Renewable Energy Certificates (RECs) in Six APEC Southeast Asia Economies

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Authors (in alphabetical orders)**:**

Ario JATI (Indonesia) ario.jati@aperc.or.jp
Asmayati AB MANAN (Malaysia) asmayati.manan@aperc.or.jp
Thanan MARUKATAT (Thailand) thanan.marukatat@aperc.or.jp
Nabih MATUSSIN (Brunei Darussalam) nabih.matussin@aperc.or.jp
Quoc Huy PHUNG (Viet Nam) huy.phung@aperc.or.jp

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Produced by:
Asia Pacific Energy Research Centre (APERC)
Inui Building, Kachidoki 11F, 1-13-1 Kachidoki
Chuo-ku, Tokyo, 104-0054, JAPAN
Telephone : (81) 3 5144 8551
Fax : (81) 3 5144 8555
Email : master@aperc.or.jp
Website : https://aperc.or.jp

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Executive Summary

Renewable Energy Certificates, or RECs, are market-based instruments that represent the property of non-power attributes of renewable electricity generation. RECs are considered one form of Energy Attribute Certificates or EACs. RECs have been widely accepted internationally as evidence of renewable electricity generation and consumption. In general, one REC represents 1 MWh of renewable electricity generated.

The concept of RECs was first introduced in the US in 1987, followed by the first trading of RECs in California in 1995. In more advanced markets, RECs serve as an important and effective tool to promote renewable energy investment beyond what is achieved through the implementation of compulsory programs such as the renewable portfolio standard (RPS) in the United States or the renewable energy target (RET) in Australia. In Japan, other forms of certificates are used for different purposes. For instance, the Green Energy Certificates (GECs) are used for the purpose of trading environmental values of renewable energy. In addition to the increasing demand for RECs from large-scale utilities to fulfill compulsory requirements, there is an increasing demand for RECs from renewable electricity consumers in the voluntary market who wish to achieve renewable energy (RE) targets, such as companies participating in the RE100 program as well as individual households. The size of RECs trading in advanced markets is substantial. In the US, 550 million RECs were traded in 2020 at a price of 10-250 USD/REC depending on market location and type of REC. In Australia, 46 million RECs were traded in 2022 at a price of 40-65 AUD/REC.

For the six Asia Pacific Economic Cooperation (APEC) southeast Asia economies, RECs began trading as early as 2015, primarily to serve increasing demand from commercial users for renewable electricity in voluntary markets. Currently there is no compulsory RE requirement in these economies. By the end of 2021, there were 12 883 MW of RE generation capacity registered for RECs eligibility, three quarters of which were hydro and solar generators, followed by biomass, wind, and thermal. The total cumulative number of issued RECs from 2015-2021 was 29 million, with 8.3 million RECs issued in 2021 alone. With market mechanisms of RECs in place, demand for RECs in southeast Asia economies is expected to increase substantially, driven largely by the need from voluntary commercial users to achieve RE commitments, mostly by 2030-2035. Despite increasing demand of RECs, southeast Asia economies, with the exception of Malaysia, currently rely on the market systems and procedures of private service providers of RECs. Malaysia developed its own RECs market platform and specific RECs framework in 2020. Specific legislation governing and/or departments regulating RECs markets are not yet in place in southeast Asia economies but are currently under development.

In order to further develop sustainable and efficient RECs markets, it is recommended that dedicated legislation and regulatory unit(s) should first be established in each APEC southeast Asia economy to regulate and set the direction for the RECs market. As seen from the examples of this report, well-design RECs markets can serve as an effective market-based mechanism to promote investment in renewable electricity in order to achieve renewable and decarbonisation targets, and at the same time to lessen the burden of government to incentivize RE investors. Additionally, coexistent compliance and voluntary RECs markets can accelerate RE investments but a combined approach requires careful balancing of costs and benefits. The 'additionality criterion' of RECs and the use of RECs as a financial instrument can also help promote new RE investment. Harmonization of RECs attributes among six APEC southeast Asia economies is important to ensure accounting and integrity of RECs in the region. Furthermore, RECs markets in the six APEC southeast Asia economies could potentially be integrated to become a large and complex regional market to encourage integrated renewable energy investment and allow economies to benefit from the diverse and untapped renewable resources in the region in conjunction with plans for the expansion of a regional transmission grid. However, it is recommended that southeast Asia economies study and evaluate this potential before moving forward on such a program.

Introduction

A REC represents attributes of electricity generated from a renewable energy sources and is considered to be one form of Energy Attribute Certificates (EACs). As for RECs, the energy attributes are either bundled or unbundled from the physical electricity, and the two products—the attributes embodied in the certificates and the commodity electricity—may be traded separately. RECs are quickly becoming the currency of renewable energy markets, primarily because of their flexibility and the fact that they are not subject to the geographic and physical limitations of commodity electricity. RECs are currently used by utilities and marketers to supply renewable energy products to end-use customers as well as to demonstrate compliance with regulatory requirements, such as renewable energy mandates. For this reason, RECs have become widely accepted globally and demand for them is increasing rapidly.

In APEC southeast Asia economies in particular, RECs systems and RECs markets began as early as 2015. The demand for RECs in the region has been growing significantly due to the needs of multinational and local companies aiming to comply with their voluntary renewable energy consumption targets.

The purpose of this report is to describe and analyse the emerging RECs markets in APEC's six southeast Asia economies, namely Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam, and to present the authors' perspectives on factors leading to successful implementation of RECs. This report provides an examination of RECs markets, describes how RECs are marketed, and describes the key challenges inhibiting further growth in these markets. The report also examines mature RECs markets in selected APEC economies to learn from their success and remaining challenges.

Section 1 contains a brief history of the development of RECs. Section 2 provides additional background on RECs in four APEC well-developed RECs markets, namely the US, Japan, China, and Australia. Section 3 presents the status of RECs markets in APEC six southeast Asia economies. Section 4 describes the development and challenges of the RECs markets in the six APEC southeast Asia economies and presents issues for consideration for future development of RECs.

Note: *Data used for analysis and presentation in this report were obtained from I-RECs and TIGR[1] Reports in July 2022 and September 2022, respectively. Data do not include registration or RECs with other agents, transactions of RECs made directly between generators and buyers of RECs, or RECs procured from outside the identified APEC economies.*

[1] I-RECs refers to International RECs Standard Foundation https://www.irecstandard.org/. TIGR refers to Tradeable Instrument for Global Renewables tracking and reporting system under APX Company https://apx.com/tigr-documents-and-reports/.

Section 1

Background: Renewable Energy Certificates (RECs)

Background: Renewable Energy Certificates (RECs)

- RECs are one of various forms of energy attribute certificates (EACs). RECs, as well as other forms of EACs, are market-based instruments and tradable commodities that represent the environmental and other non-power attributes of renewable electricity.
- The US is one of leading countries to initiate the RECs system and RECs markets to promote RE. The first trading of RECs started in California in 1995 under jurisdiction of the Public Utility Act (1978)[1].
- A REC is measured in megawatt hours (MWh) at the point of generation as the electricity flows into the grid. Typically, each REC represents one MWh of generated electricity.
- Each Certificates has standardised information. It bears a unique number, and contains several elements, including the renewable energy source, facility identification, facility name, facility nameplate capacity, date of generation, and issuance date.
- In general, there are two types of REC markets, the compliance market and the voluntary market
    - The compliance market is where the utilities are required to meet a certain target of RE electricity generation. For example, in the US RECs can be used to comply with a mandated Renewable Portfolio Standard (RPS), which requires utilities to produce a minimum share of electricity generation from renewable sources.
    - The voluntary market is where business firms set voluntary targets to use a certain amount of RE electricity. One example is the RE100, which is a forum where global leading companies announce their RE targets. In order to achieve these targets, RECs are an important tool to certify RE consumption.
    - There is also an increasing voluntary market where individual residentials choose to consume RE electricity, for example in the US and Australia.
- Two types of RECs are available in the market: bundled and unbundled.
    - Bundled RECs: RECs are sold together with associated renewable electricity.
    - Unbundled RECs: RECs are purchased separately from the renewable electricity.
- The flexibility of unbundled RECs strengthens the renewable energy market as consumers can purchase renewable electricity from any electricity provider at any time but does raise potential concerns about double counting and the legitimacy of claims of RE consumption and production.
- Electricity customers can use RECs to certify their efforts to reduce their Scope-2 CO2 and other GHG emissions, which are the emissions produced as a by-product of the generation of electricity that they purchase from a third-party provider.
- RECs cannot be used to reduce Scope-1 or Scope-3 emissions, which are the direct emissions of the electricity purchaser or the emissions of the purchaser's customers, respectively.

Figure 1.1: Sample of issued REC

Note: [1] Green Power Market, US EPA Renewable Energy Certificates (RECs) | US EPA

Overview of the RECs Process

- The general REC mechanism starts when a renewable power plant registers its generation facility with the issuing organization.
- Upon generating the electricity, the power plant owner informs the REC issuer. The issuer then issues the RECs specifically for the generated amount in its tracking system. The RECs are then eligible to be acquired and transferred toa buyer, which could be the consumer of the generated RE or any buyer in the RECs market.
- The custodian of the final transaction of RECs claims the renewable attributes in the RECs tracking system. The RECs are then retired and recorded upon redemption.
- Being one of the internationally-recognized instruments to claim RE in meeting decarbonisation targets, RECs are usually governed by authorized bodies both at local and international level in order to ensure the attributes of the RE generated and claimed.
- The owner of RECs can claim the RE credits only on direct electricity consumption, so called Scope-2, to comply with the desired volume of RE electricity, such as the RE-100 target.
- A third-party auditor monitors the RE generator to reconcile the amount of renewable electricity generation and the number of RECs credited to the facility.

Figure 1.2: Mechanism of RECs

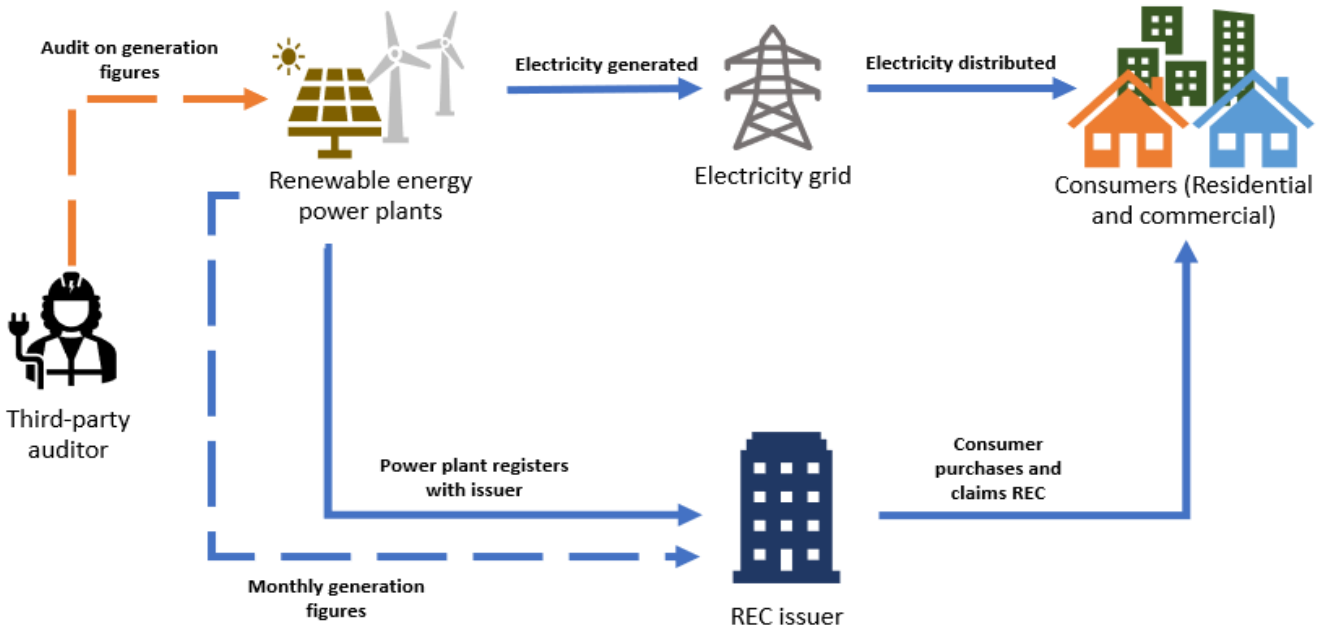
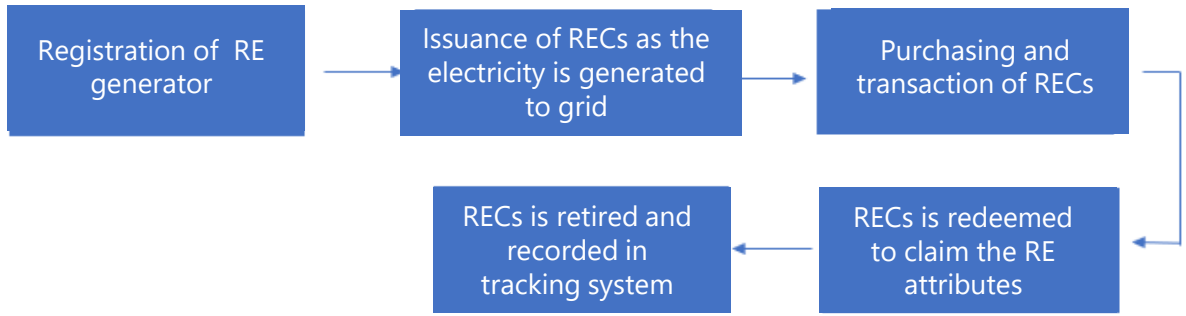


Figure 1.3: Process of RECs



Section 2

Energy Attribute Certificates (EACs) in Four Advanced APEC Economies

Overview of Energy Attribute Certificates (EACs) in four advanced APEC economies

- In the selected APEC advanced economies, many different energy attributed certificates are currently employed as instruments to support for reduction of GHG emissions, and REC being one of them. Each system is designed to meet specific purpose. For example, J-Credit system used in Japan is developed by the Japanese government to promote GHG emission reduction by using of renewables, energy efficiency, fuel not specific to RE switching, carbon sinks by forestry, and others, similar to the Clean Development Mechanism (CDM) under UN Framework Convention on Climate Change (UNFCCC).
- Due to the differences of the RE credit and certificate systems used in each economy, different trading and reporting platforms are used to facilitate the transaction. There are, for example, five different online platforms in the US[1] to verify and keep track of RE instruments, plus other manual platforms in some states.
- Challenges of the advanced economies on the different RE credit and certificates systems are mainly on the information of attributes attached to each system, which are not always standardised and, in some cases, not adequate for verification of renewable attributes. Japan's NFC, for example, does not have the attribute information[2]. The only information attached to the certificates is whether the electricity is supplied under FiT or Non-FiT, and whether it is derived from renewable energy or not.
- Another challenge is the linkage of claims of certificates with other carbon trading systems. For example, owners of China's Green Electricity Certificate (GEC), due to the existence of the emission cap-and-trade system (ETS), might not be able to claim for avoided GHG emissions associated with their renewable energy consumption.
- Most of the current RE credit/certificate systems in advanced economies are under review process to support the growing demands, especially from private companies to achieve their 100% renewable targets.
- The understanding of EACs/RECs in advanced economies helps the southeast Asia economies to develop their REC markets more effectively and sustainably.
- According to RECs guidelines from USEPA, RECs should contain at least the following attributes[3]:
  - Certificate data and type
  - Tracking system ID
  - Renewable fuel type
  - Renewable facility location
  - Nameplate capacity of project
  - Project name of power generation
  - Project vintage (build date)
  - Certificate (generation) vintage
  - Certificate unique identification number
  - Utility to which project is interconnected
  - Emissions rate of the renewable resource

Table 2.1: Types of EACs and RECs available in selected APEC advanced economies

Selected Economy	Type of EACs/RECs
United States	RECs, Green Tag, RE Credit, Tradable Renewable Certificates (TRC)
Japan	Non-Fossil Certificates (NFC), Green Electricity Certificates (GEC), J-Credits, and RECs (by I-RECs)
China	Green Electricity Certificates (GEC), and RECs (by I-RECs)
Australia	Large-scale generation certificates (LGCs), small-scale technology certificates (STCs)

Notes:

[1] Status and Trends in the US voluntary market (2020 data), NREL, September 2021

[2] Electricity Certificates for Renewables: Comparison of Japanese and International Systems, Renewable energy Institute, April 2022

[3] Renewable Energy Certificates (RECs), Unites States Environmental Protection Agency, https://www.epa.gov/green-power-markets/renewable-energy-Certificatess-RECss#one

RECs in the United States Green Power Market

Development of RECs market

- The United States (US) is one of leading countries to initiate the certificates and credit systems to promote renewable energy.
- The Public Utility Act (1978) opened opportunity for power market as well as invention of Investment Tax Credit (ITC) mechanism to promote renewable energy, followed by first state requirement of renewable generation in 1983 (Iowa) and subsequently other tax credits such as Production Tax Credit (PTC) for wind in 1992.
- In 1995 the first trading of RECs was mentioned in California, followed by a launch of voluntary renewables certificate Green-e in 1997 as bundled certificates.
- The green power market was first launched in California in 1998 by APX, followed by the first REC product sold by All Energy Company in Massachusetts in the same year.
- Demands for RECs in the US are from two main markets. The compliance markets are utilities and electricity wholesale and retail companies, so called Load-Serving Entities (LSE), that have obligation to meet state's Renewable Portfolio Standards (RPS) requirements. The voluntary markets are those in which institutions or consumers purchase renewable energy to meet their voluntary needs.

Estimated size of RECs market

- The US National Renewable Energy Laboratory (NREL) estimated the size of RECs demand in 2020 at 550 TWh (million RECs), 358 TWh from Compliance market (65%), and 192 TWh from Voluntary market (35%)[1]. (Figure 2.1)
- Of the total 192 million RECs of voluntary market, the unbundled RECs were most popular with 86.4 million RECs sold in 2020, followed by direct power purchase agreements (PPAs) of 51.8 million RECs. There were 7.5 millions market participants in the voluntary market in the US in 2020 (Table 2.2).

Management of RECs market

- In the US, RECs markets are regulated under Federal Energy Regulatory Commission (FERC) and Federal Trade Commission (FTC) at federal level, as well as under state regulatory level such as state Public Utilities Commissions (PUC). The Department of Energy (DoE) and the Environmental Protection Agency (USEPA) with their designated agencies play key supporting roles in RECs markets.

Market price of RECs

- Price of RECs in the US voluntary market at the end of 2018 was 0.7 USD/MWh, with an increasing trend to reflect higher demand from household consumers. For the compliance market the prices vary by states to reflect demand and supply of each region. RECs prices in 12 states in NREL report[1] in 2018 were in the range of 10-15 USD/MWh.
- In compliance market, the solar RECs (SRECs) is in high demand with 2018 prices varied from 100-250 USD/MWh.

