



# Decarbonization through renewable energy

Understanding Asia Pacific's Corporate Power  
Purchase Agreement landscape

KPMG Asia Pacific

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November 2022

# Foreword

As more and more countries respond to climate change and announce their commitments to Net Zero, supporting mechanisms and measures continue to bloom. Renewable energy, one of the major components to achieve decarbonization targets, has started to become mainstream worldwide.

In the Asia Pacific region, many governments are already pushing for increased renewables to reduce greenhouse gas emissions and drive energy transformation, resulting in a more friendly environment for the development of the renewable industry. In addition to the Net Zero targets at a national level, renewable electricity procurement at the corporate level is a vital action to take for walking the talk on commitments of RE100<sup>1</sup> and science-based targets.

The need for corporate renewable power in the Asia Pacific region is growing rapidly due to the global supply chain requirements and local carbon reduction regulations. However, many obstacles are yet to be overcome in order to create a robust demand and supply market. Our report on the Corporate Power Purchase Agreement (CPPA) landscape in Asia Pacific, aims to provide a clear view on the CPPA market, and summarize the opportunities and challenges in the current renewable energy market.

The impact of climate change is beyond our imagination. The cost of inaction is even higher. Asia Pacific is one of the most vulnerable regions to climate change on this planet. KPMG is dedicated to support our clients on their mitigation and adaptation strategies in this region. This report will provide Asia Pacific businesses a holistic and comprehensive overview on CPPA in the region, insight and assistance to decision makers in forming their strategies on renewable energy procurement.

We have a responsibility to work together towards a common, sustainable future. While KPMG Taiwan has led the development of this report, all our member firms are committed to our global ESG strategy. KPMG professionals assist clients in fulfilling their purpose and achieving their ESG goals.

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<sup>1</sup> RE100 is the global corporate renewable energy initiative bringing together hundreds of large and ambitious businesses committed to 100% renewable electricity.  
Source: <https://www.there100.org/>

**Niven Huang**  
ESG Leader for KPMG Asia Pacific  
KPMG in Taiwan





“

Corporate procurement is a new growth driver for renewable energy in Asia-Pacific. More and more international corporations are joining initiative RE100 and making a commitment to achieve 100% renewable energy no later than 2050. corporate decarbonization via corporate PPAs becomes an opportunity to gain a competitive advantage and secure ESG goal.

”

Corporate Power Purchase Agreement (CPPA) schemes offer an effective way to help decarbonize countries' power consumption not only by increasing corporate investment in the renewable energy sector, but also by providing large power consumers an effective tool to meet their sustainability commitments. With dedicated commitment and advocacy from corporations, CPPA has the potential to accelerate energy transition across the Asia Pacific region.

However, every market in this region has varying levels of maturity in electricity market liberalization and regulatory framework, which makes green energy procurement even more challenging. According to the RE100 annual report in 2020, 42 percent of its new members are from the Asia Pacific region.

Corporations are looking for ways to power their regional operations, supply chains and product life cycle with clean energy. They have also identified Asia Pacific region markets such as China, Japan, South Korea, Taiwan, Singapore and Indonesia as the most challenging markets for achieving 100 percent renewable electricity.

This report aims to give a clear view on the CPPA market in the region. It demonstrates the development in the region, renewable energy targets and policies of key international corporations in different markets. It provides executive strategies on green energy procurement in Asia Pacific for enterprises to use as a reference.

Special acknowledgment to KPMG Taiwan for taking the lead in making this report possible.

**Steven Chen**

Global Infrastructure Power Sector Lead  
(focusing on current CPPA market in Asia Pacific)



We now live in a world where achieving Net Zero is probably one of our age's most important social, political and economic objectives. Nearly every country has ratified the 2015 Paris Agreement on Climate Change, which calls for keeping the global temperature rise to 1.5 degrees Celsius above preindustrial era levels. However, if we continue to increase carbon emissions, temperatures will continue to rise to levels threatening our planet's future. Therefore many countries and corporations are committing to achieving net zero emissions within a shorter time frame. The key date was 2050, but with growing concern about the acceleration of climate change, progress needs to be made between now and 2030.

As corporations account for approximately two-thirds of the world's electricity end-use consumption, they will likely play a vital role in decarbonizing global economies by 2050. Corporate Power Purchase Agreements (CPPAs) have emerged as a pivotal solution to enable corporations to reduce their scope 2 carbon emissions concerning electricity consumption. As a result, we have been witnessing dramatic growth in the use of CPPAs in recent years.

In addition, as a result of the conflict in Ukraine, the question of energy security and affordability has risen to the top of the agenda. This has resulted in two important outcomes – Firstly, corporates are now much more willing to enter into long-term corporate PPAs as it offers a hedge against increasing energy prices. Secondly, the EU and other Governments have aligned energy security with clean energy solutions, which will help accelerate renewables deployment globally.

Therefore this report on the Asia Pacific's CPPA landscape is so important and timely. The region is critical not just for the companies headquartered in the region but also for many Asia Pacific companies that form part of global supply chains. For international corporations to fully decarbonize and meet their Net Zero objectives, supply chains must also be decarbonized to reduce scope 3 emissions. One of the more effective ways of doing this is using CPPAs. This report provides a detailed review of the landscape in all key geographies across the Asia Pacific region. It highlights the opportunities and some of the fundamental barriers that exist today. As the report points out, different rates of progress have been made in the regulatory environment to enable CPPAs across the various jurisdictions. However, the direction of travel is very much in the right direction.

It is also important to remember that removing barriers to the adoption of CPPAs brings more comprehensive economic benefits when eliminating unnecessary regulatory barriers, including:

- security and independence of supply, which is becoming increasingly relevant given the growing number of threats to energy supplies
- financial benefits for corporations given the potential to avail of lower cost of renewable energy
- increased economic activity across supply chains as any CPPA solution typically involves a new build of renewable power generation
- It is an increasingly vital dimension to help secure foreign direct investment as many global corporations will not invest without access to clean energy solutions for their local operations
- It will assist jurisdictions in meeting their specific climate targets

Hopefully, this report will encourage many other global corporations to embrace the significant opportunities to avail of CPPAs throughout the region as part of their own Net Zero journey.

**Michael Hayes**  
Global Head of Renewables  
(focusing on CPPA global impact and trends)





Corporate PPAs play a role to ensure a long term purchaser of power for renewables, and under the right terms with the right entities, can support financing from both an equity and debt reach. ”

**Sally Torgoman**

Partner  
KPMG Australia



We have 70 RE100 member companies, and 247 companies, 36 with net zero target, taking action in SBT as of May 2022. While the government is targeting 36-38% of renewable energy in FY2030, PPA and/or procuring green energy is one of the most effective strategic option to reduce GHG emissions. ”

**Junichi Adachi**

Partner  
KPMG in Japan



Corporate demand for clean electricity has huge potential to drive investment in renewables and accelerate the global energy transformation. While most companies actively sourcing for clean energy are head-quartered in Europe and North America, we have started seeing Chinese companies joining force given their commitment or targets set for climate goals. Corporate Power Purchase Agreements are a major response to achieving 100% renewable energy procurement. However, as most emerging and developing markets have not established direct power purchase contracting mechanism or are still in the pilot stage, it is critical that relevant stakeholders including corporates, regulators, renewable players, state grid companies, etc. work together, to enable market liberalisation, adjust regulatory framework so as to stimulate a rapid scale-up of corporate sourcing, responding to the huge demand for decarbonisation. ”

**Wei Lin**

Partner  
KPMG China



The pressures from government, customers, investors and other groups on reducing carbon emissions of corporates push companies to seek effective tools to achieve their reduction goals. ”

**Lee, Dong-Seok Derek**

PARTNER  
KPMG in Korea

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# Highlights—an Asia Pacific view on CPPAs



CPPA market in Asia Pacific is not fully developed but showing significant potential for growth.

As of 2020, ca., 12 percent of cumulative CPPA volume was originated in Asia Pacific, led by India and Australia. The Asia Pacific market has been a challenging market for businesses to source renewable electricity due to limited availability, regulatory complexity and high costs, but it also offers the biggest opportunities for clean energy investment and growth.



Evolving regulatory framework to implement changes to the CPPA framework.

Taiwan, South Korea, the Philippines and Vietnam now stand out for regulatory reforms to enable CPPAs. In Taiwan, the liberalization of the renewable energy market allows corporations to purchase green energy from the generators. South Korea opened its renewable energy market to third-party PPAs this year with state-owned utility KEPCO as an intermediary. Vietnam is piloting synthetic direct PPA mechanisms for renewable energy projects at a scale from 400MW to 1,000MW to be implemented from 2021 to 2023. In the Philippines, the implementation of a green energy option program offers choice for large power users to source their own electricity from renewables.



The phase-out of generous feed-in-tariff (FiT) scheme is expected to increase the appetite for CPPAs.

In many Asian markets such as Japan and Vietnam, renewable energy projects have benefited from high FiT, making CPPA a less attractive option then. However, as FiT rate starts to decline, markets are shifting to auction mechanism. This has resulted in CPPA becoming an alternative for developers to secure fixed.



Economics and net-metering are driving the rooftop solar installation and increasing adoption of on-site PPA.

With the falling costs, rooftop solar can provide cheap and clean power for the corporate buyers. In some markets, renewable energy developers are able to offer 15-30 percent discount to the grid tariff for commercial and industrial users. Enabling policy such as net-metering also provides fertile ground for rooftop solar growth.



Growing company interest in CPPA across Asia to achieve sustainability pledge.

The RE100 membership continues to grow and diversify—with 42 percent of new members coming from the Asia Pacific region. Multinational corporations with sustainability commitments are looking into greening their Asian supply chain. In 2019, Google signed its first solar PPA in Taiwan from a 10MW PV installation to power its data center. In Singapore, technological firms such as Microsoft and Facebook are actively procuring renewable energy, ranging from 50MW to 100MW.



Asia Pacific progressing towards a low-carbon energy future.

Many countries have set decarbonization targets to reduce greenhouse gas emissions and transition from fossil fuel to low carbon alternatives. Energy suppliers and generators are expected to continue to develop renewable energy products and services that are suitable for all types of businesses.

# Common CPPA structures

## On-site PPA

Description	Benefits	Considerations
<ul style="list-style-type: none"> <li>In an 'on-site' or 'behind-the-meter' PPA, the renewable asset is built on the premises of the consumer and has a direct wire connection to the facility.</li> <li>Renewable assets can be customized to suit the load profile of the consumer, both in terms of the facility's size (surplus power can be fed to the grid) and in the daily profile.</li> <li>A utility or developer can provide shaping services by supplying residual demand requirements or purchasing surplus power.</li> </ul>	<ul style="list-style-type: none"> <li>Direct link generation/load with low interconnection costs.</li> <li>Potential demand charges reduction.</li> <li>Easy to integrate into sourcing portfolio.</li> </ul>	<ul style="list-style-type: none"> <li>Need roof or land space availability and permits.</li> <li>CAPEX burden and (often) no economies of scale.</li> <li>Supply limited to one site/location.</li> </ul>

