

REenergising Asia

Assessing renewable electricity readiness among key Asian markets



Stakeholder Contributors

Anoop Chaudhry

(Nomura Bank)

Garzay Ahmedi and Sara La Sala

(GO2 - Guarantees of Origin for New Renewable Energy)

Gina Lisdiani

(Allotrope Partners - Clean Energy Advisory Southeast Asia)

Hang Dao (World Resources Institute) and **Tung Ho** (Allotrope Partners), representing Clean Energy Investment Accelerator, Vietnam

Jules Chuang

(Stonegate - Green Asset Management Asia)

Mohamad Irwan Aman

(Sarawak Energy, Malaysia – Utility)

Alongside many other corporate contributors who wished to remain anonymous under Chatham House Rules.



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EXECUTIVE SUMMARY

Net-zero emissions cannot be reached without extensive decarbonisation of electricity. The International Energy Agency (IEA) estimates that this transformation would require renewables to rapidly expand from the current 29% to at least 90% of all electricity generation by 2050. How are markets in Asia rising to the challenge of optimal renewable electricity (RE) generation capacity? Are current market infrastructures enabling a conducive environment for RE generation, demand and supply? More importantly, how well placed are key Asian markets to meet the RE ambitions they have set for themselves to 2030 and beyond? To answer these questions, CDP puts the spotlight on ten RE markets in Asia to assess their transition towards renewables. The total annual electricity demand of these markets exceeds 11,000 TWh, close to half of global electricity demand, making their transition central to our aspiration for global decarbonisation.

This research is divided into two parts. The first involves CDP's proprietary index **Asia Renewable Electricity Competitiveness Index (AREC-Index)**, to assess individual electricity markets and corporate RE sourcing practices. The results from the application of this methodology are intended for policymakers, financiers, or corporate users of RE to understand the attractiveness of underlying RE markets based on the strengths and gaps in existing infrastructure. The AREC-Index methodology pairs desktop research conducted by CDP with novel use of CDP's climate change corporate dataset of **1,170 companies** in the selected markets. Indicators have been developed. Twelve of these indicators explore a market's RE policy environment and macro-level performance, and six explore corporate RE sourcing behaviour.

The second half of the report focuses on recommendations accumulated from 36 RE stakeholders in the underlying markets. These stakeholders are participants from the energy industry, its financiers, corporate electricity consumers, and not-for-profits. Qualitative recommendations gleaned from these participants primarily focus on areas of improvement they would like to see in market infrastructure to accelerate the growth of RE in Asia. Together with the AREC-Index, 10 detailed market-level assessments are presented. These link concrete, data-driven insights in each market with essential feedback from stakeholders.

The analysis suggests that, across Asian markets, there is a need for robust renewable energy tracking mechanisms to establish reliability and transparency in RE sourcing. Capacity building around corporate RE sourcing will remain a high priority requirement as companies on the ground remain unclear on the RE options available to them. RE infrastructure in the identified markets needs further streamlining of licensing regimes, financial incentives, and aligning of provincial RE goals to national targets. Overall, markets should consider pairing RE targets with a reduction in fossil fuel subsidies to develop long-term strategies for renewables that are aligned with Nationally Determined Contributions (NDCs).

This research is an inaugural study by CDP with support from HSBC. CDP welcomes feedback on the AREC-Index methodology as it continues to expand and strengthen its market selection criteria, indicators and insights in subsequent research. CDP especially welcomes feedback from RE stakeholders, including policymakers whose support is critical to CDP's data-driven work.





BACKGROUND AND METHODOLOGY

The scope of renewable energy discussed in this report includes all renewable energy supply technologies, including wind, solar, biomass, small and large hydroelectric, as well as emerging technologies which are produced from renewable energy sources. Power generation accounts for around 40% of energy-related CO₂¹ and is a dominant contributor to adverse climate change. Renewables remain the energy of choice for generating electricity and reducing carbon dioxide and methane emissions, and play a fundamental role in reducing emissions across all economic sectors. A decarbonised power sector, dominated by electricity generated from renewable sources, is at the core of our transition to a sustainable future.

Markets in Asia have increasingly made public announcements on RE ambitions up to 2030, some going farther and aiming for net-zero emissions by 2050. These goals have subsequently resulted in the development of policies that aim to provide a conducive growth environment for RE to play an increasingly dominant role in the overall electricity sector over the next two decades. RE progress across markets have, however, varied significantly across geographies. While in some markets there may be many RE supply and demand options available, in others it may be virtually impossible to generate or trade in RE.