Figure 2.1: US Green Power Market 2010-2020

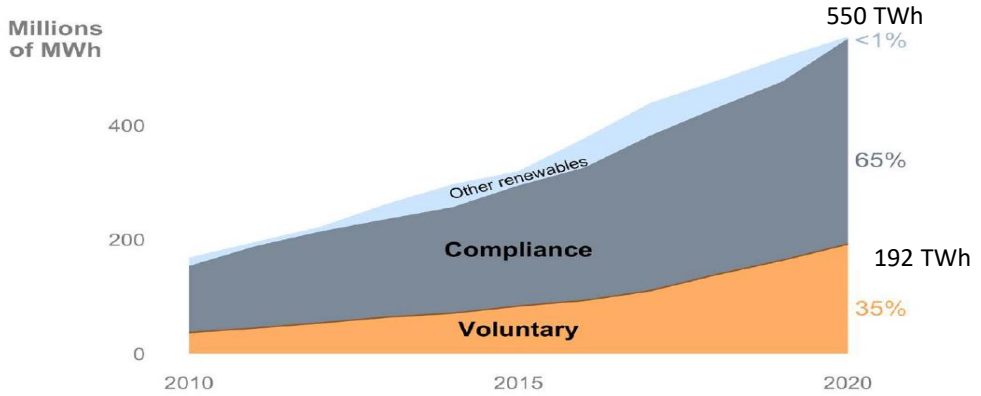


Table 2.2: Segmentation of the US voluntary market in 2020

Segment	Sales (million MWh)	Participation
Utility green pricing	11.6	1,085,000
Utility renewable contracts	7.7	42
Competitive suppliers	21.6	1,537,000
Unbundled RECs	86.4	221,000
Community choice aggregation	13.0	4,684,000
Power purchase agreements	51.8	414
Total	**192.1**	**7,527,000**

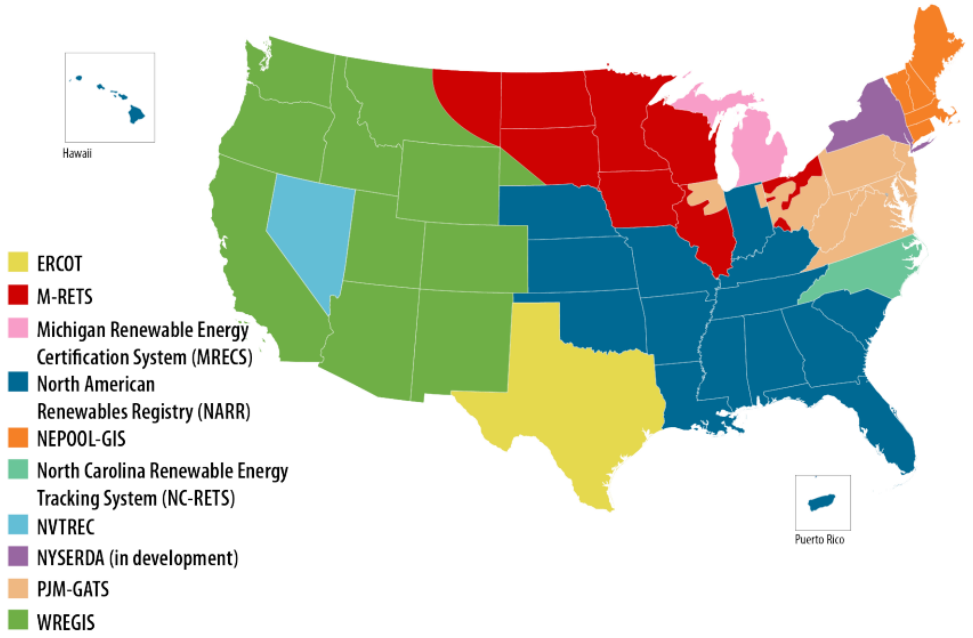
Note: [1] Status and Trends in the Voluntary Market Report (2020 data), Publications | NREL

RECs in the United States Green Power Market

RECs Tracking System

- Robust tracking system is one of the most important factors in a successful RECs market[1].
- US have created RECs tracking systems to verify compliance with RPS targets. These electronic tracking systems ensure that RECs are only "retired" (used to meet compliance) once by assigning a unique serial number to each megawatt-hour of renewable energy generation, which constitutes a RECs.
- However, some systems also track the attributes of RECs, such as the type of renewable energy facility (e.g., wind or biomass), the project location, and the generation date.
- In compliance markets, tracking systems are used by both obligated utilities and by public utility commissions (PUCs) that oversee compliance.
- Utilities use the systems to manage their RECs portfolios, transfer RECs to others, and ultimately to demonstrate compliance with the RPS by transferring RECs into retirement accounts. RECs deposited into retirement accounts can no longer be traded. PUCs use retirement accounts to verify the number of RECs a utility is using to comply with RPS requirements.
- Tracking systems are also used in voluntary markets, though their use is not as predominant as in compliance markets. The Green-e energy certification program, a leading certifier and auditor of RECs in the voluntary market, allows green power suppliers to use tracking systems to simplify some parts of the Green-e audit process.
- Tracking systems operate primarily on a regional basis, since many state RPS policies allow RECs from regions to contribute. Each different RECs market as shown in Figure 2.2, for example, has own tracking system for tracking and reconciliation of the RECs.

Figure 2.2: US Green Power Market 2010-2020



Note: [1] Emerging Markets for Renewable Energy Certificates: Opportunities and Challenges, NREL, Publications | NREL

RECs in the United States Green Power Market

Challenges of the US RECs

- **Project finance and RECs.** RE developers generally need an upfront guaranteed revenue stream to secure project financing for new projects. RE developers are currently exploring opportunities to use long-term agreements to sell RECs to finance the new RE projects.
- **Communicating RECs.** RECs are intangible and difficult to explain, yet the US National Association of Attorneys General suggests that marketers disclose to consumers when they are providing certificates, not power.
- **RECs substantiation and verification.** Not all states have RECs system. Even among the states with RECs system in place, not all are employing electronic database. Electronic tracking systems in some states cannot communicate to each other, thus the challenge to reconcile the RECs transaction.
- **Domestic RECs markets.** RECs markets in the US are regional markets. Tracking systems and regional legislation that allow regional RECs imports and exports would help facilitate domestic trade. Other factors that could encourage broader markets include a federal RPS that supports domestic RECs trading, a federal greenhouse gas policy that recognises the contribution of renewables, stronger federal direction to states on including renewables in emission cap-and-trade programs, and more large companies buying domestically-sourced RECs.
- **RECs ownership uncertainty.** In certain circumstances, RECs markets have been hindered by questions about uncertain ownership of RECs. To reduce market uncertainty, regulators and legislators need to clarify their intent when designing regulations and incentive programs to promote RECs and RE.
- **Environmental claims.** One challenge for marketers is communicating the environmental benefits associated with RECs. This is especially problematic for RECs sourced from areas where emissions markets (such as SO_2 and NO_x) are regulated by cap-and-trade programs that do not provide allowances for renewables. Although most renewables have low or no emissions, they are unlikely, in these circumstances, to reduce overall emissions.
- **RECs definition.** A RECs definition that includes environmental attributes is more credible and more practical than the one without. A unified definition of the attributes of RECs is therefore important.
- **Disaggregation of attributes.** There is general agreement in the US that a RECs owner can choose to sell a whole RECs (assuming a RECs is defined to include all attributes) in voluntary or compliance markets, or sell the attributes in emissions markets without double counting. But the desire to maximise revenue from multiple markets leads to an interest in disaggregating whole RECs and selling component parts in separate markets.

Observations on Development of RECs Markets in the US

1. The US RECs markets have been evolving for over 20 years of development. The RECs markets have gained significant acceptances from both the compliance and voluntary customers.
2. US's Renewable Portfolio Standard (RPS) policy has largely contributed to the success of RE markets RECs markets by creating demands and market mechanisms to facilitate for compliance of RPS targets for the utilities.
3. The US large RECs market value (estimated 64 billion USD in 2020[1]), large RECs market size (estimated at 550 TWh in 2020[2]) and high number of market participants (7.5 millions inhelped promote various types of market offerings and mechanisms such as bundled and unbundled RECs, RECs futures, and arbitrage market.
4. Collaborations between government agencies at state and federal levels, as well as with energy regulators also contributed to the success of RECs.
5. Increasing RECs demand and attractive market value of RECs have helped promoting new RE investment by creating additional income stream to support project financing.
6. Declining technology costs help to drive down RECs prices and create more demand especially in voluntary market.

Notes: [1] Emerging Markets for Renewable energy Certificates: Opportunities and Challenges, NREL, Publications | NREL
[2] Status and Trends in the Voluntary Market Report (2020 data), and Status and Trends in US Compliance and Voluntary Markets (2010 data), NREL

Energy Attribute Certificates (EACs) in Japan

- Japanese electricity market was a monopoly of 10 regional utilities before being progressively reformed and liberalized through three stages of reforms in 2015, 2016, and 2020.
- Japan installed electricity generation capacity in 2021 was around 271 GW. In 2019, the electricity generated was 1 037 TWh, with fossil fuels (coal, oil, and gas) constituting around 72%. Renewable energy, including hydro, biomass, solar, wind, and geothermal, accounted for 18% of the generation, and the remaining was accounted for nuclear energy.
- The renewable electricity demand from corporate customers in Japan is growing. Companies in Japan have several options to source renewable electricity: onsite generation, buying green electricity products, and energy attribute certificates.
- There are basically three types of electricity certificates in Japan (Energy Attribute Certificates): Green Electricity Certificates (GEC), J-Credits (renewable energy generation), and Non-Fossil Certificates (NFC). Unlike other countries where the energy attribute Certificates is measured per 1 MWh of electricity, Japan's measurement is measured per 1 kWh.

Green Energy Certificates (GEC)

- It was established in 2000. GEC is used to certify and trade the environmental value of renewable electricity for self-consumption. The Japan Quality Assurance Organization (JQA) manages the GEC certification. The GEC is tradable; however, it is not traded over an online system. GEC-attributed information for each Certificates is disclosed on the JQA website.
- In the GEC, the tracking system records several information such as owner name, serial number, generation amount, generation period, technology, date of issuance, and supplier name. However, it doesn't track the commission date of the power generation.
- The GEC from onsite renewable generation projects used for self-consumed can be issued to make a claim credit for renewable energy. The excess power of any onsite generation may also be sold to the grid, and the GEC can be retained on behalf of the consuming entity. However, the attribute is taken away if the generated electricity is sold to the grid under the FiT scheme.

Figure 2.3: Japan Electricity Supply System

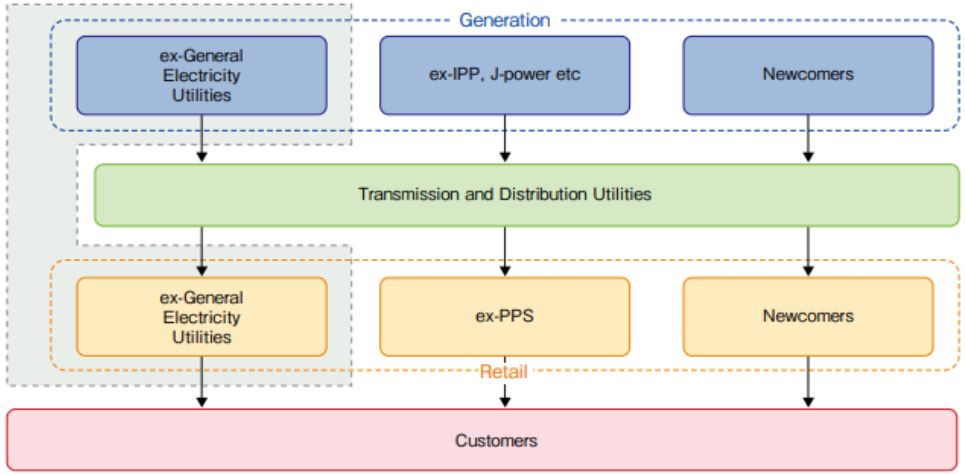
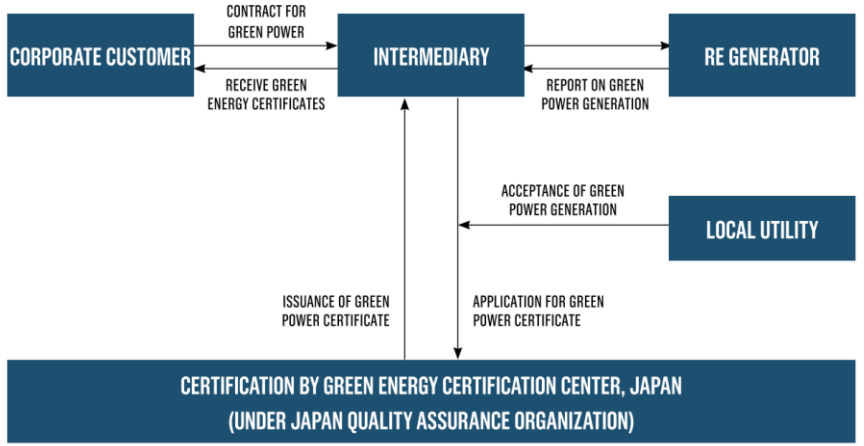


Figure 2.4: Certification Process For Green Energy Certificates



Source: FEPC 2021, RE100, Renewable Energy Institute, APEC Energy Overview 2022

Energy Attribute Certificates (EACs) in Japan

- The GEC issuance almost tripled, from 2009 to 2020, reaching around 600 million kWh. It is expected to increase, as the number of onsite renewable generation increases in Japan.
- Biomass power generation dominates the GEC issuance in Japan, though, in 2020, the number of GECs from solar increased substantially. The transaction price of GECs was around 2-4 yen/kWh for large volumes, and it's expected to decrease.

J-Credit Scheme (Renewable)

- It is a system to trade CO_2 emissions reduced by self-consumption of electricity from renewable energy sources as credits. The trading unit of J-Credits is the amount of CO_2 emission. The credits are calculated based on the average CO_2 emission per kWh of electricity for the entire economy in the fiscal year in which the electricity was generated.
- The J-Credit system is operated by the government, which is responsible for certifying facilities and CO_2 emission reductions. Consumers of renewable energy-based J-credit can choose to retire them as offsetting credit or as an energy attribute Certificates. J-credit has a strict standard for verification, and it is tracked from its production to its retirement to avoid double accounting attributes.
- Several power generation, such as on-site solar PV, is eligible for both energy attribute Certificates, GEC and J-credit. Therefore, verification and confirmation are needed so that they will not overlap each other.
- J-Credit can be sold by the owner directly or through an auction. The average bidding price for J-Credits (renewable) was about 1.38 yen/kWh in January 2022.

Source: RE100, Renewable Energy Institute

Figure 2.5: Issuance Amount of Green Energy Certificates (unit : 100 GWh)

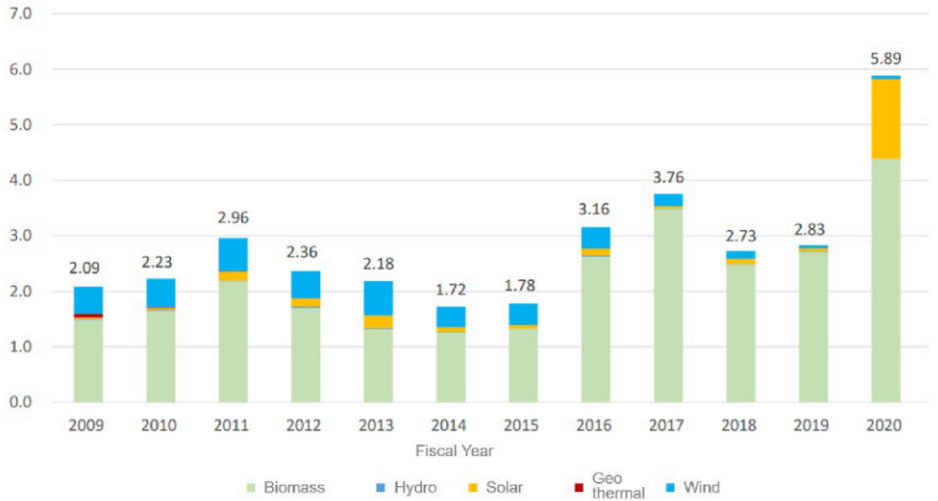
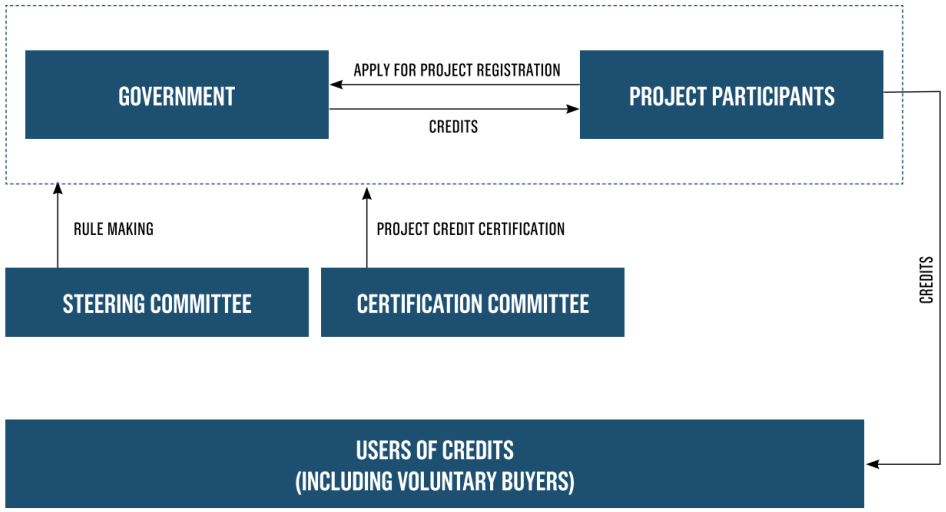


Figure 2.6: J-Credit (Renewable) Scheme



Energy Attribute Certificates (EACs) in Japan

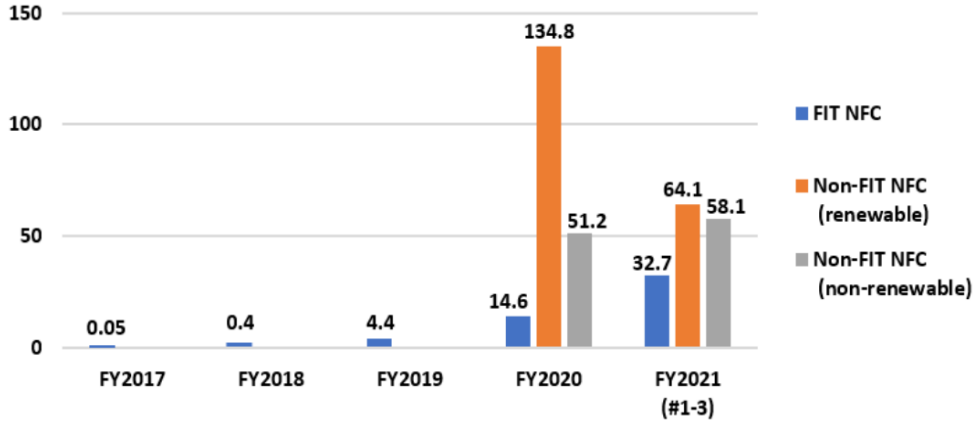
Non-Fossil Fuel Certificates (NFC)

- NFC, when it first launched in 2018, was designed to serve two purposes, to lock the environmental value of Feed-in Tariff (FiT) renewable generation so it could not be exploited, and to monitor the electricity retailers on their required target of 44% or more of non-fossil share by 2030. Therefore, NFC was being issued for only the FiT renewable electricity generated connected to the grid. (FiT-NFC).
- The NFC scope was expanded to certify not only for the FiT renewable generation but also for non-FiT renewable and non-FiT non-renewable.
- The standard setting and the issuer of the NFC is Agency for Natural Resources and Energy (ANRE) under METI. FiT NFC and Non-FiT NFC can be purchased through auction in Japan Electric Power Exchange (JEPX). In the case of Non-FiT NFC, the transaction method is also possible through bilateral transactions between the generator and retailer. FiT NFC can be purchased by electricity retailers, brokers, and electricity users. However, for the Non-FiT NFC, the Certificates is only possible to be purchased by the electricity retailer and electricity user in the case of based on PPA.
- The majority of Non-Fit NFC are from large hydro, residential solar (non-FiT), and nuclear. The floor price is set for market trading of NFCs. The floor price of FiT NFC was 0.3 yen/kwh from November 2021, and 0,6 yen/kWh for non-FiT NFC. The transaction volume of NFC is quite significant for the three types of NFC.

EACs Challenges for Japan

- Currently, there are three types of certificates that work in Japan: GEC, J-Credit, and NFC. The system is quite complicated for the market participant as each Certificates has its own specification for issuance, method, and condition to use.
- The tracking information recorded for EACsh Certificates is different, and some lack information to be able to track the Certificates from its production until its retirement.

Figure 2.7: Transaction volume of NFC (unit : 100 GWh)



*FY2021 #4 auction is scheduled for May 2022.