## Direct PPA (off-site)

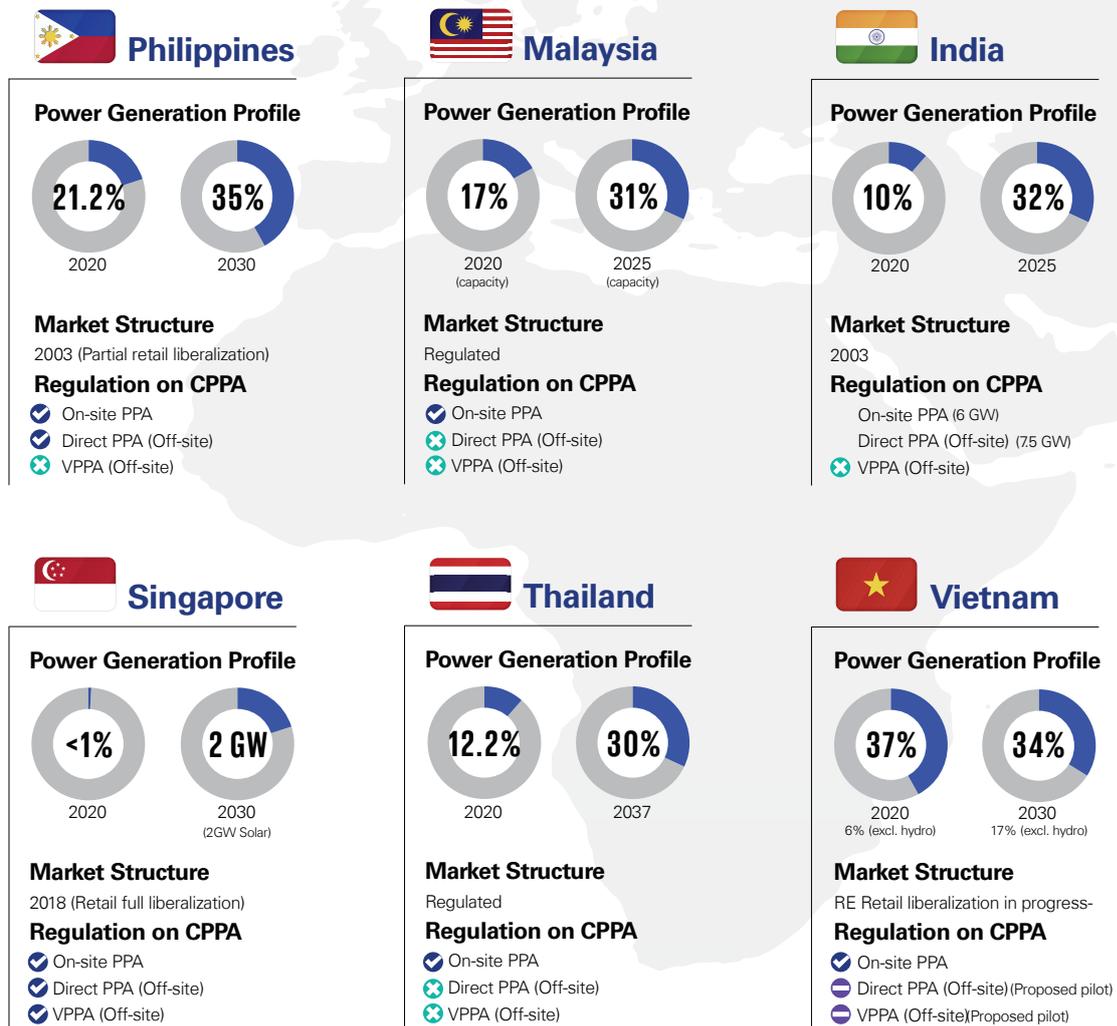
Description	Benefits	Considerations
<ul style="list-style-type: none"> <li>Under a physical PPA, the renewable asset is located off-site, but physical delivery of the power occurs.</li> <li>A utility 'sleeves' the renewable power to the consumer via the grid.</li> <li>Corporations can form a consortium of buyers to contract the electricity from a single renewable.</li> </ul>	<ul style="list-style-type: none"> <li>Hedge against market power price volatility (if fixed price PPA).</li> <li>Project optimization due to larger assets (scale effects).</li> <li>Potential for multi-site supply.</li> </ul>	<ul style="list-style-type: none"> <li>Require deregulated retail market/wheeling.</li> <li>Project must be located in the same network as load.</li> <li>Potential fees for sleeving/wheeling.</li> </ul>

## Virtual PPA (off-site)

Description	Benefits	Considerations
<ul style="list-style-type: none"> <li>The consumer buys power from a utility at local retail price.</li> <li>The consumer also enters into a separate contract with a renewable installation to settle the difference between the wholesale price and a contractual strike price allowing the consumer to (partially) hedge its power purchase price.</li> <li>There is no physical transmission of power between the producer and the off-taker allowing the PPA to be signed across national or state borders.</li> </ul>	<ul style="list-style-type: none"> <li>No location/network limit.</li> <li>No incremental sleeving/wheeling fees.</li> <li>Hedge against market power price volatility.</li> </ul>	<ul style="list-style-type: none"> <li>Larger potential for accounting impact.</li> <li>Basis risk when reference price differs from retail price.</li> <li>No saving for network charges.</li> </ul>

# Asia Pacific CPPA market overview

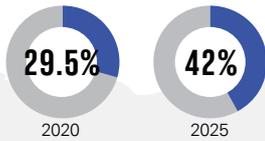
- One of the drivers for CPPA is the government push for increased renewable energy. Though the power generation mix of most Asian countries is dominated by fossil fuel, the deployment of renewable energy has been accelerated in some jurisdictions through a series of policy mechanisms, such as feed-in-tariff, auction, and renewable energy certificates.
- Many Asian markets operate under the regulated power market in which the state-owned utilities have monopoly over the power supply. However, Taiwan, South Korea, the Philippines and Vietnam have carried out regulatory reforms to enable off-site PPAs.
- In terms of procurement options, on-site solar PPAs are the most common form and continue to grow due to the competitiveness against grid supply. However, there is potential for increasing direct PPA or virtual PPA as the market liberalizes.





### China

#### Power Generation Profile



#### Market Structure

Retail liberalization in progress

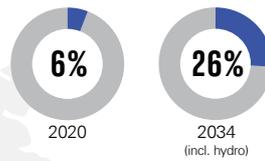
#### Regulation on CPPA

- On-site PPA
- Direct PPA (Off-site) (Pilot stage)
- VPPA (Off-site)



### South Korea

#### Power Generation Profile



#### Market Structure

2021 (RE Retail)

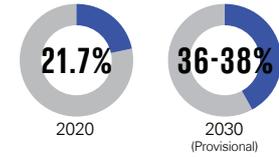
#### Regulation on CPPA

- On-site PPA
- Direct PPA (Off-site)
- VPPA (Off-site)



### Japan

#### Power Generation Profile



#### Market Structure

2016 (Retail full liberalization)

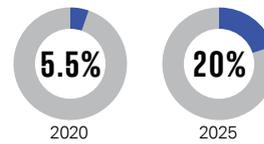
#### Regulation on CPPA

- On-site PPA
- Direct PPA (Off-site) (Very limited)
- VPPA (Off-site) (Under trial)



### Taiwan

#### Power Generation Profile



#### Market Structure

2017 (RE Retail)

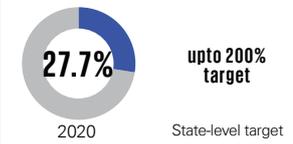
#### Regulation on CPPA

- On-site PPA
- Direct PPA (Off-site)
- VPPA (Off-site)



### Australia

#### Power Generation Profile



#### Market Structure

2008 (Retail full liberalization)

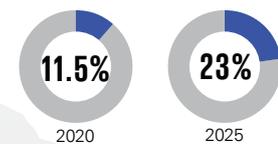
#### Regulation on CPPA

- On-site PPA
- Direct PPA (Off-site)
- VPPA (Off-site)



### Indonesia

#### Power Generation Profile

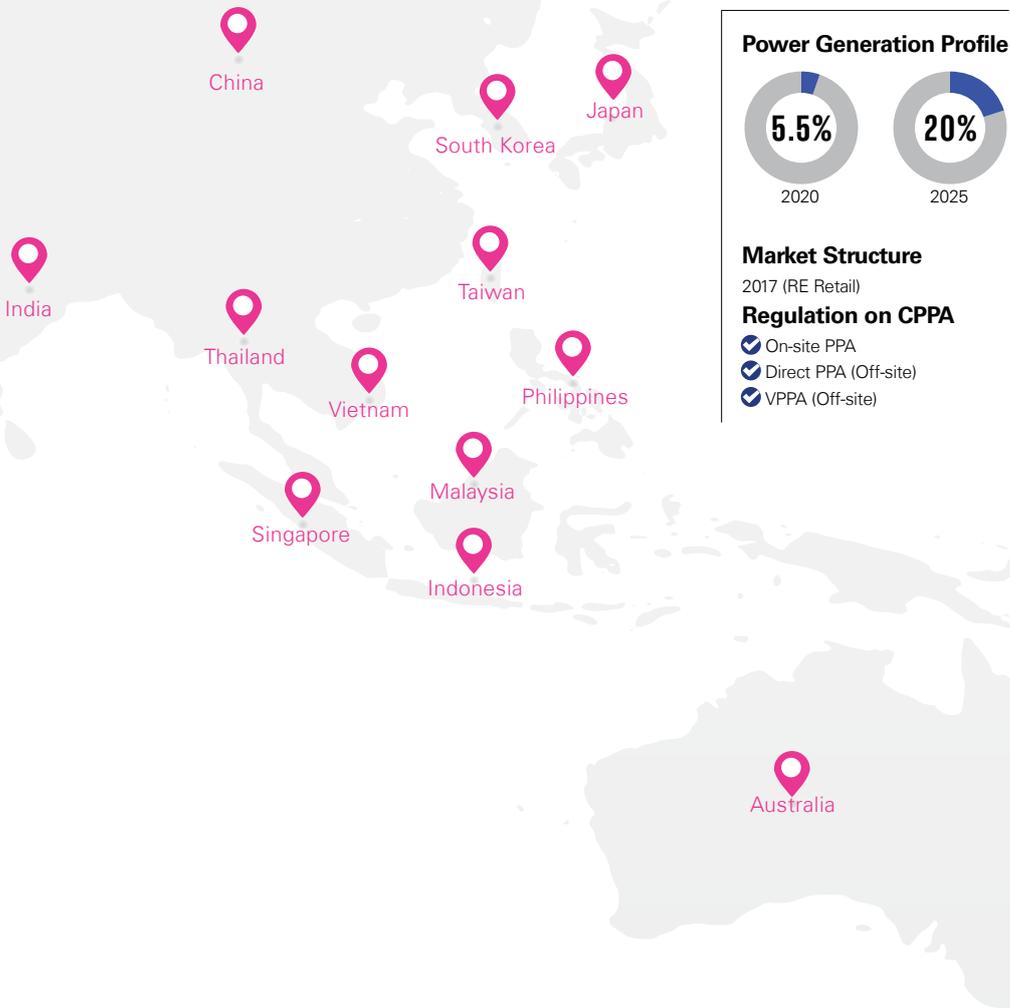


#### Market Structure

Regulated

#### Regulation on CPPA

- On-site PPA
- Direct PPA (Off-site)
- VPPA (Off-site)



# Big corporations' renewable energy target

Business plays a key role in taking climate actions.

Currently, over 300 companies have joined RE100, a global initiative, and made a commitment to achieve 100% renewable energy. Some corporations also have set ambitious carbon reduction targets to transit to a low-carbon, even zero-carbon, economy.

Despite the differences in the progress of renewables' adoption, corporations generally set 100% goal to be achieved by 2030.

	Current Progress	2025	2030	2040	2050
RE100	316 members (as of June 2021 )		(members) 60% RE	(members) 90% RE	(members) 100% RE
Facebook	100% RE for business operation in 2020		Net Zero emissions across value chain		
Google	100% RE for global operations in 2017		Fully decarbonize electricity supply and operate on 24/7 carbon-free energy		
Microsoft	60% RE for data centers in 2020	100% RE	Carbon negative		Remove historical carbon emission
Decathlon	59% RE for global operations in 2019	100% RE for global operations by 2026			
Nike	48% RE in 2020	100% RE for global facilities	Reduce GHG emissions by 65% for operated spaces, and by 30% across extended supply chain		
*INGKA	76% of the electricity was from renewable sources. IKEA reached 100% renewable electricity in retail and centres operations across 23 countries. 6.6% of the electricity consumption was generated on-site in 2021.	100% RE for retail opera-	Climate positive, 100% RE across value chain		

\*The IKEA franchisee with IKEA retail operations.

	Current Progress	2025	2030	2040	2050
Walmart	29% RE	50% RE	Reduce emissions from its supply chain by 1 gigaton		
P&G	70% RE in 2020		100% RE for global value chain		
General Motors	Over 1GW of RE consumption in 2020		100% RE for US sites and global sites by 2035	Carbon neutral in its global products and operations	
Dell	50% RE in 2020		75% RE	100% RE	Net Zero
Intel	75% RE in 2020		100% RE and zero waste		
TSMC	7.6% RE in 2020		100% RE for non-fab facilities		100% RE



# Big corporations' renewable energy policy

Not all big corporations include Renewable Energy Certificate(REC) purchasing as a method to achieve renewable target.

Solar and wind energy are the most popular renewables for bundled PPA procurement. Due to some environmental risks, geothermal, biomass and hydro energy are not widely accepted among corporations.

Some companies have launched investment funds to help accelerate the development of renewable projects.