1. <https://www.iea.org/reports/net-zero-by-2050>

Anticipating upcoming policy changes, CDP observes that the corporates are increasingly committing to procure RE and are voluntarily disclosing their RE generation and consumption patterns through CDP's platform. In 2019 and 2020, over 40% of new members joining the RE100 initiative (which commits its members to sourcing RE across their entire operations) were headquartered in Asia-Pacific. Despite these encouraging signs, it is, as yet, difficult to estimate which market infrastructures are better positioned to meet corporate demand and supply for RE, the current infrastructure gaps that exist between ambition and implementation, and areas where corporates are seeking infrastructure support to further improve RE sourcing in the coming decade.

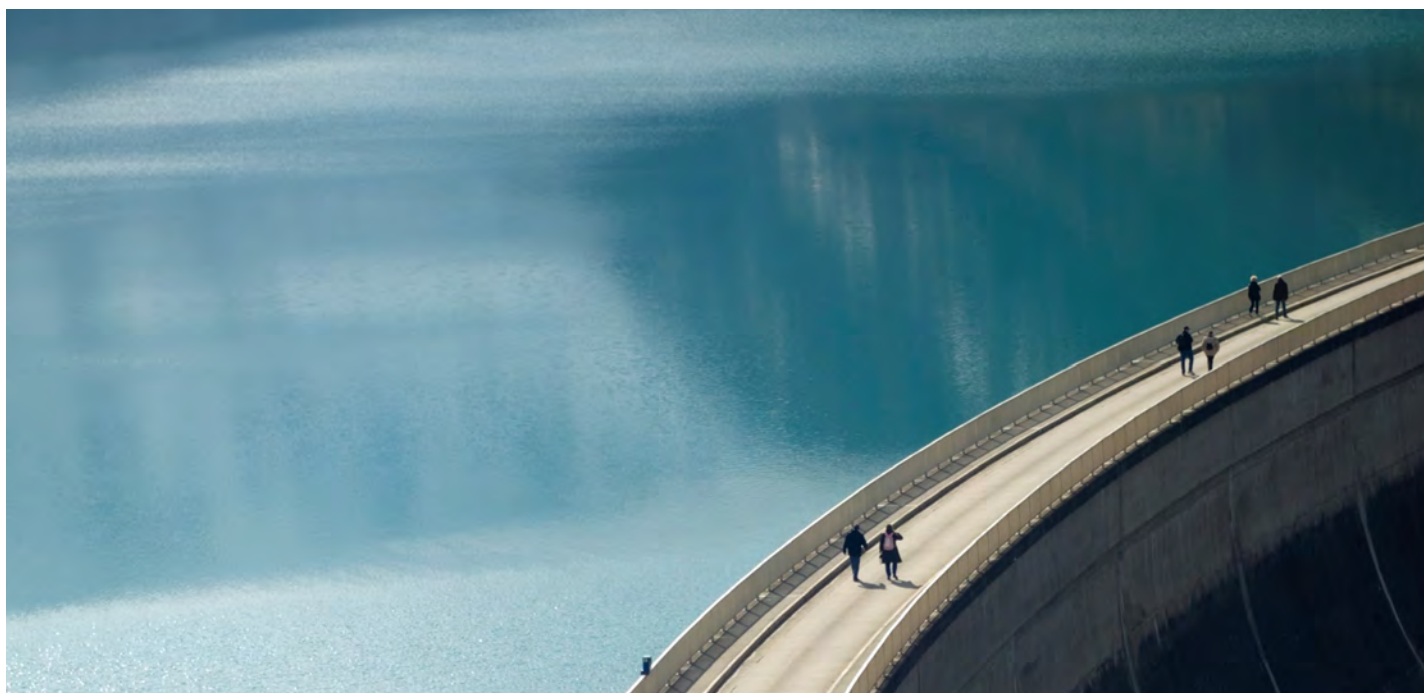
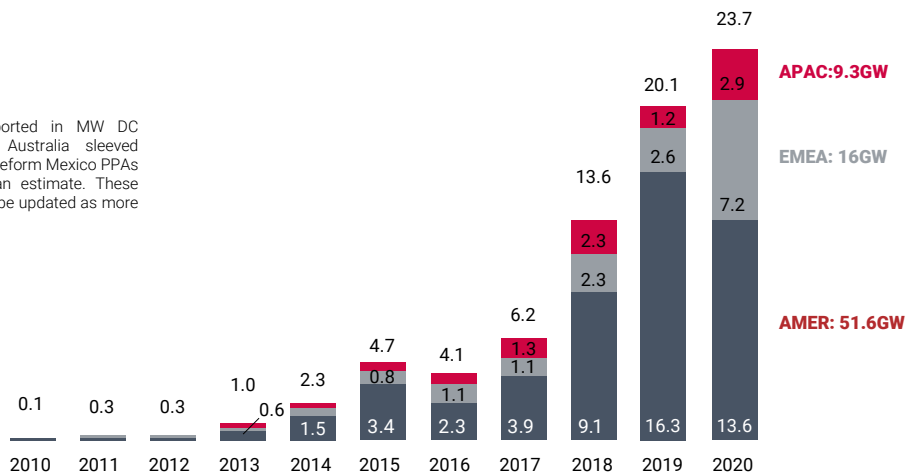
As the industrial and commercial sectors globally account for over 50% of total electricity consumption, trends in corporate generation, and buying and selling of RE, reveal fundamental behavioural change effects transition. Analysing the factors that support or hinder the growth and use of RE by corporates in Asia is a crucial starting point to our understanding of the ambition gaps that currently exist between our determination and our ability to meet the goals of the 2015 Paris Agreement.