Source: Japan Electric Power Exchange (JEPX)

Source: Renewable Energy Institute

Energy Attribute Certificates (EACs) in Japan

Table 2.3: Comparison between EACs in Japan

Details	Green Energy Certificates (GEC)	J-Credit (Renewable)	FiT - NFC	Non FiT-NFC (Renewable/non-renewable)
STANDARD SETTING BODY & ISSUER	Japan Quality Assurance Organization (JQA)	Jointly by Ministry of Economy, Trade and Industry (METI), Ministry of the Environment (MOE) and Ministry of Agriculture, Forestry and Fisheries (MAFF)	Agency for Natural Resources and Energy (ANRE)	Agency for Natural Resources and Energy (ANRE)
TYPE/ELIGIBILITY	Generation facility accredited by Japan Quality Assurance Organization (JQA)	Generation facility accredited by J-Credit Scheme Certification Committee	Generation facility certified as FiT facility by the Government	Generation facilities using non-fossil fuels without FIT
TECHNOLOGY	Solar, Wind Hydro, Geo-thermal, Bioenergy	Solar, Wind Hydro, Geo-thermal, Bioenergy	Solar, Wind, small & Medium Hydro, Geo-thermal, Bioenergy	Solar, Wind, Hydro, Geo-thermal, Bioenergy, Nuclear and others
OWN USE/GRID ELECTRICITY	Mainly Own use	Mainly Own use	Grid connected	Grid connected
PURCHASING METHOD	Purchase from issuing body	Auction by J-Credit Secretariat, Sales by J-Credit owner or broker	Via auction in Japan Electric Power Exchange (JEPX)	Via auction in Japan Electric Power Exchange (JEPX), bilateral contract
TRACKING INFORMATION	Owner name, Serial number, Generation amount, Generation period, Generation technology, Date of issuance, Supplier name	Credit ID, Project number, Project operator name, Geographical area, Project overview, Project type, Certified period, Certified amount, Renewable electricity amount	Facility ID, Facility Type, Facility Name, Generator Name, Generation Output, Certified Date, Commission Date, Facility Location, Allocated Amount	Facility ID, Facility Type, Facility Name, Generator Name, Generation Output, Certified Date, Commission Date, Facility Location, Allocated Amount
CANCELLATION	Anytime (No vintage)	Anytime (No vintage)	From April of the generation year to March next year	From April of the generation year to March next year
PRICES DISCOVERY	Depends on the price band determined by issuing body	Vary by bilateral negotiation or via tender	Vary by tender	Vary by tender
BUYERS	Corporates, local governments, etc	Corporates, local governments, etc	Retailers (Retailers can buy NFCs on behalf of the corporate customers), Broker, and Electricity user.	Retailers (Retailers can buy NFCs on behalf of the corporate customers)

Source: RE100, Renewable Energy Institute

Green Electricity Certificates (GEC) in China

Overview of GEC

- The GEC system was launched as a pilot program in 2017-2018 to develop a renewable electricity market-based mechanism in China. The GEC is under the jurisdiction of China Renewable Energy Engineering Institute (CREEI).
- GECs allow individuals and companies to claim the environmental benefits associated with renewable electricity generation, which is purchased voluntarily.
- By Sept 2017, China's GEC trading platform had issued 8 million certificates, corresponding to 8 billion kWh of on-grid wind and solar electricity, equivalent to what Beijing's residents consume in an average five months.
- With this development, an increasing number of stakeholders are contacting Carbon Disclosure Project (CDP) asking for a review of the Chinese GECs system using RE100 technical criteria.

The Renewable Energy Portfolio Standard (RPS)

- In December 2016, The National Development and Reform Commission (NDRC), a Chinese government body, launched the 13th Renewable Energy Development Five Year Plan (for the period 2016–2020) which set targets to increase non-fossil energy to 15% by 2020 and 20% by 2030.
- In 2018, the National Energy Administration (NEA) released a draft policy: Renewable Portfolio Standard and Assessment Methods (NEA 2018).
- In 2019, the NDRC and the NEA published a Notice on the establishment and improvement of a safeguard mechanism for renewable electricity consumption (Renewable electricity quota) - a benchmark Renewable Energy Portfolio Standard (RPS) that was set to become effective in 2020 for the next five years.
- The notice makes it clear that the annual renewable electricity (RE) consumption quota is assigned to the provinces of China.
- There are two types of obligated entities under the RPS:
  - State owned electricity distribution companies, retail electricity companies and independent retail electricity companies;
  - Electricity users who purchase electricity through the electricity wholesale/merchant market and companies that own their own power plants.
- Currently, large scale onshore grid connected wind and solar PV projects receiving a FiT are eligible to participate in the GEC system.
- The Chinese government is planning to launch subsidy-free wind and solar projects, and there is the possibility that these projects will be eligible to issue GECs. The GEC system does not cover distributed RE generation.
- The GEC system primarily helps reduce FiT subsidies from the government via driving a market-based mechanism. Obligated entities can use GEC to meet their RPS targets, thus creating demand for GECs in the market. Voluntary buyers such as corporates and individuals can also demonstrate their support for renewable energy via GEC purchase and fulfil voluntary sustainability targets.

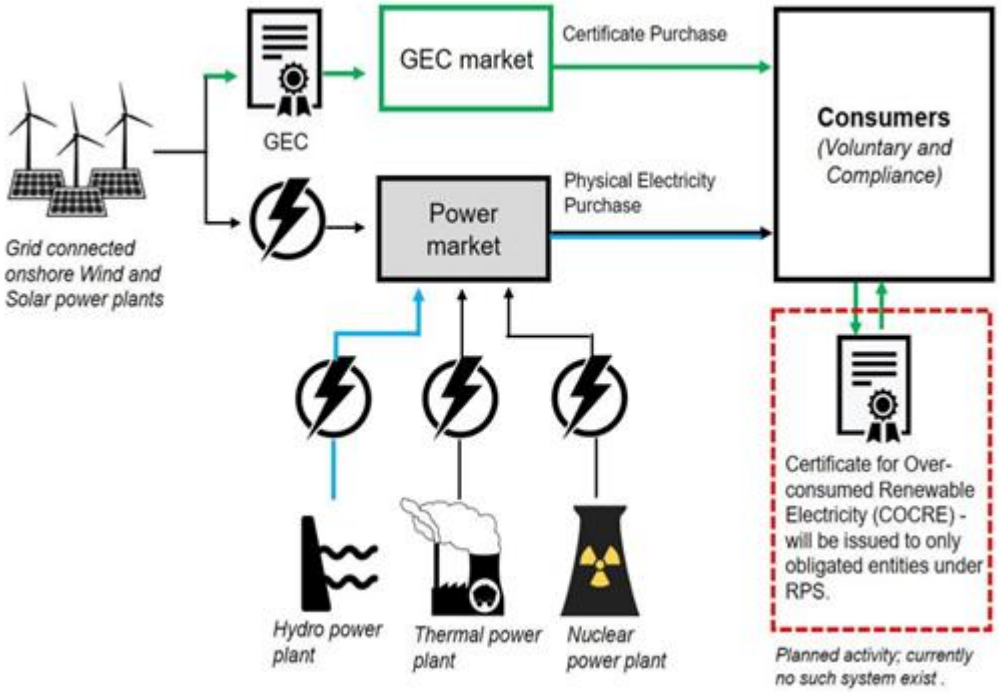
Source: Green Electricity Certificates (GECs) of China Technical Assessment Report | August 2020 https://www.there100.org/sites/re100/files/2020-10/Chinese%20GEC%20Paper_RE100_2020%20FINAL.pdf

Green Electricity Certificates (GEC) in China

Key details of the GEC system

- The GECs are issued to large-scale grid connected onshore wind and solar PV plants (excluding distributed power plants). Each GEC represents 1 MWh of RE generation.
- RE generators receiving FiT can issue GECs. However, once they sell the GECs on CREEI's electronic platform, they forego government subsidy (FiT). If they are not able to sell their GECs, the associated generation is still eligible to earn government subsidy ensuring the RE generator receives one revenue stream only.
- The government subsidy payment rate acts as a price cap for GECs. In March 2019, GECs ranged from USD 20–45 for onshore wind, and USD 45–104 for solar energy.
- Currently, GEC is the only attribute Certificates which can be owned and used to comply with the RPS target. There might be another Certificates system in future (i.e., Certificates for Overconsumed Renewable Electricity or "COCRE") to capture over-consumption of RE by obligated entities (consumption that exceed the RPS target), but this hasn't been set up yet).
- The National Renewable Energy Information Management Centre (the Centre), an independent third-party organization provides verification services for GEC system.
- The GECs convey basic information to its users such as resource/fuel type (e.g., wind, solar), serial ID, generator ID, generator name, generator location, vintage (date of generation), and issuance date.
- The environmental attributes captured through GEC include the GHG emission rate of electricity, sulfur dioxide and nitrogen oxide, which represent the replacement effects of coal-fired power generation.
- The RE generators participating in GEC system are also eligible to participate in China's Emission Trading System (ETS).
- The GEC has no expiry date, however under the RPS, the validity period of the GEC corresponds to the period of annual target assessment. The GECs are valid only within the assessment period of that year.

Figure 2.8: GEC System



Source: https://www.cleanenergyregulator.gov.au/About/Pages/Accountability%20and%20reporting/Administrative%20Reports/The%20Renewable%20Energy%20Target%202015%20Administrative%20Report/The-renewable-energy-Certificates-market.aspx

Green Electricity Certificates (GEC) in China

Conclusion on Compliance of GECs with RE100 Technical Criteria

- As the RE100 technical partner, CDP undertook a preliminary technical assessment of the Chinese GEC system.
- Though the GEC provides most of the necessary information to its user, it is still not robust enough to guarantee exclusive claims by the user. This is due to the potential for double counting of environmental attributes across GEC, GHG offsets, and other Certificates systems operating in China.
- Further, due to the existence of the emission cap-and-trade system (ETS), GEC users might not be able to make avoided GHG emissions claims associated with their renewable energy consumption.
- Additionally, there is no mechanism in place to restore the avoided emissions claim to the GEC buyers.
- Therefore, to avoid double-counting and to enable credible claims by the user of GEC, RE100 can only accept claims made using GECs if the user of GECs follows the "Requirement" provided in Table 2.4, that it is required for the user of GEC to redeem all other instruments e.g., GHG offset and any other energy attribute Certificates (if issued to the same RE generation) in order to achieve attribute aggregation and claim renewable energy usage in a credible manner.

Table 2.4: Further requirements and recommendations to meet RE100 criteria

Criteria	Requirements/ Recommendation to enable credible RE usage claims
Attribute aggregation, Exclusive claims	**Requirement:** The RE generators participating in GEC system are able to issue multiple environmental market instruments such as energy attribute certificate and GHG offsets for the same generation. Making a credible RE usage claim requires ownership of **all environmental attributes** associated with the generation that can be owned, and that **none of these attributes have been sold off, transferred, or claimed elsewhere**. If separate instruments have already been created for different attributes of power generation (e.g. carbon attributes), attribute aggregation can be achieved by bringing these instruments together – by demonstrating ownership and retirement of all instruments that make up a RE usage claim. To meet the RE100 criteria, **GEC users are required to redeem all instruments e.g. GHG offset and any other certificate (if issued to the same RE generation).**
Vintage limitations of claims	**Recommendation:** GECs will convey the date of generation (but no expiry date of the certificate). To make a credible RE claim, users of GEC should check the vintage of the certificates which should be reasonably close to the reporting year of the electricity consumption to which it is applied. For reference, companies can consider Green-e Framework for Renewable Energy Certification. Green-e® Energy Certified sales that are made in a given calendar year must be generated within the 12 months of that calendar year, the six months before the calendar year began, or the three months after the calendar year has ended. This creates a 21-month window of eligible generation dates from which renewable energy generation can be used toward Green-e® Energy Certified sales in any given calendar year. Please check more information here: https://www.green-e.org/faq

Source: https://www.cleanenergyregulator.gov.au/About/Pages/Accountability%20and%20reporting/Administrative%20Reports/The%20Renewable%20Energy%20Target%202015%20Administrative%20Report/The-renewable-energy-Certificates-market.aspx

RECs in Australia

Overview of RECs market in Australia

- RECs market in Australia started before 2000. It is regulated by Clean Energy Regulator (CER) under the Renewable Energy (Electricity) Act 2000.
- Number of RECs issued in Australia has been tagged with the Renewable Energy Target (RET) since 2001, with the introduction of the Mandatory Renewable Energy Target by the Government of Australia.
- Individual or company can either purchase RECs with electricity supply (bundled RECs) from a retailer or purchase it separately (unbundled RECs) from a generator/broker and electricity supply from a retailer.
- RECs are a primary commodity of the RET scheme and is also traded in the secondary market.
- RECs market is valued at AUS$3.5 billion in 2022[1]. The value is based on wholesale price (spot) as of 11 July 2022.

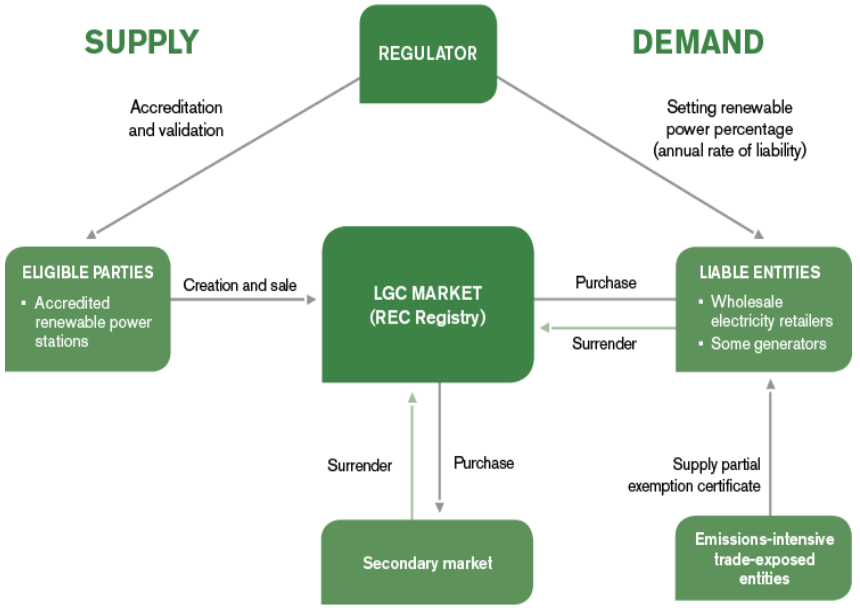
Management of the RECs market in Australia

- CER manages the RECs registry in Australia.
- CER is a regulatory body established under the Clean Energy Regulator Act 2011. It is responsible for accelerating carbon abatement in Australia through the administration of the National Greenhouse and Energy Reporting scheme, Renewable Energy Target and the Emissions Reduction Fund.
- CER is also responsible for managing, auditing and reporting on the participants of the RECs market and the entire market.

Type of RECs in Australia

- Prior to 2011, there was only one type of RECs in Australia which covered certificates issued by all types of renewable installations.
- Two types of RECs were introduced in the market on 1 January 2011. Each type of Certificates is tagged with different target categories under RET scheme.
- Type 1 Certificates is known as large-scale generation certificates (LGCs). The LGCs are certificates issued for electricity produced from large-scale wind, solar and hydro installations. One LGC is equivalent to 1 MWh of renewable electricity generated above the power station baseline. Number of LGCs is linked with the Large-scale Renewable Energy Target (LRET). LRET is designed to accelerate the renewables power stations development through commercial incentives and deliver the majority of the RET.

Figure 2.9: Large-scale generation certificates market



Source: www.cleanenergyregulator.gov.au

Notes: [1] Value of RECs market in Australia is calculated based on spot prices available on http://greenmarkets.com.au/

RECs in Australia

- Type 2 Certificates is known as small-scale technology certificates (STCs). The STCs are certificates issued for electricity produced from installations of solar water heaters, air source heat pumps, and other small generation units (solar, wind and hydro systems). One STC is equivalent to 1 MWh of renewable electricity generated by the such unit, or equivalent to 1 MWh of renewable electricity deemed to be displaced by the installation of solar water heaters or air source heat pumps.

How does the RECs (LGCs) market work?

Supply-side

- Renewable electricity generators (large scale) create certificates or Type 1-LGCs based on the power they generate through the RECs registry.

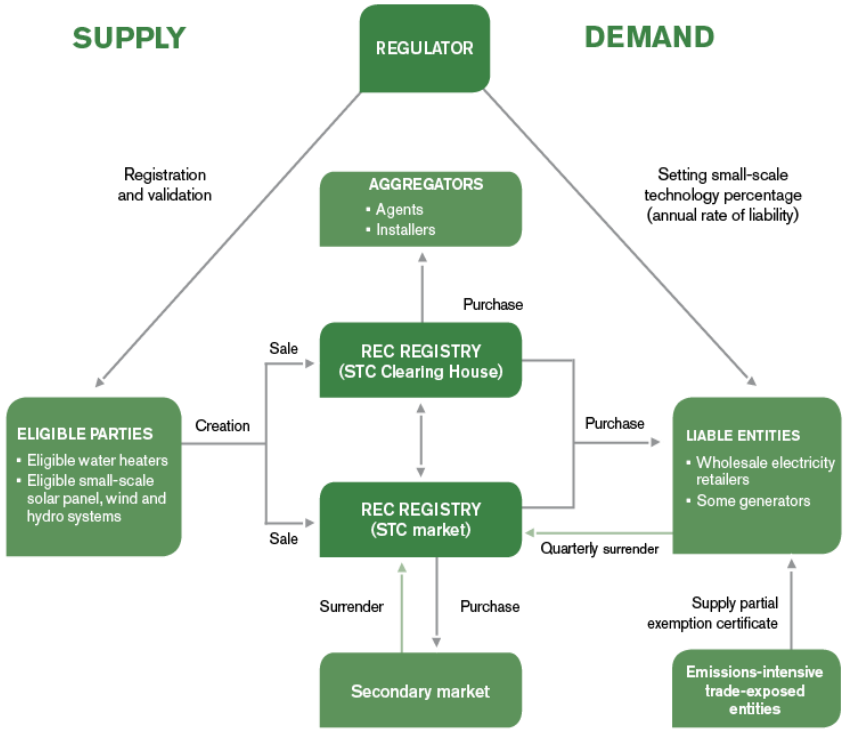
Demand-side

- Wholesale purchasers (mainly electricity retailers – also known as 'liable entities') buy these certificates to meet their renewable energy obligations under the large-scale scheme. There are various options to buy LGCs, either buying LGCs on the secondary market, buying LGCs direct from a renewable energy power station, or sourcing LGCs by establishing a large-scale renewable energy project.
- Wholesale purchasers then surrender these certificates to the CER in percentages set by regulation each year. The number of certificates that wholesale purchasers need to source and surrender is determined each year by the renewable power percentage (for large-scale generation certificates) and the small-scale technology percentage (for small-scale technology certificates). The percentages are set in regulation under the Renewable Energy (Electricity) Act 2000 each year.
- Wholesale purchasers must pay the penalty or shortfall charge if the number of surrendered certificates is less than the annual percentage set. The shortfall rate is AUD65 per Certificates if there is more than a 10% shortfall. If the shortfall is less than 10%, the electricity retailer can forward the shortfall amount to the following year.

RECs market activity in Australia

- As of 31 December 2022, a total of 35 971 733 LGCs were registered in the RECs registry[1], higher than the annual statutory target of 33 million (33 TWh). The growth is supported by the continued addition of new renewable power stations to the grid.

Figure 2.10: Small-scale technology Certificates market



Source: www.cleanenergyregulator.gov.au

Notes: [1] Total LGCs in the RECs Registry available on https://www.cleanenergyregulator.gov.au/RET/About-the-Renewable-Energy-Target/Large-scale-Renewable-Energy-Target-market-data/large-scale-renewable-energy-target-supply-data

RECs in Australia

- The growth of LGCs in the market, including large year-on-year growth in voluntary cancellations and ongoing redemption of shortfall charges, has led to an increase in LGC spot prices from 2021 to 2022, where the LGC spot prices are higher than forward markets had predicted (Figure 2.11).
- The decline in the number of STCs created in 2022 (as of September) was due to a reduction in the number of new solar PV installations in Q1 2022 and Q2 2022 following the shift of spending from home improvement to travel as international borders opened (Figure 2.12).
- STC spot prices stabilize at about AUD39.90 per certificates, slightly below clearing house prices in 2022 (Figure 2.13).