	RECs	Bundled PPA	Direct Installation/ Investment	Other
RE100	RECs (US and Canada) GOs or REGO (Europe) T-REC (Taiwan) GEC (China) Green Power Certificate/ J-Credit (renewables) (Japan) NZREC (New Zealand) I-REC and TIGR (International)	Solar, wind, geothermal, hydro, biomass (biogas)	√	Subject to announcement
Facebook	√	Solar, wind, water heat recovery system (Denmark)	√	
Google		√	√	\$150 million capital investment  Seed funding into the Center for Resource Solutions
Microsoft	√	Solar, wind, geothermal, biogas, eligible biomass, and low-impact small hydroelectric sources (per US EPA guidance)	√	Climate Innovation Fund
Decathlon	√	√	√	

	RECs	Bundled PPA	Direct Installation/ Investment	Other
Nike	√	√	√	
INGKA	√	√	√	
Walmart		√	√	
P&G	√	Wind, solar, geothermal, hydro	√	
General Motors		√	√	
Dell	√	Wind, solar, hydroelectric. Other subject to announcement		Subject to announcement
Intel	√	√	√	
TSMC	√	√	√	



# Market analysis



# Australia

## Framework

### Market and Regulatory Framework

Electricity retail market structure :

Australia's National Electricity Market (NEM) links the regional transmission networks located on the eastern seaboard of Australia and carries power from electricity generators to large power users and local electricity distributors. The NEM is the world's longest interconnected power system, spanning a distance of around 5,000km. Western Australia and the Northern Territory are not connected to the NEM, but rather, operate on separate electricity networks in the region.

Corporate PPA :

One of the growing trends in Australian energy markets in recent times has been the emergence of Corporate Renewable PPAs. Since 2017, there has been an estimated total of 88 CPPAs negotiated with 3.4GW of capacity. Renewable energy PPA prices in the Australian market started to flatten out in 2019 after seeing significant decreases from 2013 to 2018.

Renewable Energy Certificates :

Introduced as part of the Federal Government's Renewable Energy Target (RET) to help reduce emissions and promote an uptake of renewable energy projects, The Commonwealth Government awards these certificates based on the size of the renewable energy system :

- Small-scale generation certificates (SGCs) – an upfront subsidy for renewable energy systems <100kW. These are deemed upfront and awarded at the time of installation.
- Large-scale generation certificates (LGCs)—for renewable energy systems >100kW. One LGC is awarded for every MWh generated. LGCs can be bought and sold on the market based on the supply and demand for certificates by liable entities (i.e. retailers).

Renewable Energy Policy :

There are many recent developments in Federal and State policy that signal the Government's support for the continued development of renewable projects. While there remains no hard national emissions

target, Australia has set ambitious emissions targets at the State Government level.

- New South Wales : cut emissions by 50% by 2030.
- South Australia : 50% renewable energy by 2025, zero net emissions by 2050
- Victoria : zero net emissions by 2050
- Tasmania : 200% renewable energy and zero net emissions by 2040
- Australian Capital Territory : 100% renewable electricity by 2020 and zero net emissions by 2050
- Queensland : 50% renewable energy by 2030, zero net emissions by 2050
- Northern Territory : 50% renewable energy by 2030

### Renewable Market Outlook

#### Current Renewable Energy Capacity

Australia met its large-scale renewable energy target of 33,000GWh in 2020. Australia does not have a national Net Zero target and has been reluctant to update the country’s Paris Agreement targets, tax emissions or implement new programs.

#### Market Price Reference

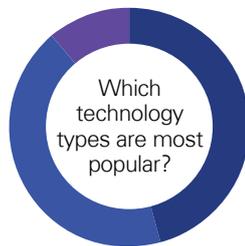
Average wholesale electricity prices experienced strong volatility with prices rising in 2022 and resulting in a temporary market suspension. As a result, average price will increase across almost states.

### PPA Case

#### Summary

Australia has witnessed growing demand for corporate PPAs from big firms such as Commonwealth Bank, Woolworths, BHP and Telstra to meet their sustainability commitment.

#### By Renewable Technology

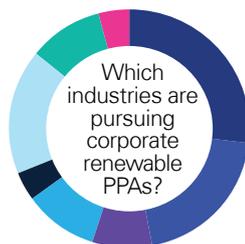


Based on project capacity

Wind continues to be the most sought after PPAs with limited availability.

■ Solar ■ Wind ■ Hybrid (Energetics, 2021)

#### By Industry



Based on GWh offtake

The resources heavy industry sector and multi-sector buyers groups account for nearly half the annual output in GWh contracted under corporate PPAs.

■ Resources and heavy industry ■ Infrastructure, utilities and logistics  
 ■ Buyers group (From multiple sectors) ■ Information and communications technology  
 ■ Manufacturing (Including agri-industry) ■ Retail  
 ■ Built environment (Including finance and universities) ■ Government

PPA Case					
CPPAs Examples	Corporate	PPA term	Energy purchased	Generator	Owner
<b>Commonwealth Bank</b>		<b>12</b> years	 <b>270</b> MW	 Sapphire <b>Wind</b> Farm	 Grassroots Trust
<b>Woolworths</b>		<b>10</b> years	 <b>244</b> MW	 Bango <b>Wind</b> Farm	 CWP Renewables
<b>Telstra</b>		Not disclosed	 <b>226</b> MW	 Murra Warra <b>Wind</b> Farm	 RES Australia /Macquarie Cap

# China

## Framework

### Regulatory and Market Framework

Electricity retail market structure :

In March 2015, the Central Committee of the Communist Party of China and the State Council issued Several Opinions of the Central Committee of the Communist Party of China and the State Council to further deepen the reform of the electric power system and encourage a market-based electricity pricing mechanism.

In May 2019, the National Development and Reform Commission (NDRC) and the National Energy Administration (NEA) issued the notice of establishing and improving the mechanism for guaranteeing renewable power consumption.

CPPA regulation :

Under current regulation, direct purchase agreements are still in the pilot stage and virtual power purchase agreements are not available in China. Distributed energy projects and renewable energy certificates are the main mechanism for renewable energy procurement in China.

REC market :

China has rolled out its own renewable energy certificates (RECs) scheme that allows consumers to claim renewable energy consumption on national REC platforms.

In January 2017, the NDRC, Ministry of Finance and the NEA jointly issued a Notice on Trial Implementation of Renewable Energy Green Power Certificate Issuance and Voluntary Subscription System (Development and Reform Energy [2017] No. 132), marking the official trial implementation of China's REC system.

REC voluntary subscription trading currently supports two trading modes. First, one-way listing. The user logs in the China RECs platform website to check the green certificates listed for sale; second is agreement transfer. Intentional sellers submit an agreement to transfer the

## Market and Regulatory Framework

transaction listing application to the REC subscription platform, including the project code, quantity, price, etc. of the subject of the transaction. Intended buyers and sellers can choose to pay online at the GSE subscription platform, or they can negotiate offline payment.

However, at this stage, RECs and green power are not bundled and traded, and there are problems of double counting. The certificate price and circulation do not yet have full financial attributes. RECs have not been included in RE100, and the current REC system lacks sufficient attraction for enterprises and individuals.

Potential CPPA mechanism :

PPAs in China are mainly signed between one of the two state-owned grid companies (State Grid or China Southern Power Grid) and power plants. The purchase price is set by the NDRC. The specific price is determined by provincial NDRC and the energy type.

CPPA is not commonly used in China. While in some cases, such as distributed energy, the power plants operate independently and provide electricity only for their own use, which is more similar to CPPA mode.

Meanwhile, government also encourages national economic and technological development zones to purchase power from power plants directly. With the development of marketization of electricity, it is reasonable to expect the CPPA mode will be adopted in the future.

Corporate demand for CPPA keeps increasing while, at present, China's market-oriented CPPA trading mechanism and pricing mechanism are not fully formed. In the eastern high electricity load provinces where they are still facing policy barriers, renewable energy is still not allowed to participate in direct power trading. Even in some pilot demonstration areas liberalized markets, the willingness of enterprises to participate is low.

National sustainability target :

**Emission target** : More vigorous policies and measures will be adopted in order to scale up China's Intended Nationally Determined Contribution, targeting to have carbon dioxide emissions peak before 2030 and to achieve carbon neutrality before 2060.

**Renewable target** : China will scale and speed up its clean energy development, targeting to achieve more than 96% of installed power generation capacity from clean energy by 2060.

**Renewable Market Outlook**

**Current Renewable Energy Capacity** Installed renewable power generation capacity by 2020 is 534.6GW, including 253GW of solar PV, 269.6GW of onshore wind power and 10.4GW of offshore wind power.

- Installed capacity target by 2030
- Solar PV : 1,200GW
- Wind power : 1,200GW

**Market Price Reference**

- Currently CPPA purchase price is unrevealed in the market.
- Government-guided prices for solar and wind energy are indicated below. Coal-fired power price will be adopted if the guided price is lower than local coal-fired power price.

	Solar PV	Onshore wind	Offshore wind
<b>2020 government guided price—incl tax (CNY/kWh)</b>	Level 1: <b>0.35</b>	Level 1: <b>0.29</b>	<b>0.75</b>
	Level 2: <b>0.40</b>	Level 2: <b>0.34</b>	
	Level 3: <b>0.49</b>	Level 3: <b>0.38</b>	
		Level 4: <b>0.47</b>	

**CPPA Case**

Direct Purchase agreements are still in the pilot stage and virtual PPAs are not available in China. No public CPPA transaction details can be found.

<b>On-site PPA</b>	Corporate	PPA term	Energy purchased	Energy type	Generator	COD/Transaction date
<b>Wahaha</b>		Not disclosed	<b>55</b> MW		Engie China	<b>2017</b>
<b>Budweiser</b>		Not disclosed	<b>4.9</b> MW		Not disclosed	<b>2019</b>

Wahaha, one of China's largest food and beverage manufacturer, has been committed to creating a resource-saving enterprise with the concept of green production. Wahaha Group is gradually transforming its subsidiaries in several provinces and cities across China to use green power.

Since 2017, Wahaha has entered a green PPA with Engie China to help bring Wahaha's sustainability strategy to life. The 34 rooftop-distributed photovoltaic (PV) projects acquired by Engie China will provide green power to 34 factories of Wahaha Group. The project has a total installed capacity of 55MW and consists of 34 sub-projects located in 21 cities across 16 provinces in China. The rooftop-distributed PV projects help Wahaha's social commitment to be a 'green and smart manufacturer' a lot.

Belgium-based Budweiser, an internationally renowned brewer, has committed to making its beer 100% renewable by 2025 and is pushing ahead with a number of renewable energy projects.

In 2019, Budweiser Asia Pacific completed the PV transformation of seven factories in China, producing 41 million kWh of green power and reducing carbon emissions by 30,000 tons. Budweiser has invested about CNY24.5 million to renovate its Foshan plant with a total installed capacity of 4.9MW and an annual renewable energy supply of 5 million kWh. In 2020, Budweiser's plant in Ziyang City, Sichuan province, adopted PPAs for the first time and achieved production through 100% renewable energy, with an annual use of 16 million kWh green electricity to reduce carbon emissions by 12,000 tons.

By the end of 2020, Budweiser will deploy 86 million kWh renewable energy in China through PV power generation and purchase agreements. By then, 59% of its annual production will be powered by renewable energy, decreasing 64,500 tons of carbon emissions.



# India



## Framework

### Market and Regulatory Framework

#### Overview :

The power sector is in the concurrent list of the Indian constitution (both Center and states are involved in decision-making and establishing policy frameworks) and is governed by the Electricity Act, 2003. India has a robust power sector with a significant and rapidly growing portion of RE capacity. India facilitates a sophisticated and multi-faceted RE policy structure along with an open market mechanism for energy procurement. Several corporations are procuring RE from the open market through PPAs and also through investments in generation projects.

#### Electricity retail market structure :

The power sector is largely unbundled to facilitate greater competition in the sector, bring efficiencies and greater transparency. There is no requirement for a license to set up a generation plant. Transmission and distribution are currently licensed activities, which are under the purview of regulatory authorities. There is potential for government reforms in the electricity sector to significantly stimulate uptake of corporate renewable PPAs in India. Introduction of Green Term Ahead Market in June 2020 is also expected to provide support to corporate buyers and RE generators to transact RE power in the short term.

