; 2019b; 2021a; 2021b.

## Indonesia

Auctions in Indonesia have been less successful due to overlapping regulations, paired with frequent changes in the legal and regulatory framework for solar PV (Hamdi, 2019; Hamdi, 2020). Geothermal auctions are often postponed or cancelled due to the need for new studies or a lack of companies interested in the projects (PWC, 2018).

The solar PV auction scheme introduced in 2013 was cancelled in 2015 due to issues with local content requirements and premiums (see Section 2.2). The Indonesian Solar Module Association had filed a lawsuit against auctioneers, arguing that solar developers were not abiding by the local content rules. The result was the Indonesian Supreme Court ordering a roll back of solar PV auctions. In turn, investors argued that the local content criteria lacked clarity and were ineffective in attracting good project developers (Kenning, 2016). Up to then, seven solar PV auctions had been conducted, but only 15 MW had been awarded, with the schemes in the provinces of East Nusa Tenggara (five locations), Gorantalo (one location) and South Kalimantan (one location). The awarded prices ranged from USD 183.60/MWh to USD 250/MWh (Susanto, 2015).

In 2016, a new regulation on local content was issued for solar PV which gave a set of requirements from the Ministry of Industry (IRENA, 2018). Then, in June 2017, Indonesia held an auction to contract 168 MW of solar PV capacity in the Sumatra region. This attracted 116 bids from interested companies (Petrova, 2017). Due to concerns from PLN regarding grid reliability, however, the auction was cancelled. As a result, new plans for auctions now aim to procure solar PV projects more gradually, over the next ten years (Mulyana, 2019).

The insufficient (or completely absent) data regarding grid conditions has also raised concerns among bidders, who have reported a mismatch between the simulated grid capacity for auctions and the actual grid capacity.

Auction participants have also complained about the short preparation time available to upload a comprehensive package of bidding documents to the platform, with this period set at 14 days after the announcement of the auction. Other concerns include undefined grid connection points and caps for solar PV connections. Regarding the latter, the regulations set a limit of 20% of PLN's grid capacity, without providing exact data on the connection points (USAID, 2017).

The geothermal auctions have also faced a myriad of implementation problems. Fifteen geothermal auctions were announced between December 2015 and July 2020, but only three were awarded contracts. Thus, and despite having ambitious targets, Indonesia has not been able to maximise its investment potential for geothermal (PWC, 2018). In addition, when the auctioneer has identified a lack of interest early on, it has sometimes opted to postpone the auction – yet, in other cases when no bids have been received it has, nonetheless, gone ahead with the auction (see Table 8).

Table 8 Geothermal auctions in Indonesia

| Name | Area (hectares) | Possible reserves (MW) | Estimated reservoir temperature (OC) | Capacity MW | Commitment bond (IDR billions) | Max. bidding price in USD cents/ kWh | Auction date* | Target COD | Outcome | Winning price in USD/ MWh |
|---|---|---|---|---|---|---|---|---|---|---|
| **Danau Ranau** | 8 561 | 210 | 200 | 110 | 2.00 | 14.60 | June 2015 | 2022 | Auction postponed | |
| **Danau Ranau** | 8 561 | 210 | 200 | 55 | 1.00 | 14.60 | Nov. 2015 | 2022 | Auction postponed | |
| **Gunung Lawu** | 60 030 | 195 | 250 | 165 | 2.00 | 14.60 | Feb. 2016 | 2022 | PT Pertamina (Persero) | 100 |
| **Way Ratai** | 70 710 | 105 | 221 | 55 | 1.50 | 14.60 | Jul. 2016 | 2022 | Konsorsium PT Optima Nusantara Energi dan Enel Green Power S.p.A. | 130 |
| **Gunung Talang-Bukit Kili** | 27 000 | 65 | 227 | 20 | 1.00 | 14.60 | Oct. 2016 | 2022 | Konsorsium PT Hitay Daya Energy dan PT Dyfco Energy | 127.5 |
| **Marana** | 48 300 | 36 | 160 | 20 | 1.00 | 21.30 | Apr. 2016 | 2022 | No interest | |
| **Gunung Willis** | 20 840 | 50 | 200 | 2 x 10 | 1.00 | 15.90 | Sep. 2016 | 2025 | No interest | |