RECs issues and challenges in Australia

Past

- In early 2000, small renewables share in the electricity generation mix was low due to high renewables energy costs and non-continuous supply. To increase participation and investment in renewables energy, the government of Australia –
    - Set a clear target to increase renewables share in the electricity generation mix (short-term and long-term) by introducing the economy-wide level's RET, with a mandatory 2% annual increment in the use of renewables for electricity generation.
    - The target of 40 TWh of renewable energy in the electricity generation mix by 2020 was revised in 2015 to a Large-scale Renewable Energy Target of 33 TWh by 2020.
- Higher energy cost for end-users (short-term impact) in 2013 as retailers are obliged to purchase the RECs at a certain percentage in addition to the carbon cost. The government removed the carbon price from the calculation of energy cost in 2015 to reduce the retail electricity price.

Current

- Reduction in the number of certificates that can be created from the existing solar capacity due to declining generating capacity.
- Developing a new scheme to replace the LGCs and STCs scheme, as the existing scheme will be phased out at the end of 2030.

Figure 2.11: LGC spot and forward prices, Jan 2020 to Sep 2022

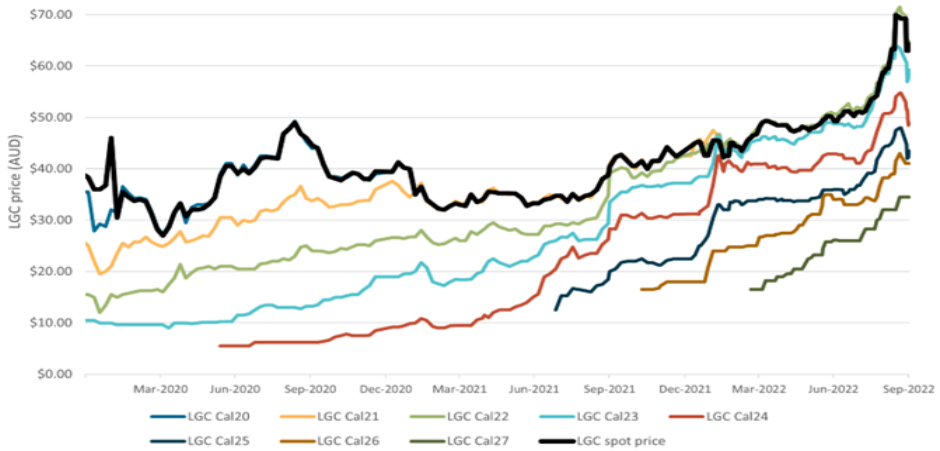
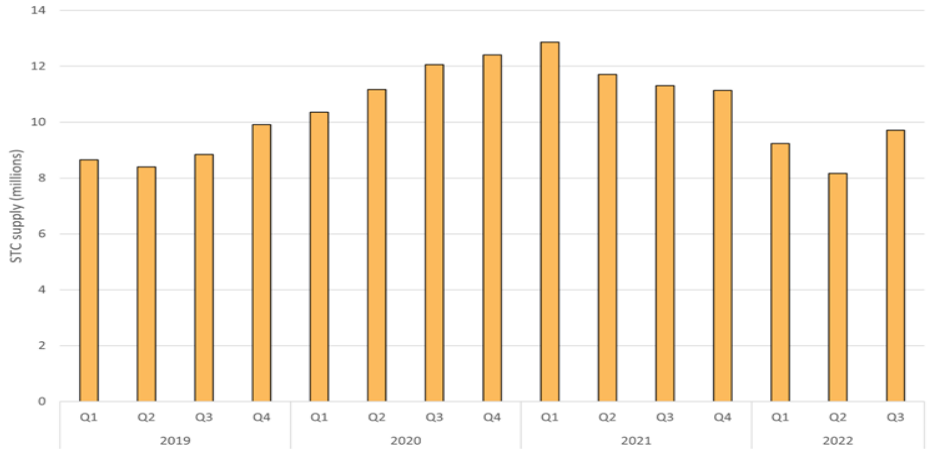


Figure 2.12: STC supply by quarter, Q1 2019 to Q3 2022



Source: https://www.cleanenergyregulator.gov.au/DocumentAssets/Pages/QCMR-data-workbook-September-Quarter-2022.aspx

RECs in **Australia**

Figure 2.13: STC spot and clearing house prices, Jan 2019 to Sep 2022

Source: https://www.cleanenergyregulator.gov.au/DocumentAssets/Pages/QCMR-data-workbook-September-Quarter-2022.aspx

Comparison of EACs/RECs in Selected APEC Economies

Table 2.5: Comparison of EACs/RECs in Four Selected APEC Economies

	US	Japan	China	Australia
Start year	• First trading of RECs 1995	• GEC launched in 2000	• GEC launched in 2017	• RECs launched in 2000
Types of market and certificates system	• Compliance market for utilities and Load Serving Entities-LSEs to meet RPS obligations • Voluntary market for electricity retail consumers • RECs is the main certificates system used in both markets	• GEC: targeted for self generation and consumption of RE electricity • J-Credit: targeted for voluntary electricity customers to promote EE, fuel switching, carbon sink • NFC targeted for electricity retailers to meet 44% non-fossil target by 2030	• GEC is the only certificates in China to claim for RPS target (launched 2019)	• From 2011 there are 2 types of RECs: Type 1 (Large Scale Generation Certificates-LGC) and Type 2 (Small Scale Technology Certificates-STC) • LGCs are generated by large RE generators (>100kW), STC by small RE generators
Estimated market size	• Compliance 358 TWh (2020) • Voluntary 192 TWh (2020) Total 550 TWh (2020)	• GEC 585 GWh in 2020 • J-Credit (renewable energy) 980 GWh in 2020 • FiT NFC 99.7 TWh 189.7 TWh in 2020	• 8 TWh (2017)	• 36 TWh (LGCs) in 2022 • 10 TWh (STCs) in 2022
Estimated certificates price	• Compliance RECs (2018): RECs=10-15 USD/MWh SREC (Solar RECs) =100-250 USD/MWh • Voluntary RECs: 0.7 USD/MWh (2018)	• 2-4 Yen/KWh (2020) • J-Credit 1.38 Yen/KWh (Jan. 2022) • FiT NFC 0.3 Yen/KWh (2021) • Non-FiT NFC 0.6 Yen/KWh (2021-floor price)	• GEC onshore wind 20-45 USD/MWh (2019) • GEC solar 45-104 USD/MWh (2019)	• Spot LGC approx. 65 AUD/MWh (Sept. 2022) • Spot STC 39.9 AUD/MWh (2022)

Comparison of EACs/RECs in Selected APEC Economies

Table 2.5: Comparison of EACs/RECs in Four Selected APEC Economies (Cont…)

	US	Japan	China	Australia
Governance body	• Federal and state regulatory commissions and authorities	• Government	• Central government	• Clean Energy Regulator (CER)
Trading and tracking system	• Different system in each region (currently 9 systems being used)	• GEC: tracked by JQA (Japan Quality Assurance Organization) • J-Credit by J-Credit auction (online) • NFC by JEPX (Japan Energy Power Exchange)	• Using online China's Energy Trading System (ETS)	• National system (RECs Registry)
Successful development	• Introduction of RPS and RECs resulted in large RECs market size and participants • Voluntary market gained popularity, enabling different market offerings	• Use RECs market to reduce FiT	• Use RECs market to reduce FiT	• Introduction of RET to create demand for renewable and to replace FiT expenditure • Single authority/single system to promote and regulate RECs • One carbon market to serve various types of carbon commodities, including RECs (LGC & STC schemes)
Key challenges	• Uniform of RECs tracking system and market platform • Disaggregation of RECs attributes for other environmental claims • Long-term buying of RECs as a tool to finance new RE projects	• Limited availability of RE and certificates • Confusion and difficulty of certificates acquisition process • Attributes not fully conform with international standards • Disaggregation of RECs attributes for other environmental claims	• Disaggregation of RECs attributes for other GHG claims such as NOx • GEC attributes not fully conform with international standards	• Attributes not fully conform with international standards • Disaggregation of RECs attributes for other environmental claims

Key Observations on Development of AEC/RECs in Four Selected APEC Economies

1. RECs in these four economies have evolved over many years of development. Except for China, which more recently launched its GEC in 2017, the other economies started their systems in 1995 (the United States) and in 2000 (Japan and Australia).
2. In these selected economies, compliance markets were first introduced as the primary tools to increase renewable energy production.
3. EACs/RECs are regulated, traded, and monitored by government agencies designated by specific legislation.
4. Concern about the future adequacy of renewable energy supply (renewable generation capacity) is causing increased demand for RECs in some developed markets, including Japan.
5. In all four economies, RECs markets are designed to provide a market-based mechanism to incentivise investment in new renewable capacities in addition to the government's support mechanisms such as the feed-in tariffs.
6. Lack of standardization of energy attributes and tracking systems for EACs/RECs is an obstacle to the trading of different attributes and claims between economies. Harmonising different REC platforms and tracking systems is currently being reviewed by RECs regulators in the selected economies.

Section 3

Current development of RECs in APEC Southeast Asia Economies

Overview: Status of RECs in Six Southeast Asia Economies

- In the six APEC southeast Asia economies; Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam, RECs activities have been launched around 2015
- The primary objective of RECs in APEC southeast Asia is to serve the demand of corporate electricity consumers who have obligations to meet RE targets.
- Currently, the two system providers for RECs, the International RECs (I-RECs) system and TIGRS/APX, are employed to manage RECs activities in APEC southeast Asia. Malaysia has recently developed its own system platform namely mGATS (Malaysia Green Attributes Tracking System) in 2019 .
- As of end 2021, there have been 12,883 MW of RE capacity registered under APX and I-RECs combined (Figure 3.1). Total accumulated number of issued RECs by the two systems were 29 153 598 RECs, equal to 29 TWh of RE generations (Figure 3.2).
- Hydro and solar dominates more than three quarters of the total 12 883 MW RE registered capacity (hydro 40%, solar 36%). Share of thermal (biomass and geothermal combined) is 18%, and wind is 6%.
- Of the cumulated 29 153 598 RECs (MWh) generated, hydro, solar and thermal each took about a third share (33% hydro, 29% solar, 32% thermal). Share of wind was 6%.
- To manage the RECs process, I-RECs appoint "RECs issuers" to provide services to clients under their standards. The issuers can be local organization such as the Electricity Generation Authority of Thailand (EGAT), or the international service providers such as Green Certificates Company (GCC). While RECs under TIGRS system all are issued by APX.
- It is anticipated that there will be 12 million RECs issued in 2022 and much more in the near future as more corporate consumers are planning to procure higher number of RECs to meet their 100% renewables targets as early as 2025-2035.

Figure 3.1: Total registered RE capacity in six APEC southeast Asia economies, 12 833 MW

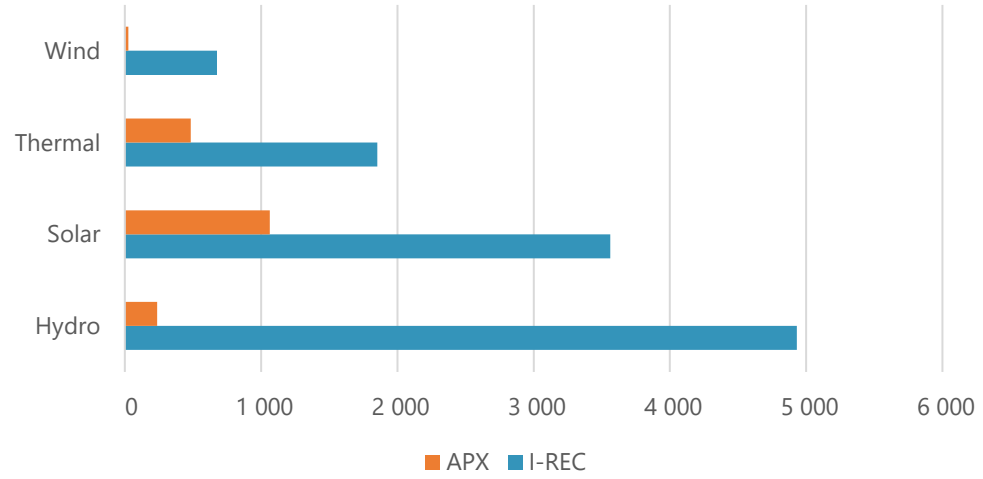
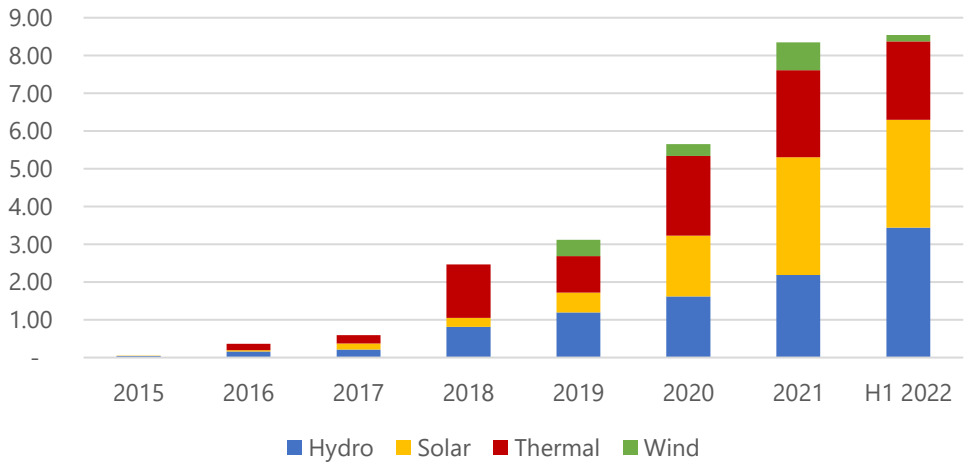


Figure 3.2: Aggregated APEC southeast Asia RECs issued annually, Accumulated 29.15 TWh (2015-H1 2022)



RECs in Indonesia

Electricity Market

- The electricity market in Indonesia is based on three typical business activities: power generation, transmission, and distribution & retail.
- The electricity utility company operates based on a specific business area, in which they can sell the electricity to their customer located in its business area. The utility company may generate electricity from their owned power plants, purchase electricity from their independent power producers (IPP), captive power, or from another utility operating in other business areas.
- At present, there are 53 electricity business areas in Indonesia. It includes Perusahaan Listrik Negara (PLN), a state-owned company that operates the biggest business area throughout Indonesia. In 2020, from a total of 72.8 GW installed power generation in Indonesia, more than 96% is operated in the PLN's business area

Installed Generation Capacity

- Indonesia's installed electricity generation capacity in 2020 was nearly 73 GW, which comprised both on- and off-grid generation. It This capacity increased by 3.1 GW in 2019, dominated by coal capacity additions, which corresponded to an increasing electricity generation as well.

Electricity Generated

- In 2019, 294 terawatt-hours (TWh) of electricity was generated, a 4% annual increase. Indonesia's power sector has been reliant on coal. Though renewables, especially hydro and geothermal, are growing. Large renewable power generation sites, such as hydro and geothermal, are still under construction. One major hydropower project, the 515 MW Poso hydropower generation plant, just recently began its commercial operation in February 2022.

Figure 3.3: Indonesia Power Market Model

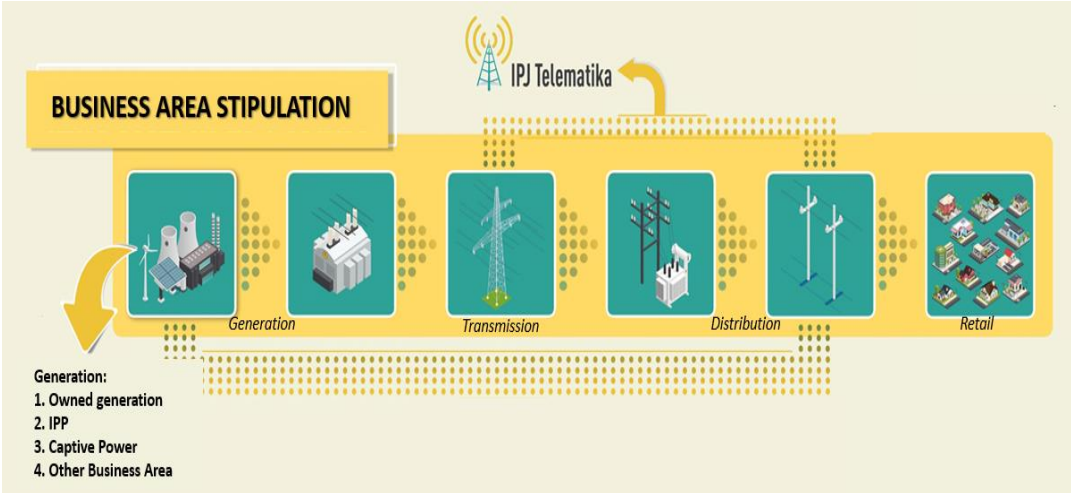
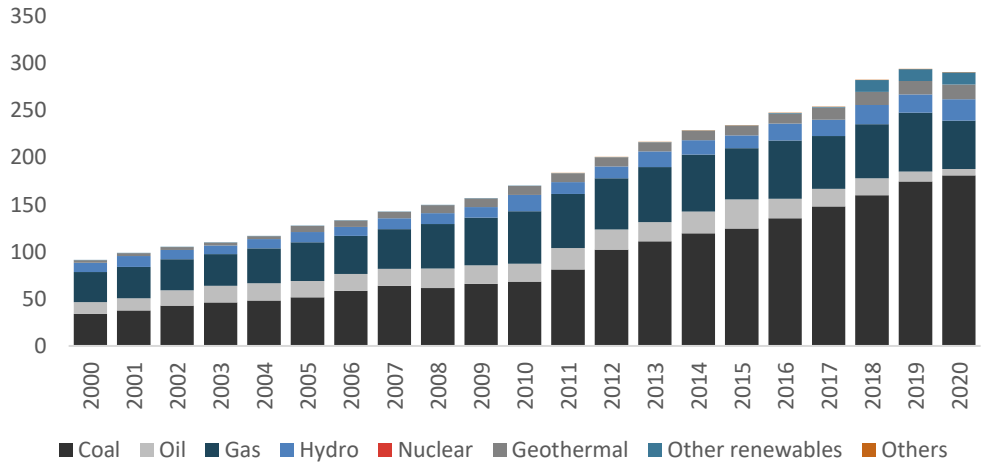


Figure 3.4: Indonesia electricity generation, 2000-2020 (TWh)



Source: MEMR, APEC Energy Overview 2022

RECs in Indonesia

Legal framework.

- The main laws that govern the development of renewable energy and electricity in Indonesia are Energy Law No. 30/2007 and Electricity Law No. 30/2009. Recently, new regulations were issued governing carbon tax and pricing to support the implementation of the carbon market. However, currently, there is no legal framework that specifically regulates RECs. The RECs in Indonesia are currently still voluntary-based.

RECs Market Mechanism

- The voluntary RECs markets mainly follow two online platforms, the I-RECs Standard and the TIGRs APX platform. The RECs market in Indonesia is unbundled, with one of the biggest RECs sellers being PLN.

TIGRs APX

- PLN enters the RECs market at present only through the TIGRs APX. PLN overs its RECs to its customers, who are all located inside the economy. The RECs from PLN is retired immediately, so it can not be traded to other parties after. PLN customers can buy the RECs via online from the PLN RECs portal or through an offline purchase agreement with PLN, and the retired RECs will be issued by APX.

- Based on the TIGRs APX registry, there are also RECs issued in Indonesia that come from generations that are not owned by PLN though small in size, and most of them are from solar.

I-RECs Standard

- In the I-RECs Standard, IREC allows a specific location or an economy to establish a local RECs issuer that follows the guidance of the I-RECs Standard. However, in Indonesia, currently, there is no local RECs issuer that has been established yet. Therefore, the RECs issuer in Indonesia is still managed by GCC, the default RECs issuer for IREC Standard. The RECs issued by GCC then enters the trading platform and can be traded, redeemed, and claimed.

- Although PLN currently does not use IREC Standard platform to sell its RECs. The number of power generation registered and RECs that has been issued through the IREC Standard in Indonesia is quite significant, meaning that renewable generation owners other than PLN have participated in the market is significant.