#### CPPA regulation :

Current RE CPPA market is driven by renewable purchase obligations, sustainability mandates and cost factors. As per current regulations, corporations with demand of over 1MW are allowed to procure power from the open market after paying the required open access charges. However, the draft open access rules notified by ministry of power even provide for consumers with a load of 100kW or more to be eligible for buying renewable power through open access. The draft open access rules when finalized, along with increasing sustainability pressures, will further give an impetus to corporate renewable market in India.

#### Business model innovations :

Business models such as group captive and captive generation (where an individual corporate consumer or a group of consumers holds equity in the generator IPP) are facilitated with additional fee waivers and incentives in order to attract direct corporate investments into off-site RE generation. Several states have introduced policies to enhance the penetration of renewable energy in the state and provide waivers on charges to consumers.

#### REC market :

The Renewable Energy Certificates (RECs) are a market-based mechanism that seek to promote renewable energy and enable virtual trade of RE without any exchange of actual power. Corporations can purchase these RECs at the price discovered at the power exchanges based on demand and supply. Factors such as low enforcement of Renewable Purchase Obligations (RPOs), consistently reduced floor and forbearance price of RECs and REC prices historically following the floor price, have hindered the growth of the market.

#### Solar rooftop (on-site generation) :

Limited scale, high transaction costs, creditworthiness collateral and varying regulations/approval processes across states have affected uptake in solar rooftop market. However, innovations such as demand aggregation, increased technology adoption and advent of EV/storage likely to stimulate demand. The Union Ministry of Power has released the long-awaited net metering policy for rooftop solar installation rules under the Rights of Consumers Rules 2020. The new rules allow prosumers to get net metering for up to 500kW or the sanctioned load, whichever is less, and gross metering for loads over 500kW.

#### National sustainability target :

Climate commitments to reduce greenhouse gas (GHG) emission intensity of GDP by 35% of 2005 level by 2030. Ambition is to reach a net installed capacity of 450GW by 2030.

Cumulative installed RE capacity of 105GW (non-hydro) and 46GW of hydro. As per the Central Electricity Authority (CEA) estimate, the share of renewable energy generation would increase from 18% currently to 50%.

Conducive policy structures, innovative finance mechanisms, cost reductions, energy market redesign and support from international institutions have been paramount.

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**Market Price Reference**

Solar tariffs/bids have been on a declining trend to reach record levels of INR2/kWh (EUR0.02/kWh). This is due to decrease in module prices (until 2020) and access to cheaper financing. Going forward, upward pressure on solar tariffs is expected in the short term.

Wind tariffs have been firming up due to access of suitable sites and increasing capital costs. They are in the range of 2.5–3.5/kWh (EUR0.03/kWh–0.04/kWh).

Future utility procurement would like focus on hybrid (and storage-based) technologies.

**CPPA Case**

CPPAs present a 40–45GW opportunity within the next 5-6years with cost reduction as well as sustainability being important drivers for corporations. As per Bloomberg Energy Finance, India is the second largest growth market for corporate RE PPAs after the US in 2019.

Corporations such as Accenture, Adobe, Carlsberg Group, Dalmia Cement, Infosys, Ikea, Mahindra Holidays & Resorts, Panasonic, Sony, Starbucks and Tata Motors have voluntarily pledged to meet 100% of their electricity demand with renewable electricity through the RE100 initiative.

The uptake of corporate renewable PPAs in India is highly dependent on policies and the regulatory environment at both the national and state levels. In December 2019, RE100 companies cited India as the sixth most challenging market for corporate sourcing of renewables due to fragmented policy and regulatory framework that differs from state to state, and uncertain charges and taxes on the procurement of renewable power.

Based on pipeline of projects with developers, it is estimated by 2022 that there will be an addition of nearly 1GW of capacity in the off-site PPA model and nearly 500MW in the on-site PPA model.

**On-site PPA**

**Overview :**

6GW of on-site solar rooftop capacity (excluding mini grid solutions and residential rooftop) are currently operating in India. Nearly a third of these projects are made up of PPA contracts (the rest are captive arrangements).

**Share of PPA market :**

The PPA market has increased from a share of 13% of solar rooftop projects in 2016 to 39% in 2020.

**Duration of PPA :**

The end-consumer pays for the power generated under a PPA at an agreed-upon tariff for a fixed period, typically 12–15 years.

**Tariff range :**

The tariff trend for rooftop PPAs declined from INR5.5–5.0/kWh in 2017 to INR4–3.5/ kWh in 2020.

Corporate	PPA term	Energy purchased	Energy type	Generator	COD/Transaction date
<b>Arvind Limited</b>	Not disclosed	<b>16</b> MW	<b>Solar</b>	Cleantech /BELECTRIC	<b>2018</b>
<b>RSSB Educational Institute</b>	Not disclosed	<b>12</b> MW	<b>Solar</b>	Tata Power	<b>2015</b>
<b>Delhi Metro</b>	Not disclosed	<b>3.3</b> MWp	<b>Solar</b>	ReNew Power	<b>2020</b>

**Direct PPA**

12GW of off-site CPPAs are currently operating in India. Several corporations are also exploring hybrid PPAs and battery storage PPAs to increase the share of RE in the electricity consumption.

Corporate	PPA term	Capacity	Energy type	Generator	COD/Transaction date
<b>Facebook</b>	Not disclosed	<b>32</b> MW	<b>Wind</b>	Cleanmax	<b>2021</b>
<b>Adobe, DS Group, Ambuja Cement</b>	Not disclosed	<b>75</b> MW	<b>Solar</b>	Amplus (Mirza, Uttar Pradesh)	<b>2019</b>

Developer Eol :

NTPC, a state-owned generator, has released a request for an Expression of Interest calling on interested corporations to directly procure RE from the company. The company, depending on the demand, will likely further develop and operate the project for the corporations.

**Virtual PPA**

Corporate buyers have not yet signed any virtual PPAs (VPPAs) in India to date, due in part to unfamiliarity with the structure and in part to low liquidity in the Indian power market. However, some large-scale corporate buyers are now considering this contract structure, particularly those who have already implemented conventional rooftop solar, group captive or third-party sale structures and who are looking to raise their ambition to reach 100% renewable power.



# Indonesia

## Framework

### Market and Regulatory Framework

#### Electricity retail market structure :

Indonesia's power market, especially for retail consumers, is heavily dominated by Perusahaan Listrik Negara (Persero) (PLN), a state-owned power provider. Only in certain remote areas, which PLN is not able to serve, the power supply to customers is provided by non-PLN entity. For commercial and/or industry self-use, captive power structure is allowed.

#### CPPA regulation :

Currently, only on-site PPA is allowed in Indonesia. PLN customers are allowed to install a rooftop solar facility on their building by itself or by a third party developer, based on MEMR Reg. 26/2021 that is effective as of 20 August 2021. Net-metering is calculated based on the difference between (a) energy imported from PLN and (b) 100% of energy exported to PLN. Any surplus of energy export will be accounted for in the next 6 months' billing, then it will be adjusted to zero. Further, rooftop system management will be conducted through an integrated electronic platform system that developed by MEMR and PLN; and Industrial Solar Rooftop with more than 3 MW capacity shall install additional weather forecast system that integrated with the Supervisory Control and Data Acquisition (SCADA) or distribution smart-grid.

#### REC market :

PLN, back in November 2020, rolled out its REC program. PLN customers who wish to get acknowledgment on the usage of renewable energy for their power consumption can apply for REC through PLN's online service platform. Each unit certificate represents usage of 1 MWh of RE and costs IDR35,000/unit (~US\$2.5/unit). The certification verification process is in compliance with international standard and PLN is in partnership with a globally renowned tracking system company to transparently verify the claim of RE usage. All proceeds from the REC program will be fully utilized by PLN to develop future RE projects. Princeton Digital Group is the first REC buyer, followed by PT Amerta Indah Otsuka signed a REC purchase agreement with PLN in July 2021 for 16.3 MVA, and other 28 local companies in December 2021.

## Market and Regulatory Framework

National sustainability target :

**Emission target** : Indonesia is targeting the reduction of green house gas emissions (Nationally Determined Contribution/'NDC') by 29% (or 834 MtCO<sub>2</sub>e) by 2030 or by 41% (or 1,081 MtCO<sub>2</sub>e) against BAU with support from international agencies. Recently, Indonesia also started the initiative to phase-out coal power plants, with existing coal power plants to be retired starting 2030 for subcritical, 2040 for supercritical and 2055 for ultra-supercritical. All coal power plant projects currently in planning stage will be stopped and replaced with RE-based power plants.

**Renewable target** : Indonesia National Energy General Plan ("RUEN") stipulates that the renewable energy usage should achieve 23% by 2025, and 31% by 2050. To achieve these targets, RE power plants' capacity is expected to be 45.15GW by 2025 and 167.65GW by 2050. Solar powered energy target is set at 6.5GW by 2025 and 45GW by 2050. To achieve these targets, Indonesia has imposed mandatory use of rooftop solar for government and public buildings at a minimum of 30% of their roof space area, while for luxury houses, industry and commercial buildings, rooftop solar has to cover at least 25% of its rooftop area.

According to the Grand National Energy Strategy 2020–2035, Indonesia prioritizes the development of solar power plants to accelerate the use of RE. The total additional RE mix target of 38 GW will be prioritized for solar power plant development in three segments, namely ground-mounted, floating PV and solar PV.

## Renewable Market Outlook

### Current Renewable Energy Capacity

Renewable energy capacity as of 2020 is 10.5GW, accounting for 14.4% of total installed capacity. The realization of installed RE power plant (including both on-grid and off-grid) reaches 10.5GW, which consists of hydropower plants of 6.1GW, geothermal power plants of 2.1GW, bioenergy plants of 1.9GW, solar power plants of 0.2GW and wind power plants of 0.15GW.

As of Q1/2021, there are 3,472 customers together with total capacity of 26.51MW capacity of 26.51 MWp who adopted renewable energy (rooftop solar PV) in order to achieve target renewables energy mix of 23% by 2025. The use of rooftop solar PV has dominated within DKI Jakarta, Central Java and DIY, East Java, Banten Bali, and Lampung.

**Market Price Reference**

Average industrial and business electricity price is IDR1,090.89–1,239.34/kWh (~US\$ca.,7.6–8,7/kWh). (source: PLN Statistics Book, 2020)

Based on the draft RE presidential regulation to be issued in 2021, indicative solar CPPA tariff based on (a) feed-in-tariff (FiT) scheme is US\$ca.,8.50-10.15/kWh depending on capacity, or (b) benchmarking price schemes is ~US\$ca.,6.5 – 8/kWh based on capacity.

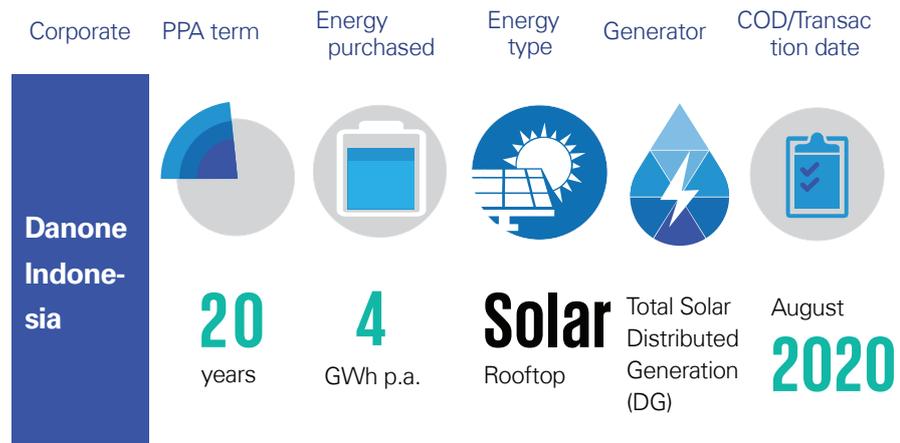
**CPPA Case**

Indonesia currently has limited but growing interest for CPPAs from multiple power generation companies such as Total Solar Distributed Generation (DG) Southeast Asia, PT Pertamina Power Indonesia, PT Cikarang Listrindo Tbk, PT Terregra Asia Energy Tbk, etc. As of June 2021, big companies/institutions such as Danone Aqua, Coca Cola, and SOEs have adopted rooftop solar with capacity range of 52kWp–7.2 MWp.