| Name | Area (hectares) | Possible reserves (MW) | Estimated reservoir temperature (OC) | Capacity MW | Commitment bond (IDR billions) | Max. bidding price in USD cents/ kWh | Auction date* | Target COD | Outcome | Winning price in USD/ MWh |
|---|---|---|---|---|---|---|---|---|---|---|
| **Gunung Galunggung** | 57 330 | 160 | 250-300 | 110 | 2.00 | 15.50 | Sep. 2016 | 2024 | No interest | |
| **Gunung Hamiding** | 42 100 | 265 | 250-300 | 20 | 1.00 | 22.60 | Nov. 2016 | 2024 | Auction postponed | |
| **Graho Nyabu** | 109 000 | 200 | 236º C | 110 | 2.00 | 15.90 | Sep. 2016 | 2025 | Auction postponed | |
| **Simbolon Samosir** | 168 800 | 150 | 240 ºC | 110 | 2.00 | 15.50 | Dec 2016 | 2024 | Auction postponed | |
| **Gunung Ciremai** | 38 560 | 150 | 210º C | 110 | 2.00 | 15.90 | Nov. 2016 | 2025 | No interest | |
| **Lainea** | 15 620 | 66 | 200º C | 2 x 10 | 1.00 | | Nov. 2019 | N/D | Auction postponed | |
| **Gunung Wilis** | 20840 | 50 | 200º C | 2 x 10 | 1.00 | | Nov. 2019 | N/D | Auction postponed | |
| **Gunung Galunggung** | 57330 | 130 | 225º C | 55 | 2.00 | | Nov. 2019 | N/D | Auction postponed | |

** Auction date means the day the result was announced for awarded geothermal projects, while for other projects it is the announcement day.*

Source: MEMR, 2020b.

The last three auctions in 2019, namely the projects of Lainea, Guinung Wilis and Gunung Galunggung, were delayed because of a need to re-evaluate data, reform regulations and reassess the impact of the COVID-19 pandemic. It is worth noting that Guinung Wilis and Gunung Galunggung were announced as being auctioned in 2016, but no company showed any interest in these projects at that time.

Ultimately, as with solar PV auctions, geothermal auctions have presented organisational and design problems, especially regarding the bidding procedures and the availability of information at the time of the auction (ADB and the World Bank, 2015).

These shortcomings include poor pre-qualification standards and bid bonds that were initially too small and may have encouraged inexperienced bidders to underbid. Information shortfalls included tariff schedules for PPAs, which derived in negotiation after the auctions took place. They also included unreliable data on the geothermal resource potential, which constrained bidders from calculating reliable cost estimates. In many tenders there was only one bidder who passed the first stage in the two-envelope system, converting the process into a direct appointment, instead of an auction. These cases are defined as "failed tenders" in Indonesia's auction rules (USAID, 2017).

## Thailand

Thailand's bioenergy auctions have had several different outcomes. For the 10 MW biogas demand band in the first auction, only three projects were awarded, with a total capacity of 5.95 MW. The (weighted) average price was USD 124.99/MWh for years 1 to 8 and USD 109.84/MWh for years 9 to 20. The (weighted) average price reduction from the FiT cap was around 17% (see Table 9).

**TABLE 9** Results of Thailand's first biogas auction

| | Capacity (MW) | Discount from FiT (%) | Year 1-8 price (USD/MWh) | Year 9-20 price (USD/MWh) |
|---|---|---|---|---|
| | 3.00 | 23.33 | 117.6 | 102.4 |
| | 2.00 | 10.25 | 132.4 | 117.3 |
| | 0.95 | 10.05 | 132.7 | 117.6 |
| Weighted average | | 16.8 | 124.99 | 109.84 |

Source: ERC, 2018.

Ultimately, competition for this demand band was low. The regulator, the Office of the Energy Regulation Commission (OERC), stated that among the reasons for this was the claim that developers found it burdensome to comply with the strict technical requirements (*e.g.* proof of land rights, building permits and licenses, and the safety and interconnection standards). These requirements did not only impose high transaction costs, but also made it difficult to pass the pre-qualification stage, thus limiting competition at the bidding stage.

In addition, political and regulatory risks in the three southern provinces of Thailand might be another underlying reason for the limited number of bidders. These factors may have exacerbated difficulties in attracting project financing (*e.g.* a high cost of capital due to high risks and uncertainties) and obtaining the supporting documents from financial institutions (*e.g.* a high insurance required to get loans to finance the project). This may have been particularly burdensome for very small power producers (USAID, 2017).

On the other hand, the demand band for biomass saw higher participation rates, greater competition, higher FiT discounts and met the capacity target. For the 36 MW auctioned, a total of 593.5 MW was received from 89 bids. Out of these, 28 projects passed the pre-qualification stage, adding up to a total capacity of 240.8 MW. Applicants that did not pass the pre-qualification round could appeal, however, and 35 did so. Almost half of them (16) were then allowed to proceed to the bid evaluation stage after having been re-evaluated. In the end, 44 projects were pre-qualified for a total of 338.3 MW – more than nine times the capacity target set for the biomass auction. Four bids, with a total contracted volume of 36 MW, were selected as winners in August 2016.