Figure 3.5: PLN Unbundled RECs scheme

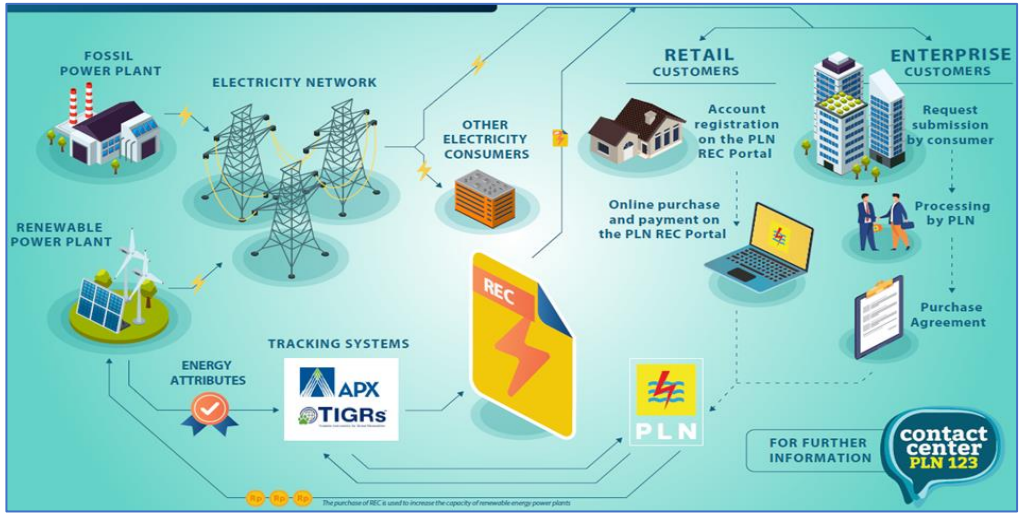
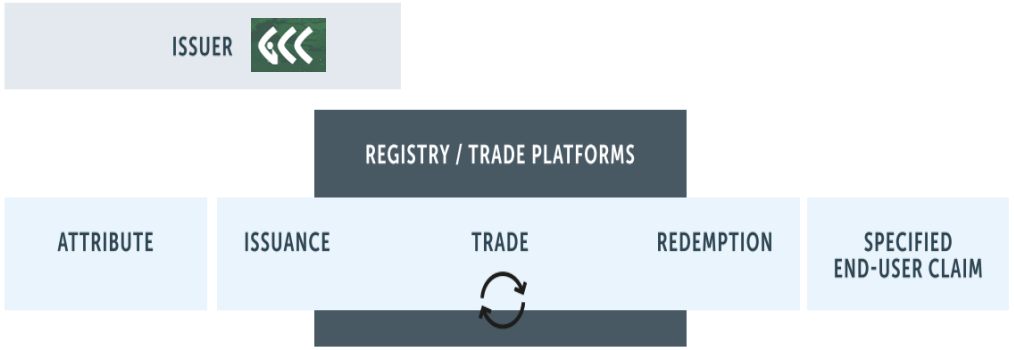


Figure 3.6: IREC Energy Attribute Certificates Market



Source: PLN, Adopted from IREC

RECs in Indonesia

RECs Market Size

- The RECs market in Indonesia is growing. The total capacity of renewable energy registered in IREC Standard and TIGRs APX until 2022 was around 1.5 GW, consisting of RECs from hydro, solar, thermal, wind, and geothermal.
- The electricity utility company, PLN, started selling unbundling RECs through the TIGRs APX registry in 2020, mainly from its three renewable generations, two geothermal power plants Lahendong (80 MW) and Kamojang (140 MW), and one hydropower Bakaru (130 MW). PLN targeting to sell its RECs to its customer, especially industrial customers that commit to using 100% renewable energy in all their business activities. For this purpose, PLN has set the unbundling RECs price of IDR 35 000/RECs.
- In the TIGRs APX, outside the renewable generation listed by PLN, there are also several solar generation projects with a total of around 10.19 MW in Indonesia registered. As per September 2022, the RECs issued in Indonesia increased from 1 187 RECs in 2019 up to 502 842 RECs in September 2022. The highest RECs issued recorded by TIGRs APX was in 2021, around 941 969 RECs, which was dominated by RECs from hydroelectric power.
- In the I-RECs standard, per July 2022, the total renewable generation capacity in Indonesia registered was around 1 021 MW, consisting of hydro, solar, thermal, and wind generation.
- The RECs, in I-RECs Standard, were issued by GCC as there is no local issuer in Indonesia. The first REC issued by GCC in Indonesia was in 2018, which was coming from solar PV generation.
- The RECs issued by GCC in Indonesia increased significantly over the past 5 years, almost tenfold, from around 8 799 in 2018 up to now around 849 479 in 2022. The RECs issued in 2022 were dominated by small-scale hydropower generation.

Figure 3.7: Registered renewable power generation in Indonesia

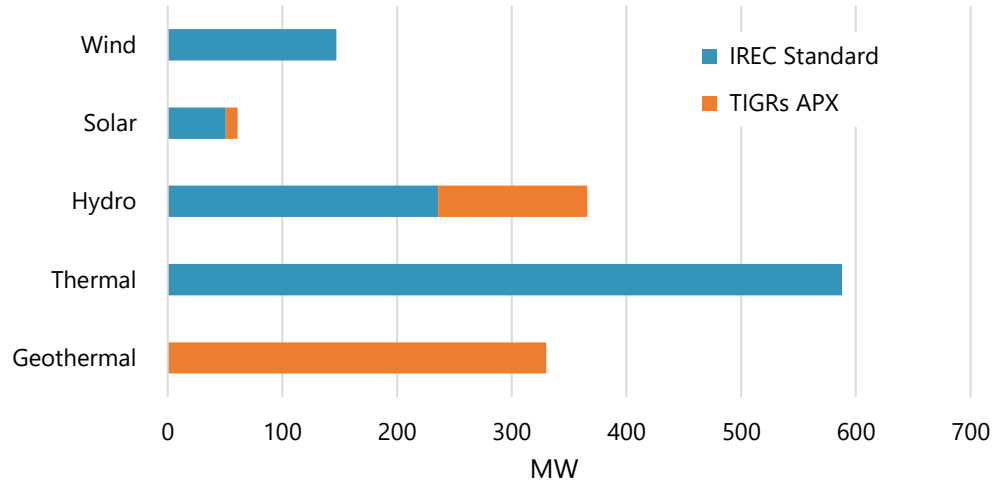
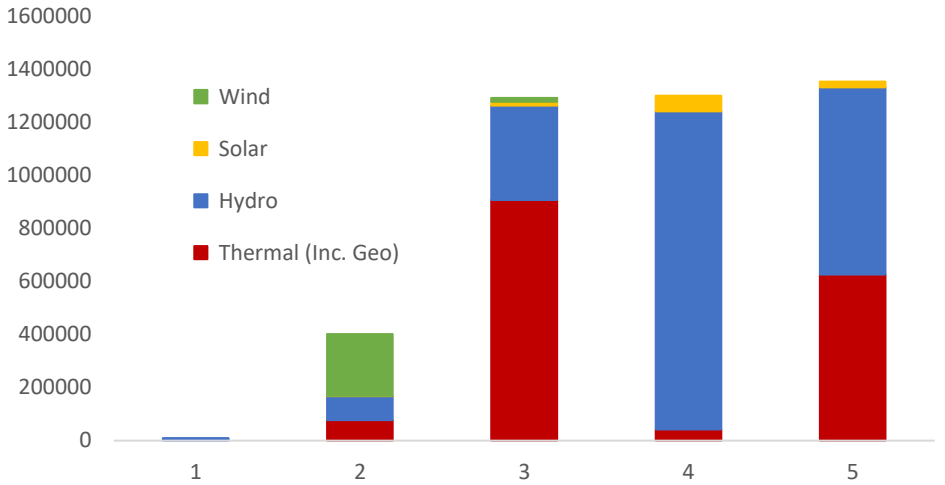


Figure 3.8: Number of RECs issued from renewable power generation in Indonesia



Source: IREC Standard, TIGRS APX per 2022

RECs in Indonesia

RECs Challenges in Indonesia

- The RECs market in the past five years has increased significantly. However, the market has not been regulated for clear implementation in the economy. Currently, there is no established local RECs issue that might ease monitoring and supervising the local RECs market.
- Potential dispute on the power purchase agreement between generator owner and utility. The electricity market in Indonesia is a single buyer model, in which the utility act as the main off-taker of electricity generated by either its own generation, IPP, or captive power. As the number of generator owners registered their assets in the RECs market increase, regulation or guidance on how RECs will be treated in the power purchase agreement is necessary to minimize any dispute in the future.
- Challenge in avoiding double claims and counting. Indonesia has regulated the implementation of the carbon offset mechanism. As the RECs market and Carbon offset are currently running at the same time. It will need rigorous supervision to avoid double claiming or double accounting of each MWh produced from renewable generation.
- Currently there is no bundling RECs mechanism, that simplify the RECs implementation and maintaining the RECs issued bundled with the electricity tariff is retired inside the economy.

RECs in Malaysia

Overview of Electricity Market

- The electricity market in Malaysia consists of three independent power systems, each located in a different region: Peninsular Malaysia, Sabah and Sarawak. Peninsular Malaysia's power system interconnects with Thailand's power system in the north of the peninsula and Singapore's power system in the south, while Sarawak's power system interconnects with West Kalimantan, Indonesia.
- Tenaga Nasional Berhad (TNB) is the utility company supplying electricity to Peninsular Malaysia areas except for Kulim Hi-Tech Park, provided by Nur Power Sdn Bhd (NUR). Sabah Electricity Sdn Bhd (SESB) and Sarawak Energy Berhad (SEB) are the utility company in Sabah and Sarawak, respectively.
- TNB, NUR and SESB electricity supply activities are regulated by Energy Commission under the Electricity Supply Act 1990, while Sarawak's state government regulates SEB electricity supply activities under Chapter 50, Electricity Ordinance.

Renewables Installed Capacity

- Renewables (RE) installed capacity in Malaysia grew steadily since the early 2010s and reached about 8 067 MW or 23% of total installed capacity in 2020. RE installed capacity in Malaysia is expected to reach 17 996 MW in 2035, more than double the 2020 level, as the government of Malaysia targeted a 40% RE share in the total installed capacity mix to accelerate the decarbonization of the power sector.
- Large hydro and solar dominated the share of RE in 2020, and it is expected the situation will be similar in 2035, where the increase of RE installed capacity is driven by solar.

Renewables in Electricity Generation

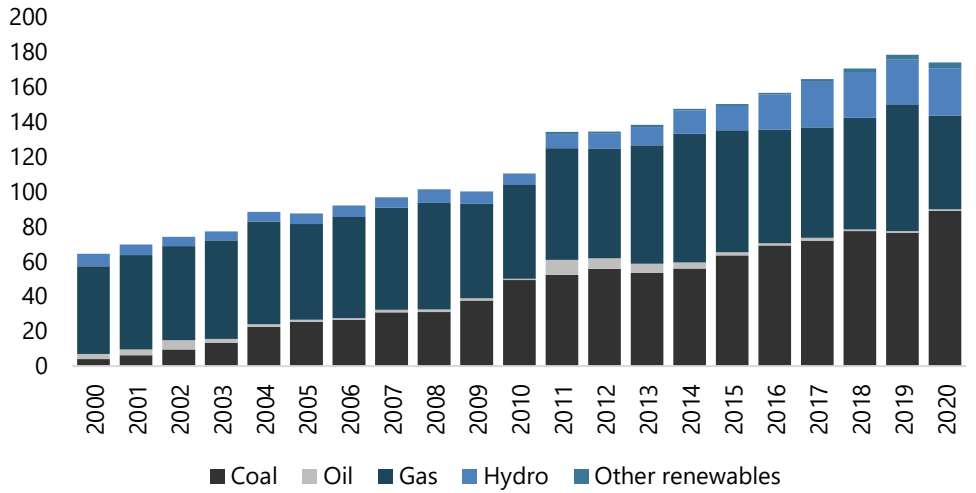
- The amount of electricity generation from RE sources has grown since 2000 and reached 30 584 GWh in 2020. Although the share of electricity generated from RE sources fluctuated during this period, the generated electricity trend is aligned with the growth of RE installed capacity.

RECs Market

- RECs market in Malaysia has deployed before 2017, and it is driven by market demand, particularly from the multinational companies on the RE100 list. As a requirement to be listed on the RE100 list, these companies need to source renewable electricity from or within the boundary of the market in which they are consuming the electricity as a commitment to energy sustainability.
- Since then, the RECs market has grown in Malaysia

Figure 3.9: RE installed capacity target by 2035 (MW)

Figure 3.10: Electricity generation by fuel, 2000 to 2020 (TWh)



Source: Malaysia Renewable Energy Roadmap, 2021 (MyRER), APERC Energy Overview 2023

RECs in Malaysia

mitigating global climate change by adopting initiatives or actions introduced by international environmental organisations such as CDP, World Resources Institute (WRI), UN Global Impact and UN Global.

- At the economy level, Bank Negara Malaysia (BNM) and Bursa Malaysia (KLSE), respectively, have issued Climate Change and Principle-based Taxonomy (CCPT) and Sustainability Reporting Requirements for financial institutes and listed companies under the main market and ACE market to support environmental sustainability.

RECs Development

- Before 2017, RECs purchasers bought unbundled RECs directly from the RE energy generator or its agent; whether the RECs was issued by GCC or APX.
- In 2017, myGreen+ scheme was introduced as an option for TNB customers to procure green energy from the mGATS trading platform. The scheme offered a myGreen+ subscription Certificates, a bundled RECs at a premium rate of 8 sen/kWh for 100 kWh blocks. However, the Certificates did not get a good response from the market due to the high premium rate, and it is not recognised internationally. As of 2020, about 120 customers had signed up for 190 MWh under this scheme.
- The myGreen+ scheme was replaced with Green Electricity Tariff (GET) programme effective December 2021. The subscriber of the GET programme will receive a local RECs, known as Malaysian RECs (mREC), which is based on international RECs standards and managed under the I-RECs registry.
- As GET's offered a premium rate of less than half of myGreen+'s at 3.7sen/kWh and mREC is internationally recognised, the 4 500 000 MWh GET annual quota for 2022 has been fully subscribed before mid-2022. The GET programme continues in 2023 with an increased available quota, offering up to 6 600 000 MWh to the subscribers with the same premium rate until December 2023 and exempted from ICPT surcharges until June 2023.
- In Sarawak, RECs purchasers have the option to procure RECs from the RECs trading platform, which was launched by SEB in 2019. The RECs transaction on this platform is managed under the TIGR registry.
- In Sabah, SESB does not offer any specific RECs procurement options for RECs purchasers as of December 2022.
- As of July 2022, Malaysia's total registered RE capacity reached 2 259 MW, where hydro capacity dominated the RE capacity mix. The registered RE capacity is expected to be doubled in the near future with Bakun hydroelectric plant in the system.

Figure 3.11: Total registered RE Capacity in Malaysia (MW) (as of July 2022)

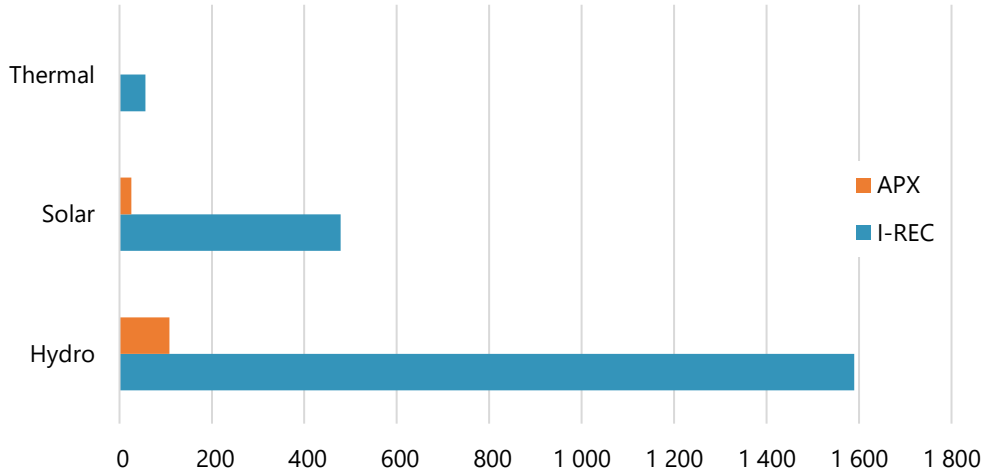
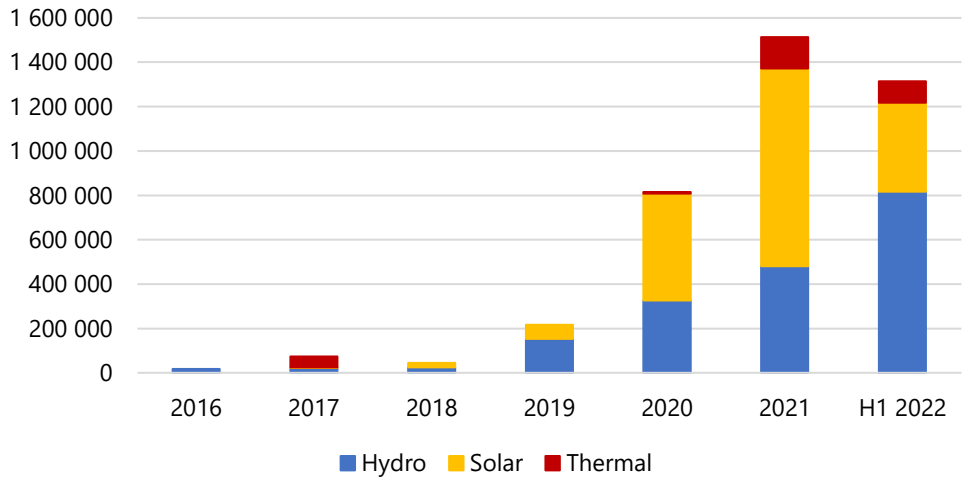


Figure 3.12: Total RECs Issued in Malaysia, 2016-July 2022 (MWh)



Source: : I-RECs and TIGR registries
Note: The total registered RE capacity excludes the capacity registered for myGreen+ scheme

RECs in Malaysia

- Annual RECs issued in Malaysia in 2021 increased about seven-fold from 2019 as interest among multinational companies and financial institutions grew significantly with their green reporting and disclosure needs.
- As of July 2022, accumulated RECs issued in Malaysia under I-RECs and TIGR registries reached 3 997 261 with the assumption that each Certificates represented 1 MWh.
- RECs market in 2021 is estimated at about USD 2.3 million with the assumption that each Certificates averaged USD 1.50 per MWh. The value of RECs market in Malaysia will increase in 2022 with the introduction of bundled mREC and a premium tariff rate under the GET programme.

RECs Legal Framework

- In Malaysia, RECs are traded on a voluntary basis, and it is subjected to the requirements or standards of each procurement platform.
- The annual GET premium rate for the bundled RECs traded at the mGATS platform is determined by Energy Commission (EC), with Minister's approval under the Electricity Supply Act 1990.
- RECs recognised as one of the initiatives to accelerate transition towards a low-carbon nation in Malaysia Renewable Energy Roadmap 2021-2035 (MyRER).