**On-site PPA**

Corporate	PPA term	Energy purchased	Energy type	Generator	COD/Transaction date
PT Badak NGL	25 years	4.9 GWh p.a. (as of December 2020)	Solar (ground-mounted)	PT Pertamina Power Indonesia	September 2018 & August 2019

Under the 25-year solar PPA, PT Pertamina Power Indonesia provide additional renewable power supply that consists of two solar systems (1MW and 3MW, respectively) in the area of PT Badak NGL. The renewable power supply is intended to support the company operational activities and has lead to electricity cost savings at LNG Bontang up to IDR900 million (~US\$63 thousand) in 2020.



Danone Indonesia has adopted rooftop solar PV with capacity of 3MWp in its five factories located in Klaten, Central Java, along with capacity of 378kWp, which generates 566MWh p.a. in Banyuwangi, East Java. The installation of solar PV enables Danone Indonesia to contribute in reducing carbon emissions of 3,340 ton/year in Central Java and 475 tons/year in East Java, respectively. In addition, Danone Indonesia is in the process of completing a solar rooftop installation in Mekarsari, West Java, by 2021, whose targeted electricity production will amount to 2.3GWh p.a. and contribute to the reduction of carbon emissions of 1,670 tons/year.

In the long term, Danone Indonesia plans to increase the rooftop solar systems in 17 factories across Indonesia by 2023 with total capacity of over 15MWp, which will produce 21GWh p.a. and aim to reduce carbon emissions up to 16,633 tons/year.



# Japan



## Framework

### Market and Regulatory Framework

#### Electricity retail market structure :

Although several M&A transactions have been observed, particularly in 2021, the number of electricity retail suppliers has been continuously increasing to over 700 since the Japanese retail market was fully liberalized in 2016. Under the current regulation, electricity suppliers are the only player eligible to sell electricity to customers and discussions on deregulation relevant to the rules are ongoing, which allow customers to directly procure electricity from generation companies.

#### CPPA regulation :

Commercial and Industrial customers seeking renewable energy have selected on-site PPA models (e.g. by setting up rooftop solar PVs which are owned by themselves or third parties—such as leasing companies). Alternatively, they procure green electricity by paying a premium for certificate costs from incumbent suppliers. Off-site PPA model service has just been provided to Seven & i by NTT Group, and while there is significant demand for huge renewable capacity, how fast it grows could depend on levels of tariffs suppliers can offer. Japanese government is considering introducing Feed in Premium for some renewable assets (e.g. solar PV) in a couple, and under the scheme, generation companies need to select whether they sell electricity to the wholesale market or electricity suppliers rather than network companies. As such, the regulatory change would also be a catalyst to accelerate CPPA schemes.

#### REC market :

While Japan has introduced three types of REC (i.e. J-Credit, Green Electricity Certificates and Non-Fossil Certificates), non-fossil certificates for the majority of overall credit purchases (87.9/89.3 billion kWh in 2019). Yet 99.5% of these non-fossil FIT certificates lacked the tracking data that large corporations need to meet RE100 requirements. Regulatory change in relation to FIT non-fossil certificates allows consumers to procure certificates directly from Green Investment Promotion

Organization(GIO) rather than electricity suppliers, reduce its minimum price and attach tracking data to all the certificates to be issued.

National sustainability target :

**Emission target** : Japan aims to decrease its GHGs by 46% in 2030 from 2013 levels, which the PM declared at Leaders Summit on Climate in April 2021.

**Renewable target** : The Strategic Energy Plan, which was just released in late 2021, articulates the target ratio for introduction of renewable energy up to 36%-38% of the country's energy mix for power generation in FY 2030~31. Japan mainly sees offshore wind and solar PVs as key renewable technologies to achieve its national target.

## Renewable Market Outlook

### Current Renewable Energy Capacity

Offshore wind :

The government aims to develop a series of projects worth 30~45GW in total by 2040 by continuously constructing 1~2GW annually to add current developed capacity (0.2GW). Mitsubishi-led consortium won all three first large-scale offshore wind auctions in December 2021, whose capacity is ca.,1.7GW in total, by offering approximately JPY11.9~16.4/ kWh.

Solar :

Although Japan has already installed 58GW of residential and utility scale solar PVs (as of Sep 2020), the Japanese government expects to further accelerate solar PV development while estimating its LCOE at around JPY8~11/kWh in 2030.

### Market Price Reference

An average electricity price for commercial and industrial customers in January~August 2021:JPY9.6-14.9/kWh.

An average electricity price for small business and residential customers in January~August 2021:JPY19.4-27.5/kWh.

Solar corporate PPA tariff :

Not disclosed

FIT Non-Fossil Certificate :

JPY0.3/kWh (weighted average:the second auction in FY2021)

**CPPA Case**

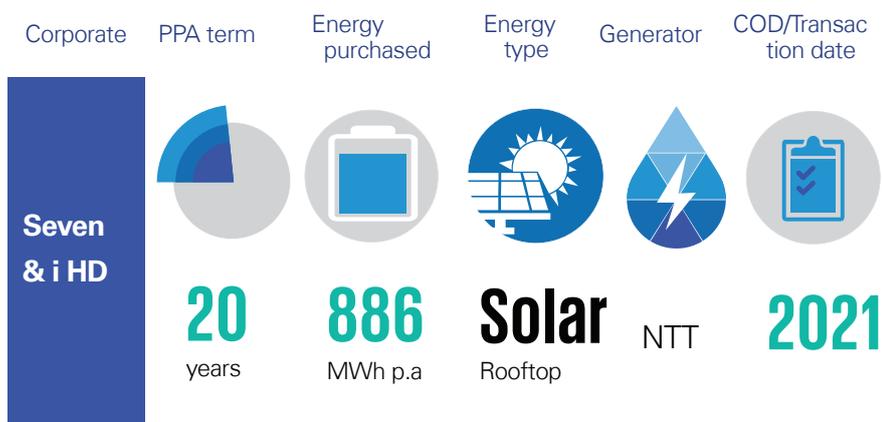
Despite regulatory difficulties, a number of leading Japanese firms, across industries, appear to have a growing appetite for CPPAs. The pioneering corporations introducing CPPA schemes in Japan include Aeon, Sony and Seven & i, all of which have declared to making a commitment to RE100 ahead of other domestic firms. Additionally, several domestic power suppliers are attempting to provide electricity generated from renewables to their customers while developing small-scale solar PVs together with domestic developers. For virtual PPAs, a few Japanese firms are undergoing the trial projects. METI initiated discussion on deregulation around VPPA schemes to develop the CPPA market in Japan.

On-site PPA	Corporate	PPA term	Energy purchased	Energy type	Generator	COD/Transaction date
<b>Aeon</b>		 Not disclosed	 Not disclosed	 <b>Solar</b> Rooftop	 MUL Utility Innovation	 <b>2019</b>
<b>Sony</b>		 Not disclosed	 <b>900</b> MWh p.a	 <b>Solar</b> Rooftop	 FD	 <b>2020</b>

Aeon, one of the leading retailers in Japan, has installed 1.16MW peak rooftop solar systems at their shopping mall in March 2019.

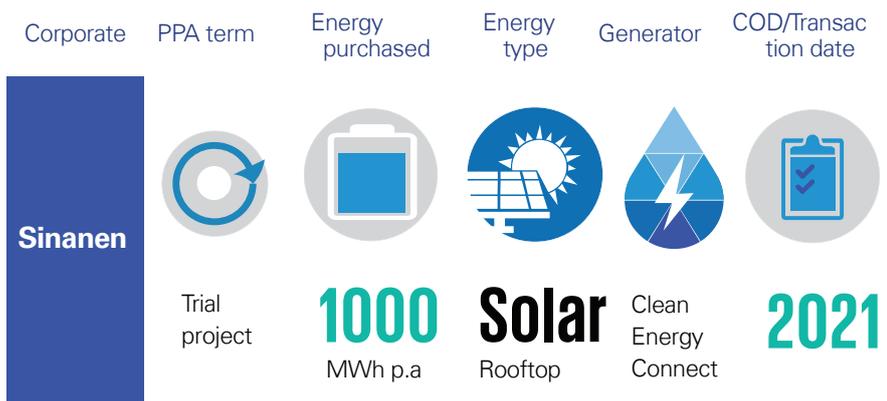
Sony has installed a 1.7MW scale rooftop solar system on its logistics warehouse and generated surplus is supplied to the company’s manufacturing plant via the grid company’s network.

**Direct PPA**



Seven & i HD, another leading retail firm in Japan, has concluded country's first off-site CPPA with NTT. All of the procured capacity is distributed to its 40 group branch offices via the grid companies' networks.

**Virtual PPA**



SINANEN & Clean Energy Connect has launched the country's first trial project for VPPA, utilizing non-FIT solar PV generators to evaluate business feasibility and market/business risk.

# Malaysia

## Framework

### Market and Regulatory Framework

Electricity retail market structure :

Mix of single buyer with wholesale generation and vertical integrated models; further market liberalization under study.

CPPA regulation :

The Malaysian Government through the Sustainable Environmental Development Authority (SEDA) recently introduced 500MW quota for Net Energy Metering (NEM) 3.0 in Peninsular Malaysia only, which allows installed solar PV to export excess energy back to the grid paid on a 'one-on-one' offset basis. New initiatives under NEM 3.0 include household, government entities and net offset virtual aggregation program.

On the other hand, Self-consumption (SELCO) applies when electricity is being generated for own usage but surplus will not be exported to the grid for individual, commercial and industrial consumers.

REC market :

Renewable Energy Certificates (RECs) are a market-based instrument issued for every 1MWh of renewable energy generated. RECs allow owners to consume renewable energy and to meet ESG agendas. RECs are managed under TNBX, a wholly owned subsidiary of TNB.

Sustainable Energy Development Authority (SEDA) acts as an authorized verifier for the Tradable Instrument for Global Renewables (TIGRs) Registry, partnering with APX Inc. to ensure accessible RECs for corporate buyers on the TIGRs Registry in Malaysia.

National sustainability target :

**Emission target** : Malaysia has recently submitted an updated Nationally Determined Contributions (NDCs) to set the NDC target of reducing the intensity of unconditional GHG emissions by 45% by 2030 compared to 2005 levels. The NDC target has been raised from the initial 35% tabled in 2015 to 45% to aggressively address the climate change agenda.

**Renewable target** : SEDA has projected an increase from 23% to 31% RE in the national capacity mix over 2020 to 2025.

**Energy efficiency** : The last Malaysia National Energy Efficiency Action Plan (2015) provides targets to save electricity and reduce electricity demand growth for residential, commercial and industry sectors. The plan targets 52,233GWh of electricity saved against a business-as-usual scenario over the 10-year plan period and an electricity demand growth reduction of 8% at the end of 2025.

## Renewable Market Outlook

### Current Renewable Energy Capacity

Current renewable energy (RE) capacity mix as of 2021 is 23% with 77% comprising of thermal (gas and coal) capacity share.

### Market Price Reference

NEM 3.0

Domestic tariff price : MYR21.80 cents/kWh lowest up to MYR57.10 cents for the highest consumption bracket.

Commercial tariff price for medium voltage, general and peak period tariff: MYR 36.5 cents/kWh, off-peak: MYR22.4 cents/kWh

Commercial tariff price for low voltage : MYR43.5 cents/kWh for the first 200kWh/month and MYR50.9 cents/kWh for next kWh onwards.

For NOVA program, the offset rate is the System Marginal Price (SMP) through TNB Single Buyer.

SELCO

Derived based on cost benefit analysis of the grid electricity costs for the solar plant user.

## CPPA Case

The Malaysian Government's efforts in promoting attractive RE incentives has resulted in an emergence of on-site PPA opportunities for corporate buyers.

Lotuss Stores (Malaysia) Sdn Bhd (formerly known as Tesco) and NE Suria Satu Sdn Bhd (NESS) entered into the largest long-term PPA for 20

**On-site PPA**

Corporate	PPA term	Energy purchased	Energy type	Generator	COD/Transaction date
<b>Lotuss Stores (Malaysia) Sdn Bhd</b>	 <b>20</b> years	 <b>18</b> GWh p.a.	 <b>Solar</b>	 NESS	 <b>2020</b>
<b>Bosch (Malaysia)</b>	 <b>20</b> years	 <b>4.5</b> GWh p.a.	 <b>Solar</b>	 Blueleaf	 <b>2020</b>
<b>AEON</b>	 <b>20</b> years	 <b>2,797</b> MWh	 <b>Solar</b>	 Malakoff Radiance	 <b>2021</b>
<b>Ambu</b>	 Not disclosed	 <b>23,700</b> MWh	 <b>Solar</b>	 Cleantech Solar	 <b>2020</b>
<b>Ever-green</b>	 <b>25</b> years	 <b>7</b> MW under NEM scheme	 <b>Solar</b>	 Solarcity	 <b>2021</b>

years. The installation of solar PV panels in 15 stores in its first phase will collectively reduce approximately 13,624 tons of carbon emissions.