Global corporate PPA volumes, 2010-2020

GW

Source: **BloombergNEF**.

Note: Data is through 2020, reported in MW DC capacity. Onsite PPAs not included. Australia sleeved PPAs are not included. Pre-market reform Mexico PPAs are not included. APAC number is an estimate. These figures are subject to change and may be updated as more information is made available.



BACKGROUND AND METHODOLOGY

In this inaugural study, CDP evaluates the interlinkages between policy, infrastructure and corporate RE sourcing patterns across 10 key Asian markets. To action this research, CDP has developed a two-pronged approach to evaluate 10 markets in Asia to assess the current development of RE in the region, recognise leading RE markets, and establish the factors needed to catalyse the growth of RE in these markets. The first part of CDP's market analysis focuses on the development of a competitive index, **Asia Renewable Electricity Competitiveness Index (AREC-Index)**, to analyse current ambitions, capacities and capabilities of the key Asian RE markets, which has been built on CDP's own design principles of relevance, consistency, transparency, verifiability and repeatability.

The second part of the RE market analysis involves a qualitative assessment with stakeholder-driven recommendations for each market to meet the current gaps in their RE infrastructure. This has involved seeking insights from 36 expert participants in the RE sector within each of the selected markets. Contributions and insights were identified through workshops and one-on-one follow-up interviews with utility companies, buyers and sellers of RE, consultants, and RE financiers, alongside not-for-profits.

The market profiles in Section 5 highlight the recommendations, a to-do list of actions that each market needs to implement to accelerate RE implementation. Over subsequent iterations of this research, CDP will expand on our market selection criteria as a more holistic understanding of the RE market emerges across Asia. Crucially, CDP believes that insights from policymakers and their own recommendations to the non-state players in the RE industry will be an important extension of this in-depth market research that we aim to integrate into subsequent reports.

SUMMARY OF CDP'S METHODOLOGY

The ten selected markets for this report are a sample balanced between developed and developing markets. These allow CDP to evaluate RE market progress and assess which type of market is accelerating the fastest in terms of RE-installed capacities and the policies needed to support them. The map in Figure 1 below shows the spread of selected markets from East Asia, Southeast Asia, and South Asia, where RE is being developed to replace fossil fuels by 2050 to achieve net-zero targets.