RECs Mechanism (under mGATS platform)

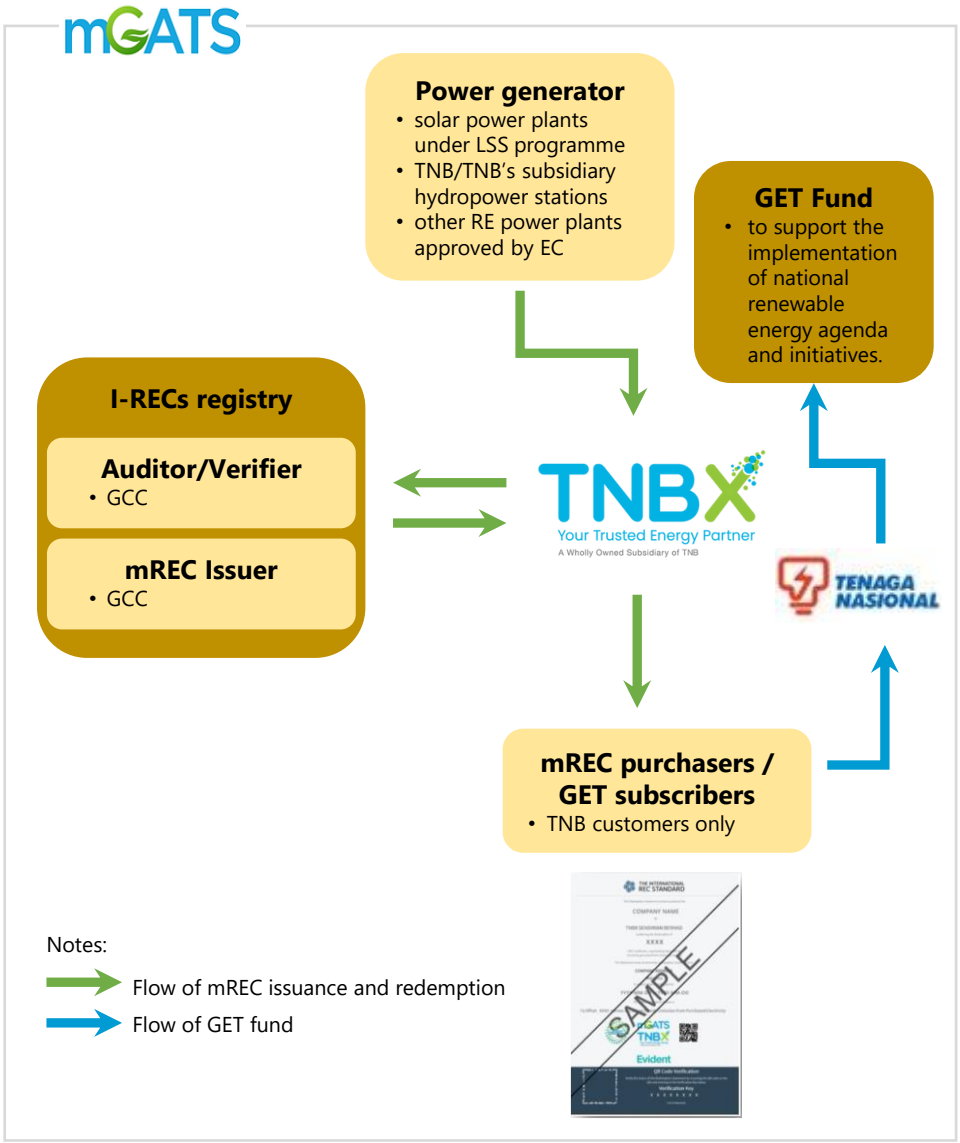
Supply side

- TNBX as a registrant registers renewable power generators, limited to power generators listed under the Large Scale Solar (LSS) programme or TNB's and/or its subsidiary's hydropower stations or any other renewable energy plants as approved by EC, under the I-RECs registry.
- GCC verifies the registration of renewable power generators under the I-RECs registry.
- TNBX publishes annual RE generation and annual GET quota on the mGATS website based on inputs received from TNB and Single Buyer.
- TNBX also publishes the status of GET subscriptions on a monthly and annual basis on the mGATS website.

Demand side

- Interested mREC purchasers sign a contract with TNB for a subscription to the GET programme. The annual subscription to GET will be offered on a first-come, first-served basis and will be renewed automatically unless subscribers request to terminate or modify their subscription.
- GCC issues mRECs to TNBX based on the annual total electricity generated by registered renewable power generators.

Figure 3.13: mREC mechanism under mGATS platform



RECs in Malaysia

- TNBX retires/redeems mRECs at the I-RECs registry to GET subscribers within one month after the end of each calendar year.

RECs Issues and Challenges

- More than one platform for RECs procurement in Malaysia, and each platform refers to a different standard and registry. Each platform also offers a different type of RECs, criteria and price.
- Annual GET quota available at the mGATS platform is limited to the total electricity generated by the list of power generators approved by EC. The 4 500 000 MWh quota in 2022 was fully subscribed before mid-2022, while the additional 2 100 000 MWh quota in 2023 was fully subscribed in less than an hour after release.
- Only TNB customers are eligible to purchase mREC under the GET programme, and mREC issued under the mGATS platform is not transferable among the RECs purchasers.
- The price to purchase bundled mREC under the GET programme is higher than unbundled RECs offered by other power generators in Malaysia's RECs market.
- The fund collected under the GET programme will flow to the GET fund and not to the listed power generators as the power generators have secured capacity, energy and other charges from Single Buyer under the existing PPAs and SLAs. As of January 2023, TNB is responsible for managing and administering the GET fund prior to the appointment of an independent entity under a new regulatory framework to ensure the fund is used to promote and develop renewables in electricity generation.
- Possibility of GET premium rate lower than System Marginal Price (SMP) due to high fossil fuels prices and declining solar PV cost. The current GET premium rate is calculated based on the differential between the procurement of green energy by the system compared to the SMP.

RECs in the Philippines

Electricity Market

- The Philippines underwent liberalisation of its electricity market following the Asian financial crisis in 1997. The Electric Power Industry Reform Act (EPIRA) 2001 was enacted to improve the quality of electricity services, as well as to increase the penetration of renewables in the Philippines' electricity mix through the Renewable Energy Market (REM).
- Installed Capacity and Generation. The Philippines installed about 7.9 GW of renewable energy power plants as of 2021, representing 29% of the economy's total installed capacity. Hydropower (3.8 GW) and geothermal (1.9 GW) were the dominant capacity, followed by solar (1.3 GW), wind (0.49 GW) and biomass (0.43 GW).
- Corresponding to the capacity, about 23 780 GWh of electricity was generated in 2021, with geothermal and hydro providing most of the baseload electricity. Solar, wind, and biomass accounted for the remaining small shares.

Legal Framework

- The Renewable Energy Act 2008 provides the framework for the establishment of RECs trading in the Philippines. Under this Act, the REM is the venue or such trading and is also intended as a facility for participants mandated for Renewable Portfolio Standards (RPS).

RECs Market

- The Philippines currently adopts both I-RECs and TIGR international standards, allowing local renewable energy power producers to issue RECs bound by these standards on a voluntary basis. The economy, however, issued a Department Circular declaring the interim operation of REM beginning the end of August 2022, thus signaling the RECs trading bound by a local standard. Trading is however yet to be carried out during the interim period, as the RECs price cap is awaiting approval from the DOE.
- The establishment of REM ensures that the RECs trading is taken place in a fair and transparent manner by all participants. REM also ensures proper pricing mechanism of RECs that is reflective of the additional renewables electricity supplied into the economy's electricity system.
- The Philippines Electricity Market Corporation (PEMC) is designated as the Renewable Energy Registrar (RER) to operate REM, as well as administer and maintain the Registry and RECs transactions. This includes issuance, keeping, and verification of RE certificates corresponding to energy generated from eligible RE facilities. The registered participants on REM will be able to access into the Philippine Renewable Energy Market System (PREMS), for registration, RECs calculation, issuance, and transfer.

Figure 3.14: Philippines renewable energy market structure

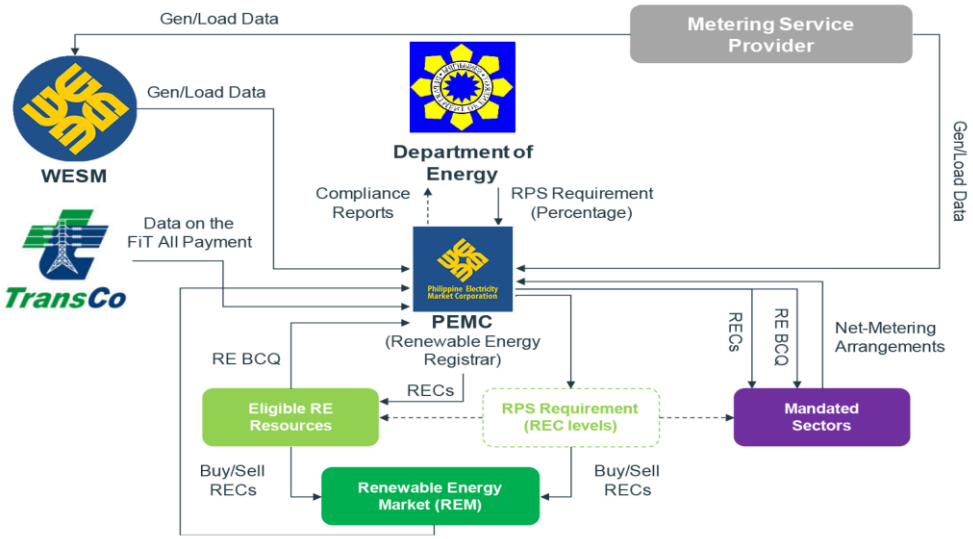
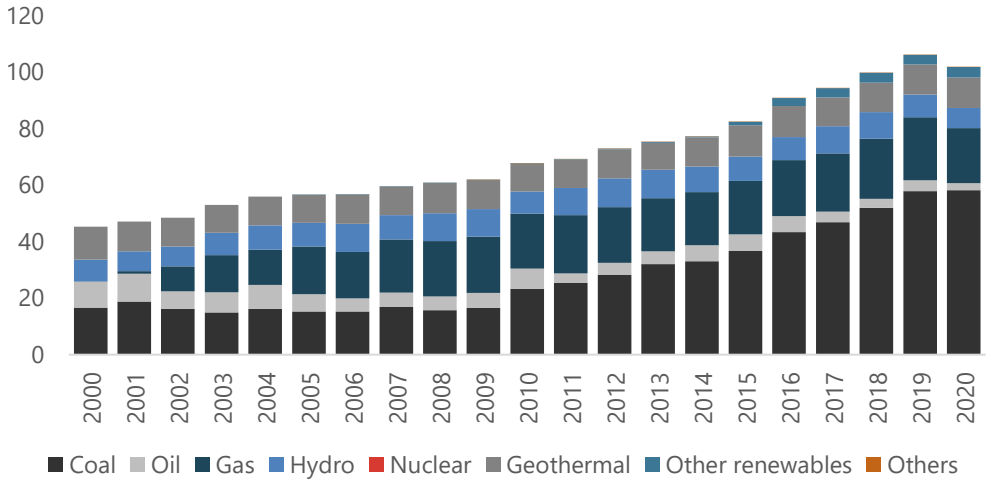


Figure 3.15: Philippines electricity generation, 2000 – 2020 (TWh)



RECs in the Philippines

I-RECs Standard

- I-RECs is currently the dominant global standard being used by local renewable energy power producers to issue their RECs in the Philippines, with total cumulative installed capacity of almost 1 312 MW registered with the standard as of July 2022. Geothermal power producers accounted for the largest participation (628.8 MW), followed by hydro (484 MW) and solar (199 MW).

TIGR

- Currently a single geothermal power plant is registered with the TIGR standard with a total capacity of 112.5 MW. The plant, located in Eastern Visayas region, has been in commercial operation since 1983.

RECs Market Size

- Significant growth in the registration with RECs market has been observed since 2016. As of July 2022, total capacities registered with I-RECs and TIGR standards were over 1 400 MW, a growth of almost 20 times relative to 2016 levels. Such total capacities represented about 18% of the Philippines total renewable energy power plants.
- The RECs participation grew in proportion with the issuance volume. As of July 2022, over 6 million RECs have been issued by local renewable energy producers registered in both I-RECs and TIGR standards, a significant growth from almost 90 000 certificates issued in 2016. The commencement of REM market operationalisation is expected to see a further boost in the participation of RECs market, and there is potential for partnership between the local market with both I-RECs and TIGR standards in the future.

RECs Issues and Challenges

- Although both I-RECs and TIGR Standards have been active in the Philippines for quite some time, the domestic REM is yet to be fully operationalised pending the introduction of the domestic RECs price cap.
- The full enforcement of the domestic REM may result in changes to the registration and issuance of RECs under I-RECs and TIGR Standards, in order to avoid double countings. However, it remains to be seen if the government may allow for involvement of both Standards at some point in the future.

Figure 3.16: Total registered RE Capacity in the Philippines (MW) (as of July 2022)

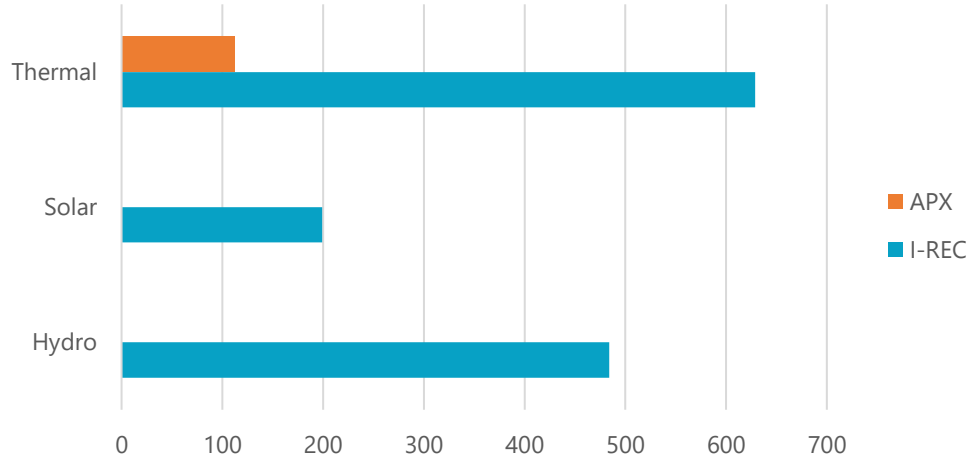
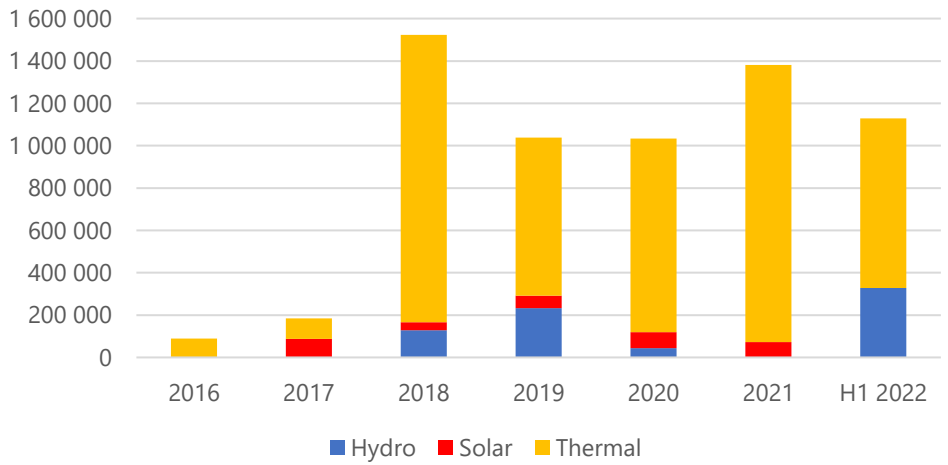


Figure 3.17: Total RECs Issued in the Philippines, 2016 – July 2022 (MWh)



RECs in Singapore

Electricity Market

- Singapore's electricity market underwent liberalisation in 1995 when the Singapore Power (SP) was established as a corporate entity to oversee the electricity and gas undertakings in Singapore, in addition to promote competition in the energy sector. The Singapore Electricity Pool (SEP) was subsequently launched to enable trading of wholesale electricity under a competitive wholesale market. Further liberalisation of the market saw the creation of the Energy Market Authority (EMA) in 2001 as an independent regulator of Singapore's electricity industry, ensuring secure and reliable electricity supply to domestic consumers at competitive prices.
- Such reforms in the electricity market open opportunities for consumers to switch into renewables to meet their electricity demands. In addition, growing environmental awareness has led to growing pressure on organisations to elevate the use of RECs in their facilities to meet their clean energy goals and reduce their carbon footprint.

Installed Capacity and Generation

- Singapore's renewable capacity comprises mainly solar PVs, which have grown to 0.44 GW in Q1 of 2021. Generation-wise, over 1 200 GWh of electricity was generated in 2019 from solar PVs alone.

Legal Framework

- The recently-launched Singapore Standard on the Code of Practice for Renewable Energy Certificates (SS 673) is aimed at providing a clear framework on improving the integrity of measurement, reporting and verification (MRV) for issuance and management of RECs, ranging from production to redemption.

Figure 3.18: Singapore electricity industry structure

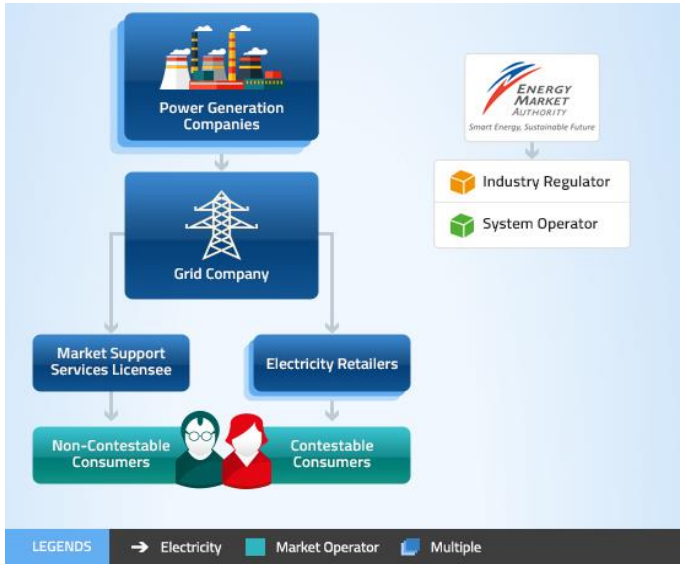
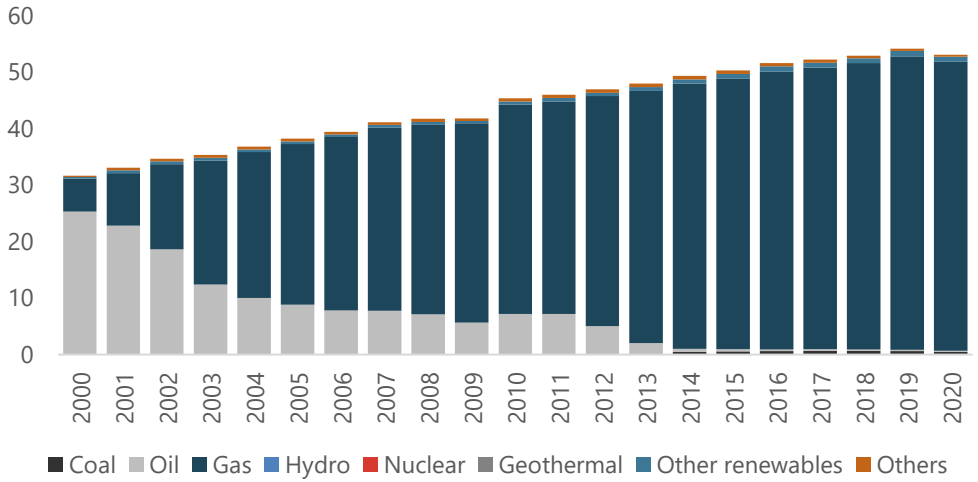


Figure 3.19: Singapore electricity generation, 2000-2020 (TWh)



RECs in Singapore

RECs Market

- Singapore has been adopting both I-RECs and TIGR standards since 2015 and 2013, respectively before the establishment of SS 673. Singapore Power Group (SGP) is the sole local issuer of I-RECs RECs, while T-RECs.ai manages the local issuance of TIGRs RECs. The fees imposed by SGP for the overall transaction of I-RECs's RECs are generally higher than those by T-RECs.ai. The launch of SS 673 provides opportunities to synchronise with existing I-RECs and TIGR standards, which signifies a clear step towards providing a greater credibility of RECs available in the market for consumers.

I-RECs Standard

- As of July 2022, over 32 MW of installations have been registered under the I-RECs standard in Singapore, majority of which is from solar PVs. These installations have generated and issued over 0.16 million RECs between 2015 and July 2022, of which half of these have been redeemed.

TIGR Standard

- TIGR standard has more installations than I-RECs in 2021, amassing over 745 MW of cumulative total installations. There were over 1 million RECs issued between 2015 and July 2022, accounting for 86% of the cumulative total issuance.