Blueleaf energy signed a 20-year PPA with Robert Bosch (Malaysia) Sdn Bhd to provide solar energy for Bosch's production and warehouse facility in Penang.

AEON Co. (M) Bhd partnered with Malakoff Radiance Sdn Bhd, the solar arm of the largest IPP in the country, to develop a solar PPA at AEON Taman Maluri Shopping Centre.

Ambu Sdn Bhd and Cleantech Solar entered into a long-term solar PPA that will be installed across Ambu's manufacturing and research and development building in Penang.

G Capital Bhd's 70% owned subsidiary Solarcity Malaysia Sdn Bhd signed a 25-year solar PPA with Evergreen Fibreboard Bhd to install and operate a solar PV energy generating system under the NEM scheme at Johor.

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#### **Direct PPA**

No direct renewable energy off-site PPA case in Malaysia as the regulation currently does not allow the same.

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#### **Virtual PPA**

There are currently no VPPAs in Malaysia.



# Philippines

## Framework

### Market and Regulatory Framework

Electricity retail market structure :

The retail sector is partially deregulated. Retail Competition and Open Access (RCOA) is on voluntary participation for contestable customers with average monthly peak demand of at least 500kW. These contestable customers have the choice to contract with retail electricity suppliers or to remain with the captive market or under the regulated services of their respective distribution utilities. The RCOA program is only available to customers in Luzon and the Visayas but will eventually cover the entire country.

CPPA regulation :

Green Energy Option Program (GEOP) is a renewable energy policy mechanism under which end users with a monthly power usage of at least 100kW can contract with qualified retail energy suppliers to get their energy directly from renewables. The GEOP allows registered third-party renewable energy developers to deliver electricity over distribution utility wires to large customers. In return, utilities are compensated with a wheeling charge by the developer or offtaker. The GEOP primarily focuses on wheeling electricity between an off-site renewable generator and a large customer.

For customers seeking to install generation on-site, up to 100kW of renewable generation on-site are allowed to export additional generation to the grid under the net metering program. Contract is signed with the distribution utility, and remuneration depends on the blended generation cost of the offtaker.

REC market :

The Philippine Renewable Energy Market (REM) is the venue for the trading of RE Certificates (RECs) that can be used for compliance to Renewable Portfolio Standard of Mandated Participants. Generation companies who own eligible RE generation facilities that participate in the wholesale electricity spot market or operate in the off-grid area, are

eligible to receive RECs for their generation. A REC price cap will be determined by the Department of Energy (DOE) and approved by the Energy Regulatory Commission (ERC).

National sustainability target :

**Emission target :** The Philippines is revising its NDC target to a 75% reduction of GHG emissions by 2030, up from a target of 70% set four years ago.

**Renewable target :** The updated National Renewable Energy Program (NREP) proposed an RE target of 55.8% by 2040 and 37.3% by 2030. The current NREP 2011–2030 targets to bring the share RE to 35% by 2030.

**Energy efficiency :** The Philippines has begun taking action on energy efficiency; in 2017, the DOE published the Energy Efficiency Roadmap 2017–2040. Overall, the Energy Efficiency Roadmap mandates energy savings equivalent to 24% across energy demand sectors in 2040, compared to the reference energy demand outlook.

Renewable Market Outlook	
<b>Current Renewable Energy Capacity</b>	Renewable energy (RE) capacity mix as of 2020 is 29.1%, with hydro contributing the most at 14.4% and followed by geothermal 7.3%, solar at 3.9%, biomass at 1.8% and wind at 1.7%.
<b>Market Price Reference</b>	Meralco's overall average retail tariff is PHP7.96/kWh in 2020 and PHP8.87/kWh in 2019. Average wholesale electricity price is PHP2.45 cents/kWh in 2020 and PHP5.43 cents/kWh in 2019.

CPPA Case	
	The standard PPAs in the Philippines tend to be either: (i) a Power Supply Agreement between a contestable market customer and a licensed RES, and/or (ii) on-site operating leasing arrangement between the site owner and the solar facility provider. A Power Supply Agreement is subject to approval from the ERC.
	There is limited case for unregulated and CPPA for utility-scale renewable energy projects in the Philippines, but the market is expected to grow with the implementation of the GEOP and more clarity around regulatory framework.

**On-site PPA**

Corporate	PPA term	Energy purchased	Energy type	Generator	COD/Transaction date
<b>Gaisano Capital</b>	 <b>25</b> years	 <b>1.66</b> MW <b>2.26</b> GWh p.a.	 <b>Solar</b>	 Total Solar DG	 <b>2019</b>
<b>Jentec Storage</b>	 <b>20</b> years	 <b>1.09</b> MW <b>1.55</b> GWh p.a.	 <b>Solar</b>	 Total Solar DG	 <b>2019</b>
<b>Robinsons Mall</b>	 Not disclosed	 <b>1.7</b> MW	 <b>Solar</b>	 Buskowitz Energy	 <b>2019</b>
<b>Festival Mall</b>	 <b>20</b> years	 <b>1.899</b> MWp	 <b>Solar</b>	 FREE	 <b>2021</b>

Total Solar Distributed Generation has locked in a 25-year contract with Gaisano Capital to provide solar rooftops for four Gaisano Malls in Luzon and Visayas with a combined capacity of 1.66MW. Total Solar has also completed three solar rooftops with a combined capacity of 1.1MW for Jentec Storage under a 20-year contract.

Buskowitz Energy is set to install solar panels on Robinsons Place Jaro (597.04kWp) and Robinsons Place Pavia (1,102.28kWp) with a total capacity of 1.7MW.

Filinvest-ENGIE Renewable Energy Enterprise, Inc. ("FREE") has signed a 20-year solar PPA with affiliate Filinvest Land, Inc. for the supply of green energy to Festival Mall. FREE will install PV panels on the rooftops of Festival Mall that can generate energy at 1.899MWp per annum.

**Direct PPA**

Corporate	PPA term	Capacity	Energy type	Generator	COD/Transaction date
<b>Mega-world</b>	 <b>2</b> years	 <b>6.17</b> MW	 Geo-thermal	 GCGI (First Gen)	 <b>2021</b>
<b>Manila PoloClub</b>	 <b>2</b> years	 <b>550</b> KW	 Geo-thermal	 GCGI (First Gen)	 <b>2021</b>
<b>Wells Fargo</b>	 Not disclosed	 <b>7.5</b> GWh p.a	 Geo-thermal	 Aboitiz Power	 <b>2021</b>
<b>NEO</b>	 Not disclosed	 <b>14.5</b> MW	 Geo-thermal	 Aboitiz Power	 <b>2021</b>

First Gen has signed a two-year contract with property developer Megaworld to supply 6.7MW of geothermal power to four upscale township and office tower projects in Taguig city, Philippines. The power supply agreement was inked between First Gen subsidiary Green Core Geothermal Inc., which is a licensed retail electricity supplier (RES), and Alliance Global Inc., the parent firm of Megaworld.

First Gen will also be supplying the electricity needs of the Manila Polo Club from the Lopez group's Green Core Geothermal Inc. The scale of supply to be delivered to Manila Polo will be at 550kW and the contract sealed by the parties will be for a two-year period.

Wells Fargo has entered into a retail electricity purchase agreement with Aboitiz Power for the supply of electricity from the geothermal power plant that will deliver 7,500MWh of renewable energy annually bundled with I-REC.

Real estate firm NEO has renewed its power supply agreement (PSA) with Aboitiz Power Corporation for the delivery of 14.5MW of geothermal energy.

Renewable energy firm Citicore Power plans to dedicate an initial 30MW from its solar portfolio for the GEOP.

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#### **Virtual PPA**

There are currently no VPPAs in the Philippines.



# Singapore



## Framework

### Market and Regulatory Framework

#### Electricity retail market structure :

Singapore operates a liberalized power market with a competitive market for generation and retail. Since 2001, the Energy Market Authority (EMA) has progressively opened up the retail electricity market to competition to allow business consumers more options and flexibility when buying electricity and benefiting from competitive pricing. In 2018, the Open Electricity Market was extended to all consumers across Singapore.

#### CPPA regulation :

Net metering is one of the key regulatory mechanisms supporting the rooftop solar installation. Solar owners can sell excess solar electricity back to the grid and be paid at the wholesale energy price.

Due to the land shortage and renewable energy resource constraint in Singapore, most of the CPPAs involve rooftop solar projects. There are two main types of PPAs: on-site and off-site solar leasing. VPPA is beginning to pick up. The price is typically discounted to the prevailing electricity price.

#### REC market :

Singapore has rolled out renewable energy certificates (RECs), which allows consumers to claim renewable energy consumption. REC platforms such as SP REC (launched in 2018) and Sembcorp REC (launched in 2020) are used to provide liquidity to trade RECs. The SP REC Platform is the sole authorized International-REC (I-REC) issuer in Singapore.

#### National sustainability target :

**Emission target :** Singapore has set a goal of reducing GHG emissions intensity by 36% by 2030 (compared to 2005). The enhanced Nationally Determined Contribution (NDC) target aspires to halve emissions from its peak to 33MtCO<sub>2e</sub> by 2050, with a view to achieving Net Zero emissions as soon as viable in the second half of the century.

**Renewable target :** Singapore targets 2GWp of solar energy by 2030. The country also plans to build more connection to neighboring countries to tap into greater potential for clean energy through regional power grids.

**Energy efficiency** is the country's core strategy to reduce its emissions, given the country's limited access to renewable energy resources. Some policies include :

- National Environment Agency Act (Chapter 195) promoting energy efficiency;
- Carbon Pricing Act no 23/2018 imposing a carbon tax initially at \$5 per tonne of GHG emissions for excess of 25,000 tons.

**Renewable Market Outlook**

**Current Renewable Energy Capacity** Singapore has recently commissioned a large-scale floating solar PV farm, which increased the total installed renewable power generation capacity to around 0.5GW.

**Market Price Reference** Average industrial electricity price: S\$20.89-21.72 cents/kWh; SP regulated tariff at S\$24.13 cents/kWh from April 2021.

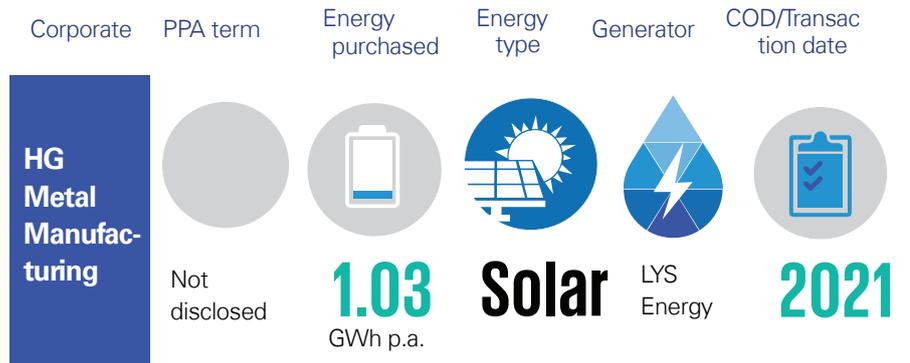
Average wholesale electricity prices in Singapore (known as the Uniform Singapore Energy Price or "USEP" ) in 2020 and 2021 are S\$70.1/MWh and S\$205.9/MWh, respectively.

**CPPA Case**

Singapore has witnessed growing demand for CPPAs from big technological firms such as Microsoft, Google, Facebook, etc. to meet their sustainability commitment, ranging from 50MW to 100MW in terms of project size.