The winners offered a discount to the fixed FiT within the 67.78% to 81.17% range (see Table 10). These high discount rates suggest that the OERC might have set its fixed FiT for biomass too high (*i.e.* the price did not reflect the true cost of the biomass power). Alternatively, the winners might also have underestimated the cost of biomass power – a phenomenon also known as the 'winner's curse'.

**TABLE 10** **Results of Thailand's first biomass auction**

<table>
<tr><th></th><th>Capacity (MW)</th><th>Discount from FiT (%)</th><th>Year 1-8 price (USD/MWh)</th><th>Year 9-20 price (USD/MWh)</th></tr>
<tr><td rowspan="5">Weighted average</td><td>9.90</td><td>81.17</td><td>93.9</td><td>84.8</td></tr>
<tr><td>9.90</td><td>81.17</td><td>93.9</td><td>84.8</td></tr>
<tr><td>9.90</td><td>77.19</td><td>97.0</td><td>87.9</td></tr>
<tr><td>6.30</td><td>67.78</td><td>103.6</td><td>94.5</td></tr>
<tr><td></td><td>77.73</td><td>96.45</td><td>87.35</td></tr>
</table>

Source: ERC, 2018.

The second auction, which was hybrid (see Section 2.1), was also competitive. For the 300 MW auctioned, the auctioneer received 85 proposals, totalling 1 644.25 MW. Out of those, 42 proposals were technically qualified, representing 755 MW. In the end, 17 proposals were awarded, fulfilling the 300 MW demand at an average price of USD 73.62/MWh. Biomass was awarded the largest capacity (258.69 MW), followed by biogas and solar (16 MW), biomass and solar (13.31 MW) and solar with an energy storage system (ESS) (12 MW). No project was awarded in the Bangkok-metro, Samui or Phuket regions (see Table 11).

TABLE 11 Results of Thailand's second auction

| | Region | Technology | Capacity (MW) | Discount from FiT (%) | Price (USD/MWh) |
|---|---|---|---|---|---|
| Weighted average | North Eastern | Biomass | 27.00 | 99.99 | 56.1 |
| | North Eastern | Biomass | 13.84 | 99.99 | 56.1 |
| | North Eastern | Biomass | 16.00 | 81.19 | 66.4 |
| | Western | Biomass | 16.00 | 81.19 | 66.4 |
| | Southern | Biomass | 21.50 | 81.41 | 66.4 |
| | Southern | Biomass | 21.50 | 81.41 | 66.4 |
| | Southern | Biomass | 24.00 | 81.19 | 66.4 |
| | Southern | Biomass | 20.00 | 80.85 | 66.7 |
| | North Eastern | Biomass | 16.00 | 79.56 | 67.3 |
| | Southern | Biomass | 13.85 | 71.19 | 71.8 |
| | North Eastern | Biomass | 11.29 | 70 | 72.4 |
| | Central | Solar PV and storage | 12.00 | 62 | 77.0 |
| | Northern | Biomass and solar | 13.31 | 51.03 | 83.0 |
| | Northern | Biomass | 13.29 | 43.65 | 87.0 |
| | Eastern | Biogas and solar | 16.00 | 43.12 | 87.3 |
| | Northern | Biomass | 21.00 | 27.07 | 96.1 |
| | Northern | Biomass | 23.42 | 15.60 | 102.4 |
| | | | | 68.08 | 73.62 |

Source: ERC, 2018.

The Community-Based renewable energy auction awarded approximately 150 MW, to be produced in equal amounts from biomass and biogas resources. There were 43 selected bids, comprising 16 biomass power projects and 27 biogas power projects (see Table 12) (Mori Hamada and Matsumoto, 2021).

**TABLE 12** Results of Thailand's 'Energy for All' auction

| Community-based power projects | No. of selected bidders | MW |
|---|---|---|
| Northern Region | | |
| Biomass | 2 | 7.75 |
| Biogas | 9 | 24.00 |
| Central Region | | |
| Biomass | 2 | 12.00 |
| Biogas | 5 | 15.00 |
| North-Eastern Region | | |
| Biomass | 6 | 29.40 |
| Biogas | 7 | 20.00 |
| Western Region | | |
| Biomass | 1 | 6.00 |
| Biogas | 2 | 5.00 |
| Southern Region | | |
| Biomass | 5 | 19.85 |
| Biogas | 4 | 10.50 |
| Total | 43 | 149.50 |

Source: Mori Hamada and Matsumoto, 2021.