RECs Issues and Challenges

- RECs in Singapore is relatively a new market and is still developing. This opens opportunities for meeting the fast-growing demand from Singaporean consumers, especially those in the commercial entities.
- It should be noted that the SS 673 is not a legal document, rather a voluntary standard. In addition, SS 673 allows for both domestic and cross-border trading of RECs within the Southeast Asia region. Given absence of clear tracking rules in the standard, it may be difficult to prove RECs procurements from within the boundary.
- Limited land space in Singapore may limit the expansion of renewable energy projects, especially those of solar PVs. This could limit the issuance of domestic RECs.

Figure 3.20: Total registered RE Capacity in Singapore (MW) (as of July 2022)

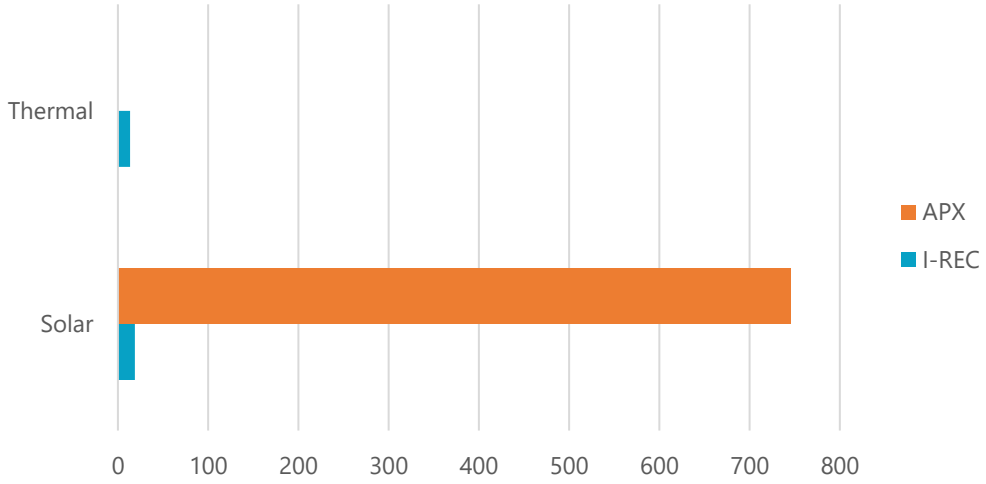
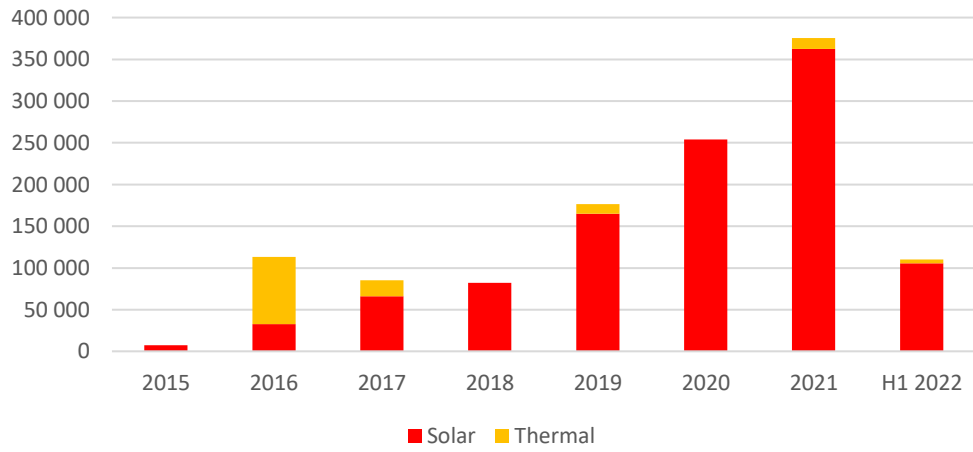


Figure 3.21: Total RECs Issued in Singapore, 2015 – July 2022 (MWh)



RECs in Thailand

Overview of Thailand Power System

- The power system in Thailand is a centralized system, with the Electricity Generation Authority of Thailand (EGAT) responsible for system operator and transmission operator. EGAT also has its own generations, as well as acts as a single buyer of the generated electricity from private power plants and imported electricity under power purchase agreements (PPAs).
- The total power generation of Thailand was 196 TWh in 2019. EGAT's own generation accounted for 26%, while the Independent Power Producers (IPPs) with generation capacity over 90 MW each accounted for 25%, Small Power Producers (SPPs) with 10-90 MW capacity accounted for 25%, with the remaining of generations by the Very Small Power Producers (VSPPs) and Independent Power Suppliers (IPSs) with capacity less than 10 MW each.
- Under current EGAT's Enhanced Single Buyer (ESB) model, 85% of total generated electricity is procured by EGAT and transmitted through EGAT's own transmission system. The remining generated power by SPPs, VSPPs, and IPSs are either connected directly to distribution grids or directly supplied to industrial consumers via private lines under approval from the authority.
- At distribution and retail levels, the two authorities namely the Provincial Electricity Authority (PEA) and Metropolitan Electricity Authority (MEA) are responsible as distribution system operators (DSOs) for provincial and Bangkok Metropolitan areas, respectively. PEA and MEA procure electricity mainly from EGAT and manage the retail sales of power to households and industrial consumers, with their own distribution grids.
- For policy and governance of power system, The National Energy Policy Committee (NEPC), chaired by the prime minister of Thailand, is responsible for power policy, as well as other energy policies, while the Energy Regulation Commission (ERC) is responsible for setting rules and regulations of the power system and power market.
- The development of Thailand power generation in TWh is shown in the bottom chart. Natural gas has been the most prominent source of energy for power generation, accounting for 62% in 2019, followed by coal at 18%. Modern renewables accounted for 18% mainly from solar and hydro power.

Figure 3.22: Thailand Power System

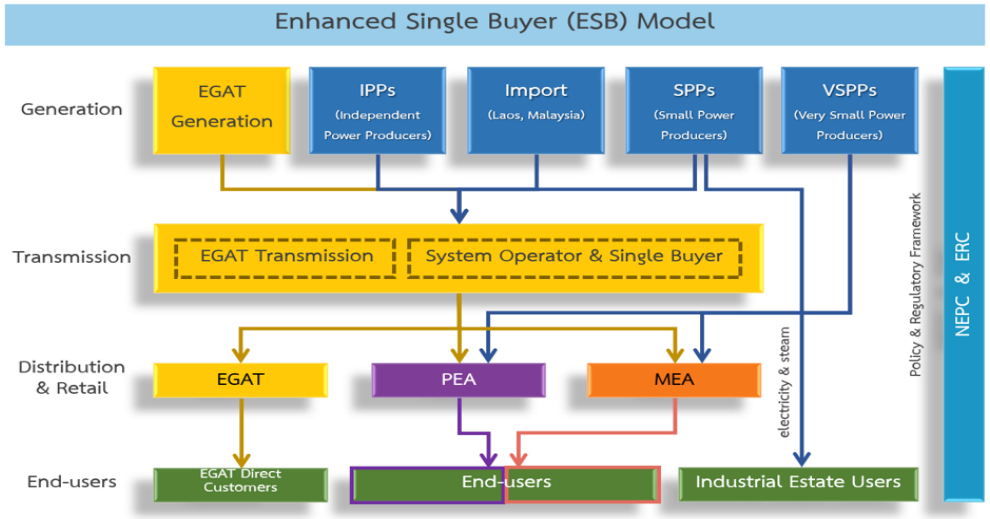
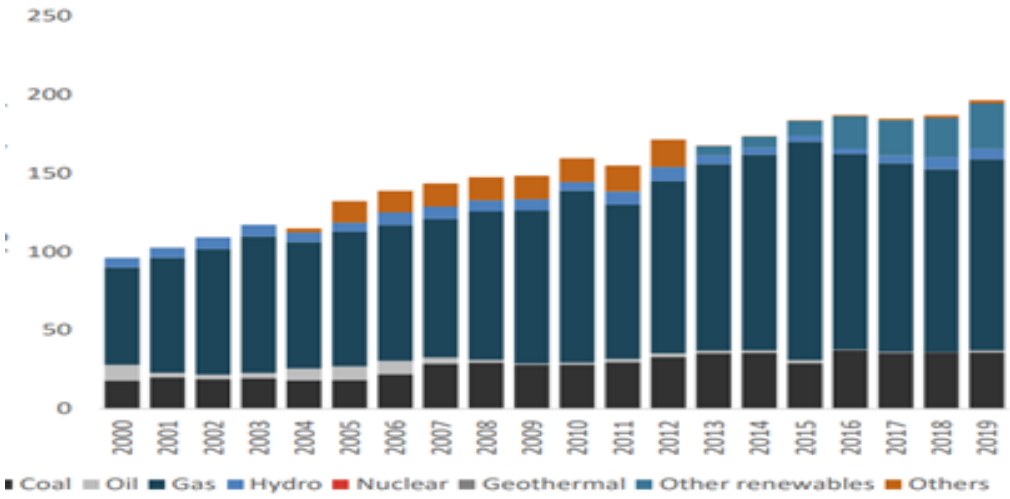


Chart credit: Petroleum Institute of Thailand

Figure 3.23: Thailand Generation by Fuel Type



Sources: www.eppo.go.th, APEC Energy Overview 2022

RECs in Thailand

Development of RECs in Thailand

Legal Framework of RECs

- The RECs activities in Thailand started in 2017. RECs activities are currently governed by relating authorities. There is not yet a single designated authority in charge of governing RECs.
- There are two ministries directly involving in RECs. The Ministry of Energy is responsible for RECs from energy perspective, while the Ministry of National Resources and Environment is responsible for RECs from decarbonization perspective.
- Under the Ministry of Energy, the National Energy Policy Council Act (1992) empowers the National Energy Policy Council (NEPC) to be responsible for energy policy, while Energy Industry Act (2007) empowers the Energy Regulator Commission (ERC) to be responsible for energy operations of both public and private sectors.

Development of RECs

- In terms of registration of renewable generation devices, Thailand has started to register its RE devices in 2015, as shown Figure 3.22. As of July 2022, Thailand has registered 3 934 MW of RE generation capacity to the RECs system, constituting from 34% solar, 30% hydro, 22% biomass (thermal), and 14% wind generation.
- Until July 2022, total 6 469 043 RECs have been issued as shown in Figure 3.23, constituting of 34% solar, 25% biomass, 24% wind, and 17% hydro, respectively.
- The development of RECs issuance is progressing in Thailand. It is anticipated that there will be total 4 million RECs issued in 2022, as compared with the actual 2.2 million RECs issued in the first two quarter.
- The increasing RECs issuances reflects increasing demand of renewable electricity consumers in Thailand, mainly from international companies who have committed to targets use of the renewables.

Figure 3.24: Registered RE Capacity in Thailand, 3 934 MW

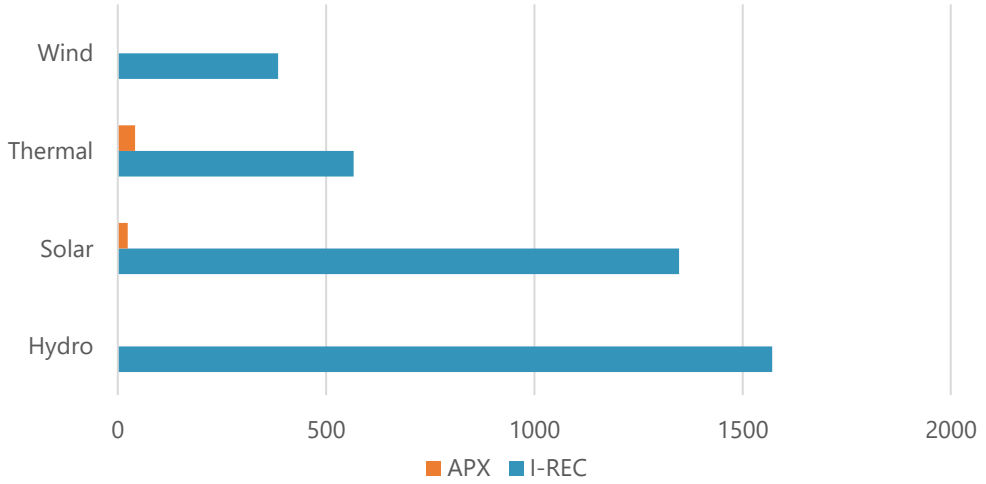
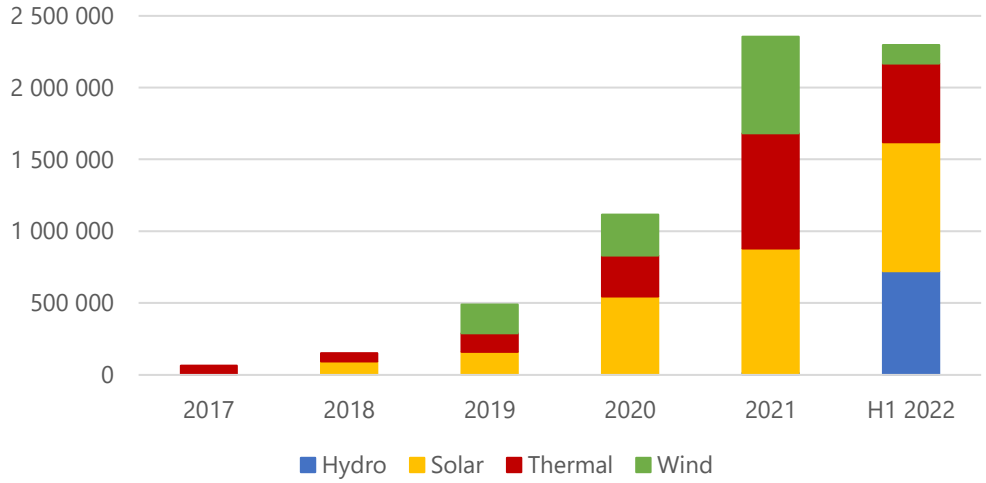


Figure 3.25: Accumulated RECs Issued in Thailand, 6 469 043 MWh



Sources: : I-RECs Report and TIGR Report

RECs in Thailand

Current RECs Market

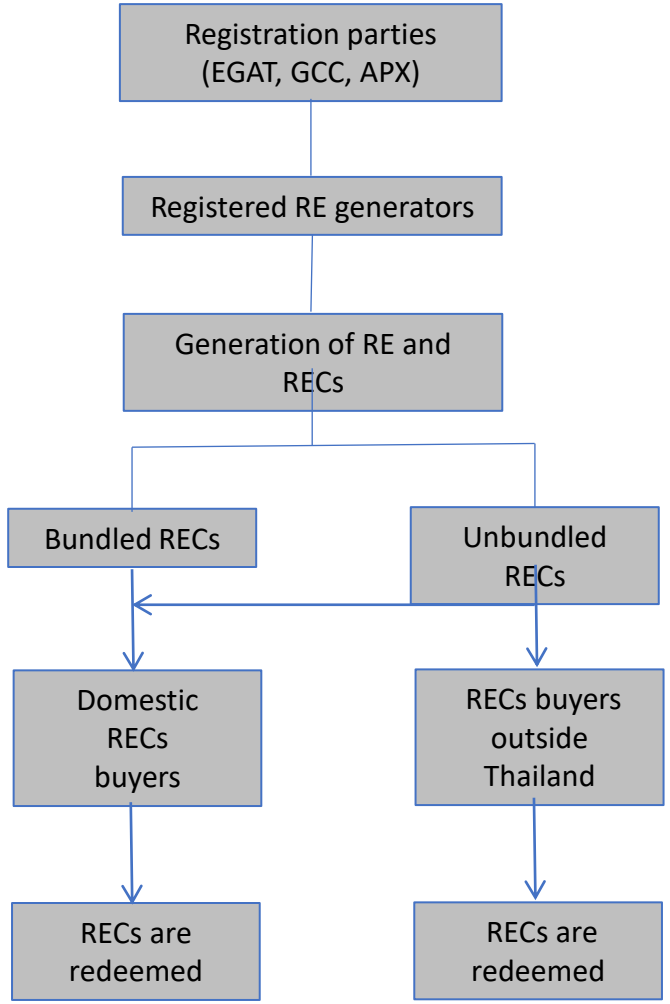
Market mechanism:

- In Thailand, registration of RE generation devices and issuance of RECs are managed by 3 service providers namely EGAT, GCC, and APX. EGAT and GCC provide services under license and standards of I-RECs, while APX provides services under Tradable Instrument for Global Renewables (TIGR) standards.
- In terms of device registration, EGAT has highest share of services at 58%, followed by GCC at 40% and APX at 2%, respectively.
- Regarding to RECs trading, there is not yet an established RECs trading platform in place in Thailand. Buyers buy RECs directly from RECs owners. Both bundled and unbundled RECs are available in Thai RECs market. Transactions of RECs are tracked and reported through the 2 systems from service providers, the I-RECs's and APX's tracking and reporting systems.
- Price of RECs is on negotiation basis. For example, the current posted price of bundled RECs from EGAT was 1.6 USD/MWh as of January 2022.

Government authorities involving in RECs

- RECs market in Thailand is currently under supervision from the two ministries. The Office of Natural Resources and Environment Policy and Planning under Ministry of Natural Resources and Environment oversees RECs from environmental and GHG management perspectives. The Energy Planning and Policy Office under Ministry of Energy oversees RECs from renewable energy perspective. At the same time, the Office of Energy Regulation Commission regulates RECs as one of the energy business.

Figure 3.26: Thailand RECs Market



RECs in Thailand

Challenges of Thailand RECs

- Dedicated authority and regulation of RECs market: RECs is currently under joint supervision of the Ministry of Natural Resources and Environment and Ministry of Energy. At the time of report there is no specific regulation for RECs market.
- Boundary of RECs trading: As RECs could be traded unbundled from the electricity, there is a possibility that a number of RECs are acquired and redeemed outside of Thailand, resulting in short of supply to local demands.
- RECs accounting systems: RECs are currently generated and traded under two systems. The lack of single accounting system makes it difficult to monitor and reconcile the RECs transactions to avoid the double-claim of RECs.
- Adequacy of RECs to serve increasing demand: It is estimated that RECs demand in 2022 for Thailand could reach 4 million RECs, as compared with 2.3 million RECs issued in 2021. There is a concern among RECs buyers that the current registered RE generation capacity is not sufficient to supply RE electricity and RECs to the increasing demand.
- Promoting other RE generators to participate in RECs market: According to EGAT, Thailand should promote higher registration of the RE devices in RECs market. Currently, the total 3 934 MW registered capacity represented for 51% of total renewable capacity of Thailand in 2021. Registration of new renewable capacity could help generate more RECs.