On-site PPA	Corporate	PPA term	Energy purchased	Energy type	Generator	COD/Transaction date
PSA Singapore		21 years	936.84 kWp 4.3 GWh p.a.	Solar	Sunseap	2018

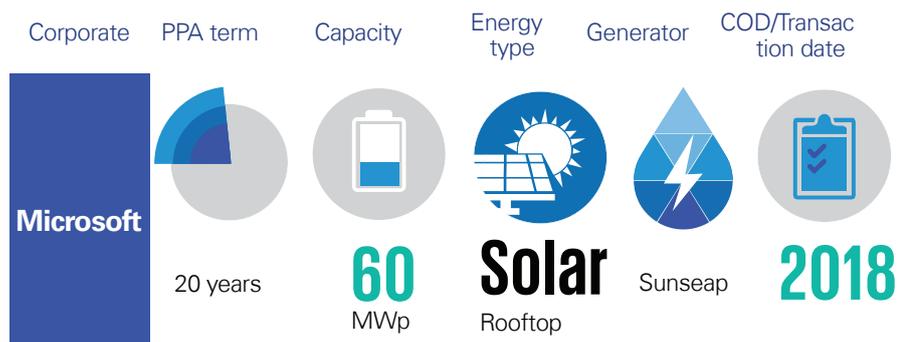
**On-site PPA**



HG Metal Manufacturing Ltd, a leading steel distributor and fabricator based in Singapore, has entered into a PPA with LYS Energy Group, to build and operate a rooftop grid-tied solar PV system at the Group’s premises located at 28 Jalan Buroh. Under this initiative, the solar PV system will also be registered under EMA scheme’s Enhanced Central Intermediary Scheme (ECIS), to enable the export of the unconsumed excess of energy produced by the PV system into the national electricity grid.

PSA Corporation and Sunseap has signed a 21-year solar PPA to constructs and install a 4MWp solar system across five sites in PSA's Singapore terminals, including terminal buildings, gates, maintenance base and workers' dormitories at Pasir Panjang Terminal.

**Direct PPA**



In March 2018, Microsoft signed a PPA with Sunseap to purchase 100% of the electricity from a new 60MWp solar project, supporting the country’s solar growth.

**Virtual PPA**

Corporate	PPA term	Capacity	Energy type	Generator	COD/Transaction date
Facebook	Multi-year	100 MWp	Solar	Sunseap	2022
Facebook	Multi-year	5 MWp	Offshore floating Solar	Sunseap	2022

Facebook and Sunseap signed the first VPPA in October 2021 for electricity generated from a network of rooftop solar projects that will be fully completed in 2022. In this case, Facebook will receive renewable energy credits from the electricity generated by rooftop systems installed on 1,200 public housing residential blocks and 49 government buildings across Singapore.

In April 2021, Sunseap has signed another multi-year VPPA with Facebook to offload electricity generated by its 5MWp offshore floating solar farm in the Straits of Johor set to be completed in 2022. All renewable energy credits from the project will be transferred to Facebook under the VPPA.

# South Korea



## Framework

### Market and Regulatory Framework

Electricity retail market structure :

KEPCO operates a combined business and has a monopoly over the transmission, distribution and retail sale of electricity in South Korea. The electricity industry in South Korea is principally regulated by the Electricity Business Act (also known as the Electric Utility Act) and the subordinate presidential and ministerial decrees issued under it. Ministry of Trade, Industry and Energy (MOTIE) is the primary regulatory authority responsible for policy in the electricity sector.

CPPA regulation :

On January 5, 2021, MOTIE announced the introduction of a Korean RE100 system and a revision to the Enforcement Decree of the Electric Utility Act. The revision is to allow a power purchase agreement (PPA) between renewable power plants, consumers and state-run power distributor Korea Electric Power Corp (KEPCO). On March 24, 2021, Korea's National Assembly passed an amendment to the Electric Utility Act that will enable companies to enter into PPAs for electricity generated from renewable energy projects. It is said to be effective from the end of October 2021, following a six-month promulgation period.

REC market :

The government has changed its renewable energy policy from FIT to Renewable Portfolio Standard (RPS) since 2012. RPS that mandates 22 power distributors with capacity over 500MW to generate a certain percentage of their electricity with renewables. The minimum quota has increased from 10% to 25% effective starting October 2021.

RECs, which certify that power generators produced and supplied power using new and renewable energy facilities, are issued and are tradable. RECs are typically sold to one of the 22 power generation companies that are obligated to generate a certain percentage of their generation output from renewable energy sources.

National sustainability target :

**Emission target** : Policy is to reduce GHG emissions by 40% of their 2018 level, up from the earlier goal of 26.3%. The enhanced target is expected to result in an additional reduction of 100 million tons from Korea's existing plan.

**Renewable target** : Policy is to target an increase in the share of renewable energy in South Korea's overall energy production mix to 20% by the year 2030. In addition, the Renewable Energy 3020 Implementation Plan was released by MOTIE on December 20, 2017. The Plan targets an increase in the share of renewable energy from 7% in 2016 to 20% in 2030 by constructing 48.7GW in newly built renewable generating capacity (30.8GW in solar power and 16.5GW in wind power).

## Renewable Market Outlook

### Current Renewable Energy Capacity

Generation capacity by 2020 is 4.6GW of solar, 1.8GW of hydro power, and 1.6GW of wind power.

Renewable energy is expected to reach up to 20% of power consumption with cumulative capacity of 63.8GW in 2030. (PV: 36.5GW, Wind: 17.7GW, Bio: 3.3GW and others: 6.3GW)

### Market Price Reference

For April 2021, the average REC spot price has been at 37,355 Korean won/REC (\$33.44/REC), which is 11% lower than 2020's REC average spot price and 41% lower than 2019's average price, as RECs are understood to be over-supplied with limited demand.

KRW/kWh	Solar Power	Wind Power	Hydro Power
<b>December 2019</b>	<b>86.08</b>	<b>92.88</b>	<b>106.74</b>
<b>December 2020</b>	<b>68.03</b>	<b>68.54</b>	<b>86.44</b>
<b>September 2021</b>	<b>98.74</b>	<b>101.36</b>	<b>109.29</b>

## CPPA Case

<b>On-site PPA</b>	Feasible
<b>Direct PPA</b>	Feasible
<b>Virtual PPA</b>	Feasible

# Taiwan

## Framework

### Regulatory and Market Framework

Electricity retail market structure :

Electricity Act and Renewable Energy Development Act (REDA) amended in 2019. It encouraged renewable electricity market liberalization in Taiwan, allowing corporate customers to contract for renewable electricity directly with generators or retailers. But the Transmission & Distribution Business in Taiwan is still chartered, only operated by Taipower (utility).

The Act also enforced the heavy electricity users in Taiwan to generate at least 10% of renewable energy by 2025, otherwise, the penalty will be applied.

CPPA regulation :

Under current regulation, on-site and off-site PPAs are allowed with bundled RECs. VPPAs are limited; consumers can only purchase RECs from self-generators.

Switchable FiT scheme and CPPA mechanism :

The renewable energy generators are entitled to enjoy a 20-year Feed-in-Tariff (FiT) rate selling electricity to Taipower (utility). After liberalization, generators are allowed to choose between FiT scheme and bundled T-REC CPPA market, and it is switchable.

REC market :

Taiwan has rolled out its own Taiwan renewable energy certificates (T-RECs) scheme, which allows consumers to claim renewable energy consumption on national T-RECs platforms. Currently, developers are prohibited from joining multiple subsidy schemes and parties cannot trade T-RECs, which eliminates the possibility of secondary markets.

National sustainability target :

**Emission target** : The Climate Action Plan (draft) targets to reach net GHG emissions by 2050.

Renewable target : 20% of electricity generation from renewable energy by 2025. Renewable energy installed capacity reaches 27GW, including 20GW of solar PV and 5.7GW of offshore wind energy.

Renewable Market Outlook

**Current Renewable Energy Capacity**

Installed capacity by 2020 is 9.5GW, including 5.8GW of solar, 2GW of hydro and 0.8GW of wind power.

Installed capacity target by 2025 :

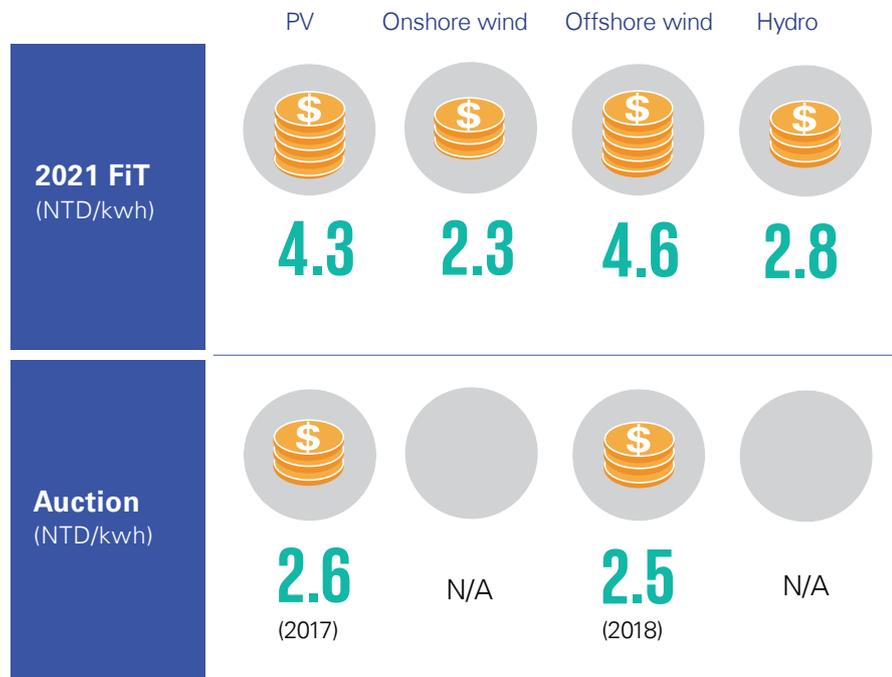
- Roof-top PV: 8GW
- Grounded PV: 12GW
- Onshore Wind: 1.2GW
- Offshore Wind: 5.7GW

Installed capacity target by 2035 :

- Offshore Wind: 15 GW

**Market Price Reference**

Since generators are allowed to choose between FiT scheme and CPPA market, FiT rate can be used as a floor price reference.



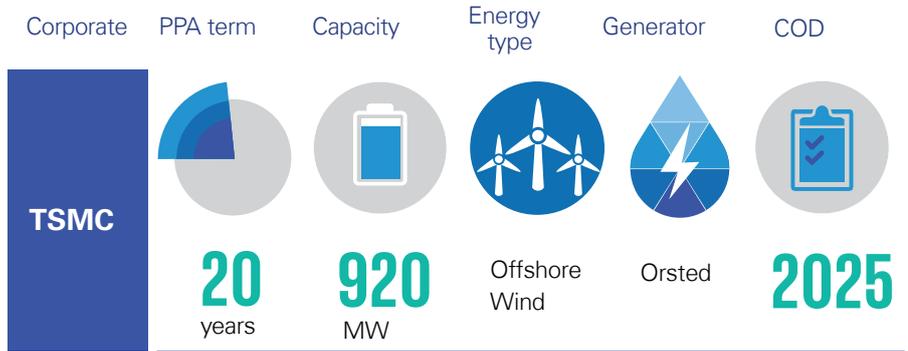
Average industrial electricity price: 2.47NTD/kWh

Average REC price: 1–2NTD/kWh

**CPPA Case**

The first CPPA signed in Taiwan in 2020. Until the end of 2020, about 1,300MW of CPPA has been signed, including PV, onshore wind and offshore wind farms.

**Direct PPA**



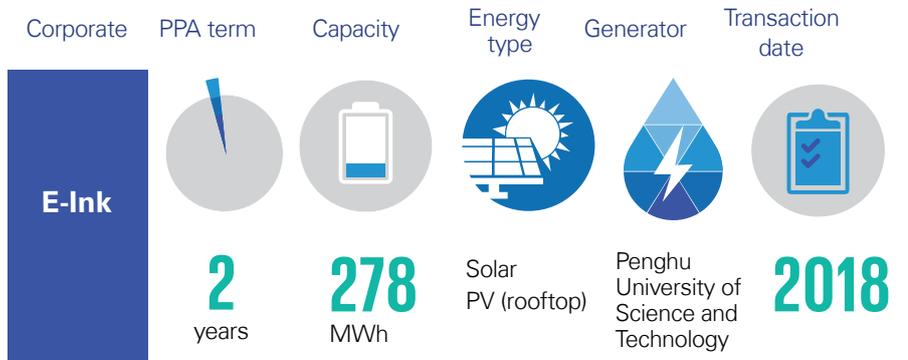
Semiconductor company TSMC and offshore wind developer Orsted signed contract on 09 July, 2020.

TSMC will purchase all electricity and RECs produced in 20 years with a fixed contract price.

Orsted won offshore wind auction in 2018 with a bidding price of 2.54 NTD/kWh. The 920MW wind farm will be operated in 2025 can generate 3.3 bn kwh per year.