The Thai 'Energy for All' scheme is a positive move towards Thailand's commitment to move from fossil fuel energy sources to renewables. It sets a goal of 30% of power, heat and biofuel coming from renewables (including imported hydropower) by 2037. In addition, the launch of the above pilot project for 150 MW sets the stage for additional auctions (Mori Hamada & Matsumoto, 2021). However, the COVID-19 pandemic has since caused difficulties with the scheme's implementation (Praiwan, 2022).

## The Philippines

The Philippines had two private renewable energy auctions in 2018: a solar auction that awarded 50 MW and an onshore wind auction that awarded 150 MW. Then, in 2022, the Philippines had its first auction round under the Green Energy Auction Programme (GEAP). This saw 2 GW of renewables auctioned, divided by demand band (technology and region). In this, 19 proposals were awarded, almost fulfilling the 2 GW target. Solar was awarded the largest capacity, at 1 490.38 MW and an average price of USD 67.10/MWh, followed by onshore wind, with 374 MW and an average price of USD 85.40/MWh. Small hydro came next, at 99.15 MW and an average price of USD 102/MWh, while biomass saw 3.40 MW at an average price of USD 94.60/MWh (see Table 13) (DOE, 2022a).

**TABLE 13** Results of the Philippines' first GEAP auction

| Technology | Awarded capacity (MW) | Price (USD/MWh) |
|---|---|---|
| **Solar** | 1 490.38 | 67.10 |
| **Onshore wind** | 374 | 85.40 |
| **Small hydro** | 99.15 | 102 |
| **Biomass** | 3.40 | 94.60 |

Source: DOE, 2022a.

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# 4 CONCLUSIONS

Renewable energy auctions are becoming a popular instrument for the deployment of renewables around the world, and Southeast Asia is no exception. Even within the same region, however, the context and starting point for the design of auctions in each country is different. In addition, among the countries analysed, not only have some of their design elements been different, but their outcomes have also varied greatly.

Currently, no Southeast Asian country has a regular or predictable schedule for auctions in place. Yet, systematic auctions not only attract a larger number of players, but also help advance the penetration of renewables by decreasing developer's risks (IRENA and CEM, 2015). Such a programme can also have a positive effect on the cost of equity, the cost of debt and debt terms (Đukan and Kitzing, 2021).

The Southeast Asian experience shows that the success of auctions greatly depends on clear, transparent and accessible information regarding auction documentation and bidding procedures. They also demonstrate that, when setting qualification requirements, finding a balance between screening out bidders that may underperform and attracting enough players for the process to benefit from competition is no easy task. If too strict, as in Thailand's first auction, participation rates may be hurt by developers finding it burdensome to comply with the requirements. Indeed, strict requirements impose high transaction costs; they can also make qualifying for the auction – when developers decide to take part in it – extremely difficult. On the other hand, poor pre-qualification standards or bid bonds that are too small may encourage inexperienced and/or unqualified bidders to enter the auction, as seen in Indonesia's geothermal experience.

LCRs can be introduced as requirements for participating in the auction, or as one of the criteria for the selection of winners (IRENA, 2019a). They can also be important industrial policy tools to support the development of a nascent domestic renewable energy industry, albeit often at a higher price, at least at initial stages. In the absence of measures to support building local capacities, however, LCRs can result in reduced competition, bottlenecks, more expensive and less efficient inputs, higher prices for end users, and an increased number of incomplete projects (IRENA, 2019b; del Río, 2017; Leigland & Eberhard, 2018). Therefore, LCRs often raise a legal concern (IRENA, 2019a). In Southeast Asia, LCRs have been implemented without backlash in Malaysia, but they have been controversial in Indonesia, to the point where solar PV auctions have been cancelled.

Lastly, regarding auction design, risk allocation among an auction's stakeholders – developers, utilities and policy makers – varies from country to country, technology to technology and from auction to auction to accommodate specific challenges and learning curves. Auctions in Singapore have also proved that land limitations can be surpassed by auction design, with auctions run for solar PV rooftop and floating solar PV projects.

Regarding outcomes, when analysed by volumes, Malaysia's auctions were successful at attracting bidders and awarding contracts, while Indonesia's were less successful. Thailand awarded capacities close to their targets, as did the Philippines, despite the lack of data to analyse. A regional price comparison, however, may be misleading. For one, Malaysia did not disclose awarded prices, while Thailand's prices are a discount from the FiT and Indonesia's auctions have not been competitive, with the price discovery attributes of auctions thus compromised.

In any case, renewable energy auctions are increasingly being used around the world to achieve objectives beyond price, including timely project completion, the integration of variable renewable energy, and in supporting a just and inclusive energy transition (IRENA, 2019a). These attributes can and should play an important role in future renewable energy auctions in Southeast Asia.

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