RECs in Viet Nam

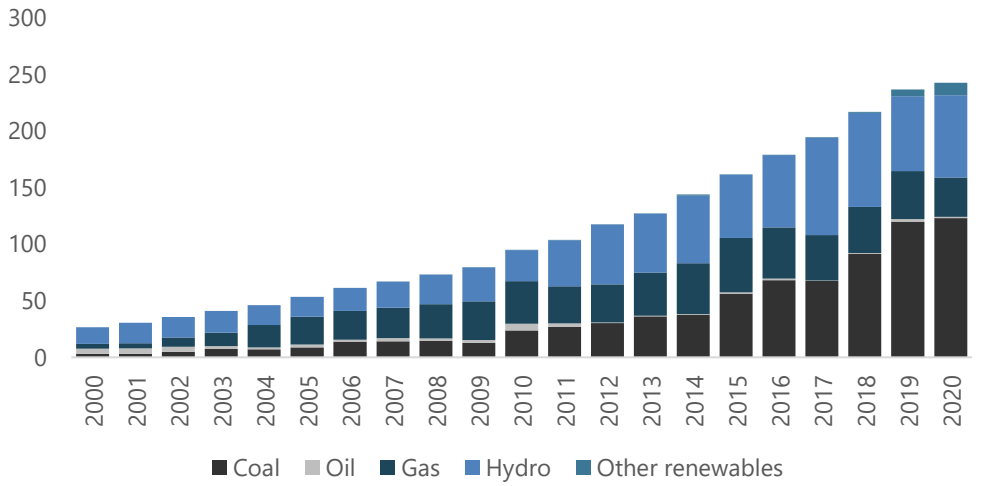
Overview of Viet Nam Power System

- Viet Nam's power sector is one of the highest growing electricity grids in the world. Although the electricity grid is interconnected across the whole economy, electricity sources are unbalanced across the economy. Coal-fired power plants are mainly located in the north, while gas-fired power plants are located in the south.
- Viet Nam Electricity (EVN) is a state-owned group that has significant control over power transmission and distribution systems, owning approximately 54% of the total power installed capacity in 2019 (EVN, 2021). Viet Nam's power sector has one of the highest growth rates in electricity grids worldwide, with a power generation growth rate of 10% per annum in 2010–2020 (EGEDA, 2022).
- Viet Nam generated 243 terawatt hours (TWh) of electricity in 2020, an increase of 2.5% from the previous year. Thermal power generation (coal, oil and gas) accounted for two-thirds of the total generation mix, followed by hydro (30%). Biomass and others constituted less than 5% of the total generation mix (EGEDA, 2022).
- Viet Nam's power sector is increasingly reliant on coal. Over half of the electricity generation was attributable to coal in 2020. The increase resulted from the newly constructed coal-fired power plants (Vinh Tan 1, Vinh Tan 4, Thai Binh and Duyen Hai 3 expansion) that began operating in 2018–2019.
- Hydropower, including medium and large-scale hydropower sources (about 20 gigawatt [GW] capacity potential), has been almost fully utilised. Small hydropower resources have a total potential of about 6.7 GW, with more than 3 GW already in operation.
- Hydropower plants are close to fully utilising, contributing around 30% of the total electricity production in 2020. Other renewables, including small hydropower, biomass, solar, and wind power, accounted for 4.5% of the total generation mix.
- Before 2018, only a small amount of solar and wind capacity was installed in Viet Nam. Thanks to the FiT mechanism, solar installed capacity increased substantially from 8 MW in 2017 to almost 16 600 MW in 2020 (EVN, 2021). Up to the end of 2021, the total solar and wind capacities together reached 20 600 MW, accounting for 27% of the total installed generation capacity.

Table 3.1: Installed Capacity by Fuel Type

Power source	2019		2020	
	(MW)	(%)	(MW)	(%)
Hydropower	20,283	36.81%	20,774	29.98%
Coal fired	19,744	35.83%	21,554	31.10%
Gas fired + oil fired	8,857	16.07%	8,858	12.78%
Wind	369	0.67%	518	0.75%
Solar	4,669	8.47%	8,871	12.80%
Rooftop solar	320	0.58%	7,785	11.23%
Biomass	293	0.53%	365	0.53%
Imported	572	1.04%	572	0.83%
Total	**55,107**	**100%**	**69,297**	**100%**

Figure 3.27: Electricity generation (TWh)



Sources: Source: EVN (2021), EGEDA (2022)

RECs in Viet Nam

Development of RECs in Viet Nam

Legal Framework

- Viet Nam has been using the I-RECs standard since 2014 and APX's TIGR Registry since 2016, where project developers can now register under these RECs tracking systems.
- As increasing requirements for RECs, recent renewable energy projects are mostly registered under either the I-RECs or TIGR system.
- However, legal framework and supported policies for RECs are yet to be developed. Most of the policies are related to renewable energy (RE) development. The Renewable Energy Development Strategy to 2030 with a vision to 2050 (REDS), implemented in November 2015, are the key policies for renewable energy development.

Development of RECs

- Issuer: The Issuer may be a government agency or an independent entity preferably acting with the recognition and support of the government authorities. The Issuer controls the registration of generating facilities, oversees and verifies the reporting of generation data, and issues RECs based on reported generation. The Green Certificates Company (GCC) is the unique RECs issuer in Viet Nam.
- Registrant: Power Generation Corporation (GENCO) must be registered with the RECs tracking system before RECs can be issued. GENCOs are able to create an account in a registry, register their production stations, and request RECs issuance, either by themselves or through the use of a third-party agent. In I-RECs terminology, the individual or organization tasked with registering the GENCO and requesting RECs issuance is called the "Registrant" and in TIGRs terminology they are referred to as the asset owner. In the I-RECs system the issuer is responsible for approving the requests to issue RECs, and in TIGRs system APX plays this role with support from a qualified reporting entity.
- RECs Buyer: RECs Buyers can be public or private entities. Buyers can approach GENCO directly or buy RECs via brokers. Sellers are also likely to be able to access a much wider market of interested buyers through using a RECs broker. In Viet Nam, common RECs Buyers include companies with international RE commitments, such as RE100, SBTi, the UN Fashion Industry Charter for Climate Action, and others (Google, Microsoft, Citi Bank, New Balance, Apple, H&M, Nike, General Motor, and others).

Figure 3.28: Registered RE Capacity in Viet Nam, 2 945 MW

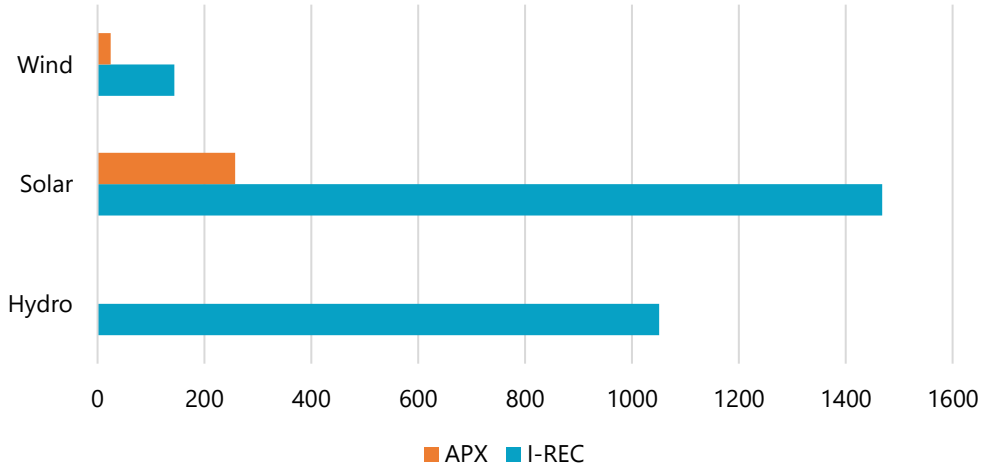
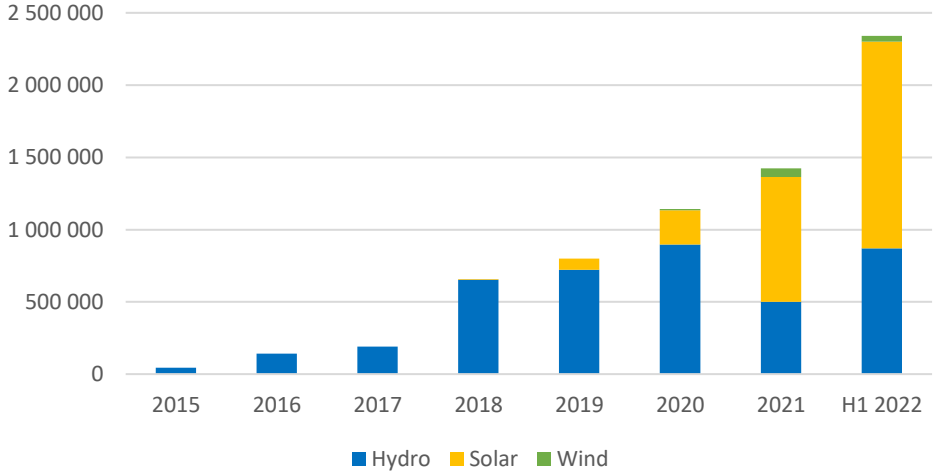


Figure 3.29: Accumulated RECs issued-Viet Nam, 6 748 826 MWh



Sources: : I-RECs Report and TIGR Report

RECs in Viet Nam

Current Viet Nam RECs Market

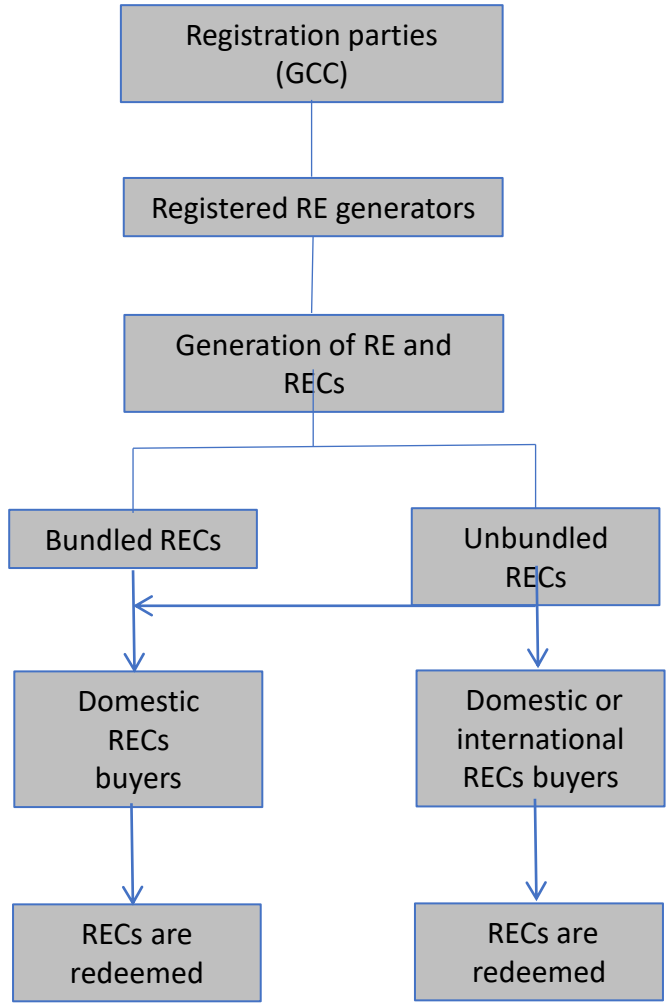
Market mechanism

- In Viet Nam, the Government has issued several Feed-in Tariff (FiT) mechanisms to support investment in RE. These FiTs range from 7.03 US cents/kWh to 10.05 US cents/kWh, depending on the RE source. However, the FiT decision issued by the Vietnamese government does not mention how the environmental attributes of the generated electricity are to be treated. Therefore, project owners are currently free to sell unbundled RECs to clients in domestic or international markets (USAID).
- Most solar and wind registered as RECs in recent years are in the Feed-in-Tariff program.
- The USAID estimated that the size of the current Viet Nam RECs market is 89 million RECs (2020 data). According to the Renewable Energy Development Strategy, Viet Nam will increase the total RE electricity production to 186 TWh (32%) by 2030 and 452 TWh (43%) by 2050.
- Demands for RECs are voluntary based primarily from RE100 or Science-Based Targets (SBT) firms that have loaded in Viet Nam, brokers and traders active in Asia.
- The total combined international demand for RE from the RE100 firms is above 220 TWh per year, with a high concentration of load in Asia, where supply chains are located.
- Recent figures from RE100 show that 43% of the green energy sourced globally by RE100 members came from unbundled renewable attribute Certificates purchases. If RE100 members combined to form an economy in 2018, they would have been the 21st largest electricity consumer in the world with a total consumption of 228 terawatt-hours (TWh). Among 195 global companies that endorse RE100 across worldwide operations, 38 member companies have operations in Viet Nam.

Government authorities involved in RECs

- RECs market in Viet Nam is currently under the supervision of two ministries, namely: The Ministry of Natural Resources and Environment (MONRE) and the Ministry of Industry and Trade (MOIT).
- MONRE is the lead Ministry responsible for the implementation of the Proposed National Inventory System as well as for the formation of a domestic carbon market and participation in the international carbon market.
- MOIT is responsible for the energy sector, including renewable energy electricity generation.

Figure 3.30: Viet Nam RECs Market



Notes: 89 million RECs are the theoretical potential based on the total generated electricity from RE source (i.e. hydro, wind, solar and biomass) including hydropower project with capacity over 30 MW. If excluding more than 30 MW hydropower plants, the potential RECs would be 38.6 million RECss·

RECs in Viet Nam

- There is currently no designated domestic organization to issue credits under a RECs system in Viet Nam. Nevertheless, both existing international registries operating in Viet Nam have interim entities that can be used to issue RECs while the Government of Viet Nam considers which domestic entity to appoint.

Challenges of Viet Nam RECs

- In Viet Nam, a nascent RECs market already exists with support from international organizations such as I-RECs, TIGRs, and GCC. However, Viet Nam does not have its own RECs tracking system and lacks a legal framework to manage the RECs activities.
- There is no designated domestic organization that plays a role as domestic RECs issuer in Viet Nam.
- Double counting occurred for RECs and Carbon credits, but lack of regulations or official documents to regulate this issue.
- Inconsistency policies and subsidies from the government are obstacles to boosting up the deployment of RE generation, finance for clean energy, and scaling up foreign investment in renewable energy.
- FiT 2 has been terminated, FiT 3 or other similar policy has not been enforced yet, causing the delay of RE projects

Future direction

- Viet Nam government needs to select to develop its own RECs system or use the existing system or adopt a hybrid approach.
- Viet Nam should take into account domestic RECs issuers.
- Need regulations to avoid double counting issues including double issuance, double use, and double claiming.
- RE policies and subsidies from the government should be implemented consistently for mid and long terms to encourage the investors.
- Government must be ensured that there is no interval between old and new policies.

Section 4
Summary and Findings

Comparison of 6 APEC Southeast Asia Economies

Table 4.1: Comparison of 6 APEC Southeast Asia Economies

	Indonesia	Malaysia	Philippines	Singapore	Thailand	Viet Nam
Types of market and certificates system	Voluntary market with RECs	Voluntary market with RECs	Voluntary market with RECs	Voluntary market with RECs	Voluntary market with RECs	Voluntary market with RECs
Cumulative registered RE capacity (total 12.8 GW) as of 1H 2022	1.5 GW	2.3 GW	1.4 MW	0.8 GW	3.9 GW	2.9 GW
Cumulative number of issued RECs (2015-H1 2022) (total 29.1 TWh)	4.3 TWh	4.0 TWh	6.3 TWh	1.2 TWh	6.5 TWh	6.8 TWh
RECs certification and tracking system	I-RECs, TIGR	mGATs, I-RECs, TIGR	I-RECs, TIGR	I-RECs, TIGR	I-RECs, TIGR	I-RECs, TIGR
RECs issuer	GCC, APX	GCC, APX	GCC, APX	GCC, APX, SPG	GCC, APX, EGAT	GCC, APX
Trading platform	GCC and PLN (APX-based platforms)	mGATs platform GCC and APX-based platforms	PREMS GCC and APX-based platforms	SPG-based platform	EGAT GCC and APX-based platforms	GCC and APX-based platforms
RECs prices	IDR 35 000/MWh (only from PLN platform)	0.037 MYR/kWh (only for mGATs platform)	N/A	SGD 15 – 25 (USD 11.3 – 18.8)	Market-based	Market-based
Governance body	N/A	NRECC (regulates GET pricing for mGATS platform only)	Department of Energy	Energy Market Authority	MoE and MoNRE (jointly)	N/A

Key Summary of RECs in APEC Southeast Asia Economies

1. REC markets in APEC southeast Asia economies are relatively new and are growing rapidly. The markets in APEC southeast Asia were initially developed to respond to the demand for RECs from commercial and industrial electricity consumers that wanted to demonstrate voluntarily their decarbonization efforts.
2. The RECs markets currently conform with the I-RECs Standard and TIGRs registry, which are accepted internationally. Nevertheless, some economies plan to develop their own registries to further facilitate and regulate the RECs markets to meet economy specific goals.
3. Most APEC southeast Asia economies have not yet established a clear legal framework or guidance governing the RECs market.
4. In several economies, RECs come from renewable generation facilities which have already been in operation for more than ten years or are enrolled in a feed-in tariff program, raising the issues of the role of RECs in boosting new investment in renewable generation as well as the legitimacy of those generators earning additional income.
5. There is evidence of REC ownership disputes between Independent Power Producers and utilities for renewable power sold under Power Purchase Agreements that do not explicitly deal with the REC ownership issue.
6. Several economies are working to limit cross-border REC transactions. Currently, unbundled RECs in APEC southeast Asia economies can be traded across the economy borders but there is concern that this practice doesn't serve the needs of the economies that are producing renewable energy.

Findings (1 of 2)

1. **With a properly designed framework, coexistent compliance and voluntary RECs markets can accelerate RE investments.**

   Accelerated investments in RE in advanced markets are primarily driven by regulation of large-scale utilities through specific RE generation targets. On the other hand, the voluntary markets can encourage additional investment in small scale RE generation and promote consumption of RE electricity by unregulated consumers. However, the concept needs to be evaluated and studied, especially the impact on overall electricity prices to end-users.

2. **Dedicated legal framework, legislation, and governance body for RECs are crucial and should be a priority in establishing an effective RECs market**.

   As the RECs market evolves, the market mechanism becomes increasingly complex to serve different specific purposes. For example, different market designs and rules are needed if/when the concept of compliance and voluntary markets is introduced. Establishing a domestic governing body is crucial to serving as an effective regulatory function, as well as official registration and verification of RECs to ensure RECs integrity and credibility. Moreover, a dedicated legal framework for RECs is essential to support the development and sustainability of the RECs markets.

   In advanced REC markets, specific market designs and rules are introduced by the regulatory body to facilitate the transaction of RECs in order to promote RE for specific customer classes. For example, in the US's Utility Green Pricing programme the utility company is allowed to procure and redeem the RECs on behalf of small household REC customers to lessen the administrative burden to those consumers. Similarly, under the US Community Aggregation program, REC aggregators are allowed to collect demands from small and medium REC consumers to bargain with REC suppliers for more attractive REC prices, thereby incentivizing more REC consumers and enabling more liquidity in the RECs markets. In Japan's REC market, the J-Credit Certificates emphasize the attribute of CO_2 to reduce those emissions.

3. **Domestic RECs trading platforms and harmonised standards are essential tools to facilitate RECs transactions, ensure integrity, and prevent double-counting.**

   Domestic RECs trading platform serves as a tool to facilitate REC transactions, as well as to monitor market performances and prevent the abuse of RECs. Efficient market rules should be established to impose regulations and standards of RECs attributes and transactions. Moreover, in economies where there is high demand for RECs, prices can be substantial and there are risks of abuse. A robust accounting system and the existence of an independent auditor is needed to detect and prevent such abuse. The regulatory body must be able to impose market rules and penalties to prevent the misuse of REC transactions. Southeast Asia economies should consider creating a domestic RECs trading platform to serve as a focal point for policies, regulations and standards.

Findings (2 of 2)

4. **RECs market should encourage additional investment in renewable energy generation capacity.**

   Most developed RECs markets, as outlined in this report (the US, Australia, and Japan), are on course to develop the RECs market as a tool to provide financial incentives for new renewable energy investments. The US is working with financial institutions to evaluate the possibility of using long-term purchase contracts of RECs to finance new RE projects. In Japan, the RECs additionality attribute concept is imposed on the certificates to prioritise and add value to RECs issued from new RE generation investments as opposed to existing facilities. China is considering using the certificates market as an incentive for RE investment to lessen the burden of government support in FiT programmes.

   Currently, most APEC southeast Asia economies mainly issue RECs from existing brownfield RE generators. Therefore, southeast Asia economies could evaluate the advantages and disadvantages of imposing an additionality requirement. One possibility is to allow the brownfield RECs in the initial stage of RECs market development and impose the additionality requirements later when the RECs market is well established.

5. **Clear ownership of RECs for existing independent RE generators should be incorporated into the new and existing electricity generation legislation.**

   The ownership of RECs can be disputed under the existing electricity supply framework of southeast Asia economies as the electricity generated by existing independent RE generators is procured and secured by the utility under the Power Purchase Agreements. If RECs becomes an additional revenue stream to the existing independent RE generators, it could undermine the effectiveness of RECs in encouraging new investments in RE.

6. **The interaction of RECs transactions across six southeast Asia economies should be studied and evaluated.**

   Discussion of the interregional RECs market among southeast Asia economies could be initiated. The benefit of the interregional RECs market could be assessed in conjunction with the ASEAN Power Grid programme.

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