TSMC has joined RE100 in 2020 and committed 100% RE by 2050. Its total electricity consumption in 2019 in Taiwan was approximately 127bn kwh.

**Virtual PPA**



Penghu University of Science and Technology consumed self-generated renewable electricity and put out its T-RECs for bidding.

Electronics company E-Ink bid T-RECs on the platform of National Renewable Certificate Center in 2018.

E-Ink bid 278 T-RECs from Penghu University of Science and Technology that were issued in 2017 and 2018 with a bidding price 1,550NTD/T-REC(=1.55NTD/kwh).



# Thailand

## Framework

### Market and Regulatory Framework

Electricity retail market structure :

The electricity market structure is operated under Enhanced Single-buyer Model (ESB) whereby the Electricity Generating Authority of Thailand (EGAT) is a state-owned generator, importer and sole purchaser of electricity from Independent Power Producers (IPPs) and Small Power Producers (SPPs).

The power purchased by EGAT is then transmitted to the Provincial Electricity Authority (PEA) and Metropolitan Electricity Authority (MEA), the two state-owned authorities, for further distribution to the end consumers.

Currently, direct purchase known as Peers to Peers (P2P) or Corporate Power Purchase Agreement (CPPA) of renewable energy is only done within industrial estates. Private parties may build their own transmission systems for certain types of projects such as floating solar facilities in industrial estates.

Very Small Power Producers (VSPPs), most commonly consumer and industrial (C&I) players who produce electricity for their own use, can also sell their excess electricity to the grid (purchased by MEA and PEA). However, net metering system has not been adopted in Thailand and is still under initial discussion among the authorities.

CPPA regulation :

Thailand's CPPA sector is still in its very nascent stage, with upcoming revised solar rooftop regulations expected to provide clarity surrounding net metering, off-site PPA, CPPAs, and private electricity trading.

REC market :

EGAT has been accredited by the International Renewable Energy Certificate (REC) Standard Foundation Board to certify the renewable energy production in Thailand. EGAT sells REC produced from EGAT power plants and also certifies REC produced by other power plants in Thailand.

National sustainability target :

**Emission target :** Under its upcoming Climate Change Act, Thailand aims to reduce its GHG emissions in 2030 by 20~25% compared to projected business-as-usual levels and to decrease CO<sub>2</sub> emissions from power sector to 0.271kg/kWh by 2037. Thailand is also committed to reaching carbon neutrality by 2050 and net zero GHG emission by or before 2065.

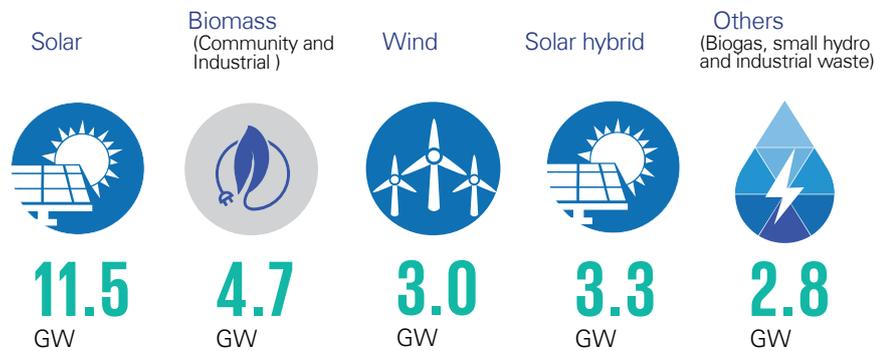
**Renewable target :** The two key energy plans, PDP2018 and AEDP2018, set to increase investment in electricity generated from renewable sources (excl. large hydro), expecting to reach 25.1GW of capacity by 2037, with solar representing almost half of the renewable capacity (11.5 GW, 45.8%).

Renewable Market Outlook

**Current  
Renewable  
Energy  
Capacity**

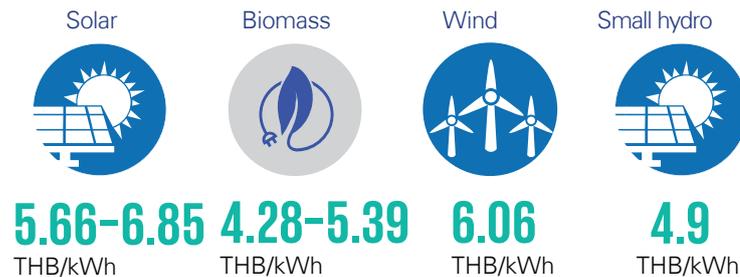
Installed capacity by 2020 is 51.9GW, with 8.0GW from renewable energy (15.3% of total capacity, excl. large hydro).

Planned installed capacity of 77.2GW by 2037, with 25.1GW (32.5% of total capacity) from renewable sources (excl. large hydro) :



**Market  
Price  
Reference**

Thai power market is operated under Feed-in-Tariff (FiT) pricing scheme (2021 FiT):



Average electricity retail price: 3.65THB/kWh (2020)

Average T-VER price: 25THB/tCO<sub>2</sub>e (2020)

**CPPA Case**

Thailand is in the beginning stages of CPPA. So far, the biggest project of CPPA with the on-site solar PV energy is at the capacity of 27MW. The adoption is widespread among business fields with the goal to avoid carbon emissions.

**On-site PPA**

Corporate	PPA term	Energy purchased	Energy type	Generator	COD/Transaction date
<b>Big C</b>	 Not disclosed	 <b>27</b> MWp	 <b>Solar</b>	 Impact Solar	 <b>2017</b>
<b>Kerry Siam Seaport</b>	 <b>25</b> years	 <b>400</b> KWp	 <b>Solar</b>	 Impact Solar	 <b>2018</b>
<b>Betagro</b>	 <b>20</b> years	 <b>25</b> MWp	 <b>Solar</b>	 Total Solar Distributed Generation	 <b>2020</b>
<b>Osotspa Group</b>	 <b>15-16</b> years	 <b>3</b> MWp	 <b>Solar</b>	 Cleantech Solar	 <b>2022</b>

Corporate	PPA term	Energy purchased	Energy type	Generator	COD/Transaction date
<b>Tata Steel</b>	Not disclosed	12 MWp	Solar	Constant Energy	2021
<b>Mitsubishi Motors</b>	Not disclosed	5 MWp	Solar	Impact Solar	2021

Impact Solar will install over 27MW of solar rooftop systems under their private PPA scheme for Big C Supercenter branches across Thailand; becoming the first of its kind for retail businesses and the largest installation capacity in Thailand to date.

Impact Solar installed a 400kW solar rooftop system on Kerry Siam Seaport Co., Ltd. (KSSP)'s warehouses located in Chonburi, with commercial operation date (COD) set for June 2018.

Total, through its affiliate Total Solar Distributed Generation, has signed a binding contract to provide 25MWp of solar rooftops for 24 facilities of one of the largest food companies in Thailand, Betagro. Reported on March 6, 2020, the contract comes along with a 20-year PPA.



Cleantech Solar announced the execution of a long-term solar PPA with Osotspa Group, a leading consumer products manufacturer and distributor in Thailand, for a combined 3MW solar PV system on Osotspa Group's factories.

Constant Energy has executed long-term solar PPAs with Tata Steel manufacturing (Thailand) Public Company Limited for their factory rooftops with a total capacity of 11.8MW. The projects are spread across three provinces, considered the largest solar power capacity to date on a steel mill in Thailand.

Impact Solar invested and installed a solar rooftop system at MMTh production facility, one of Thailand's leading automotive manufacturers, located in Chonburi province, with a total capacity of 5MW.



# Vietnam

## Framework

### Market and Regulatory Framework

Electricity retail market structure :

Vietnam's power industry is in the midst of restructuring and market liberalization reforms. The country plans to operate the competitive retail electricity market in 2023.

CPPA regulation :

On 8 April 2021, the Ministry of Industry and Trade of Vietnam (MOIT) released the latest draft circular on the implementation of the pilot program for direct power purchase agreement (DPPA) mechanism between renewable energy developers/power generation companies and private power consumers. The pilot is to be implemented nationwide with a total capacity of selected wind and solar projects of 1GW maximum. The nominal capacity of each project must be 30MW and the project must have been listed in a National Power Development Plan. The participating power consumers will be limited to power consumers for industrial manufacturing purposes who purchase electricity at a voltage level of 22kV or more. MOIT has also introduced a new requirement that the participating power consumers and developers must have a 'binding in-principle agreement' for the sale and purchase of power. The DPPA pilot program is expected to be legally approved and go into effect in early 2022, but no firm timeline has been established.

REC market :

Power consumers in Vietnam can buy renewable energy through unbundled REC such as I-RECs and TIGRs.

National sustainability target :

**Emission target** : Vietnam pledged to reduce its total GHG emissions by 9% by 2030 with domestic resources, and by up to 27% with global support.

**Renewable target** : Based on the latest draft Power Development Plan (PDP8), the contribution of solar and wind to total power generated

increases over time to 11% in 2025, 15% in 2030 and 28% by 2045. PDP8 also expects approximately 98GW of solar and wind to be added between 2020 and 2045.

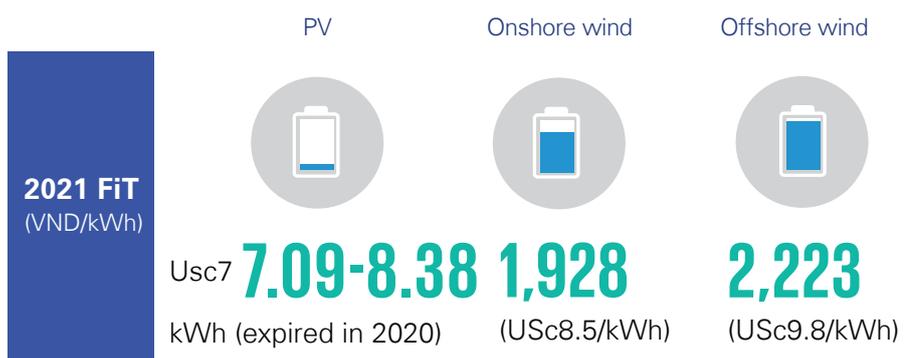
**Energy efficiency** : Vietnam’s National Energy Efficiency Program for the period 2019–2030 aims to achieve energy savings of up to 10% by 2030. Up until 2025, the plan requires the country to save at least 5–7% of its total energy, and by 2030, this rate should rise to 8–10%.

### Renewable Market Outlook

**Current Renewable Energy Capacity**

Installed renewable power generation capacity by 2021 is ca. 42GW, including 16.4GW of solar PV, 4GW of wind power and 22GW of hydro power.

**Market Price Reference**



Industrial electricity price (22kV and above): 1,536–1,555VND/kWh

### CPPA Case

The CPPA model is currently limited to small-scale rooftop solar projects. However, as the new regulation proposes to pilot direct PPA model, there would be increasing momentum for off-site PPA transactions going forward.



**On-site PPA**

Corporate	PPA term	Energy purchased	Energy type	Generator	COD/Transaction date
<b>Footwear Manufacturer</b>	 <b>20</b> years	 <b>~3</b> MWp	 <b>Solar</b>	 LYS Energy	 <b>2021</b>
<b>Men-Chuen (Textile)</b>	 Not disclosed	 <b>1,300</b> MW p.a. <b>-1</b> MWp	 <b>Solar</b>	 Total Solar Distributed Generation (DG)	 <b>2021</b>
<b>Ching Luh Group</b>	 <b>12</b> years	 <b>4.4</b> GWh p.a. <b>3.2</b> MWp	 <b>Solar</b>	 Total Solar DG	 <b>2020</b>

LYS Energy has agreed on a Power Purchase Agreement with a reputable footwear manufacturer whereby LYS will provide an all-inclusive solution that includes financing, design, installation, operation and maintenance of the rooftop solar PV system with a total size of 2,958.56kWp in Long An province for 20 years.

Total Solar DG has installed 3.2MWp of rooftop solar systems for athletic footwear manufacturers Ching Luh Group. Over the 12-year contract period, the PV panels will help mitigate around 19,000 tonnes of CO<sub>2</sub> emissions, supporting Ching Luh Group’s sustainability goals. Total Solar DG has also completed a 1MWp solar rooftop installation for local textile marker Men-Chuen, helping save 500 tonnes of CO<sub>2</sub> emissions per year.

# Protect the earth's environment



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