Figure 1. Selected Asian Markets

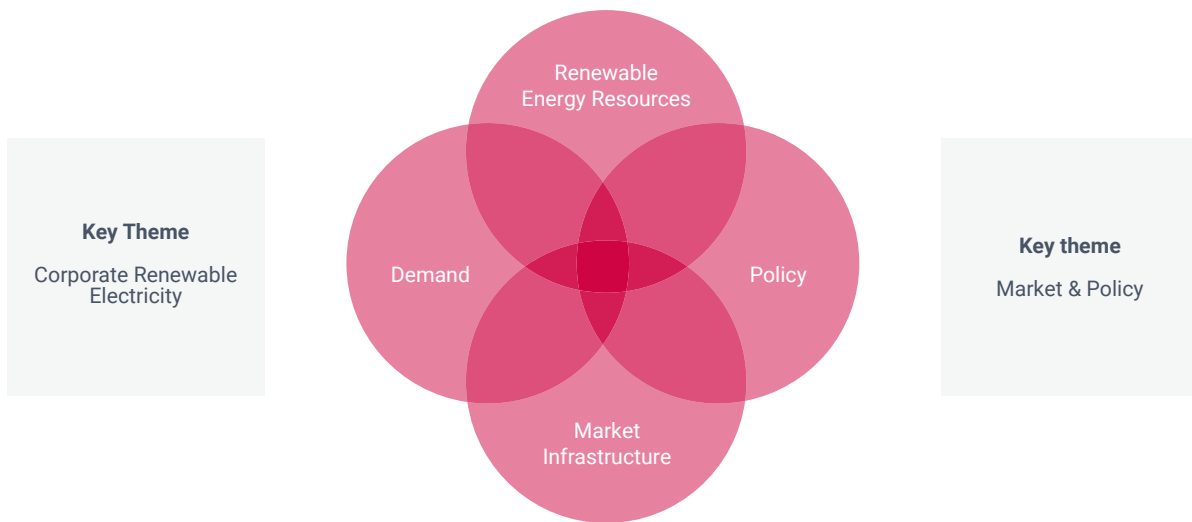


SUMMARY OF CDP'S METHODOLOGY

Asia Renewable Electricity Competitiveness Index (AREC-Index)

CDP's proprietary AREC-Index puts the spotlight on the critical role that national climate/energy goals and policies play in energy transition and supporting the growth of corporate uptake of RE. As such, the AREC-Index is designed to "name and fame" markets for their current leadership in low carbon energy transition.

Figure 2. The Nexus of Renewable Electricity Market Readiness



Renewable electricity is shaped in a market by the collision of supply and demand, market infrastructure, and resources.

To capture the complexity of the electricity markets and the transition towards RE, multiple indicators were included in the data analysis to provide a comprehensive sense of how electricity policy and market infrastructure supports development from both RE aggregate supply and demand sides. From a top-down perspective, market and policy indicators were analysed using publicly available 2019-2020 data to provide an assessment of the market fundamentals within which the RE sector operates and are likely to develop going forward. These indicators combine information on national electricity and climate commitments; market structure with various incentives provided by policymakers to support renewable generation, increase its uptake of RE; and provide proxy macro-economic measures for each market's performance.

From a bottom-up perspective, we considered corporate RE sourcing indicators to assess current corporate practices in each market based on 2020 data, as reported by 1,170 companies to CDP, the source of the world's largest database of primary corporate environmental and reporting data. These indicators track RE use across industries, voluntary RE consumption, generation-related commitments, and business models to source RE by industrial users.

Figure 3. The Renewable Electricity Market Readiness KPIs



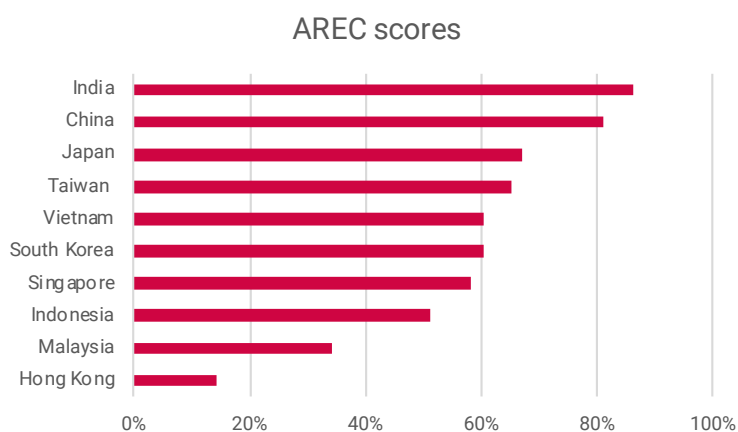


AREC-INDEX RESULTS FOR ALL TEN MARKETS

The AREC-Index is a ranking of a market's performance against AREC-Index's component indicators. The AREC-Index value for a market is its position among its peers, and the AREC score should be thought of as the tendency for that market to be leading its peers across the indicators.

Table 2. AREC-Index and AREC Scores

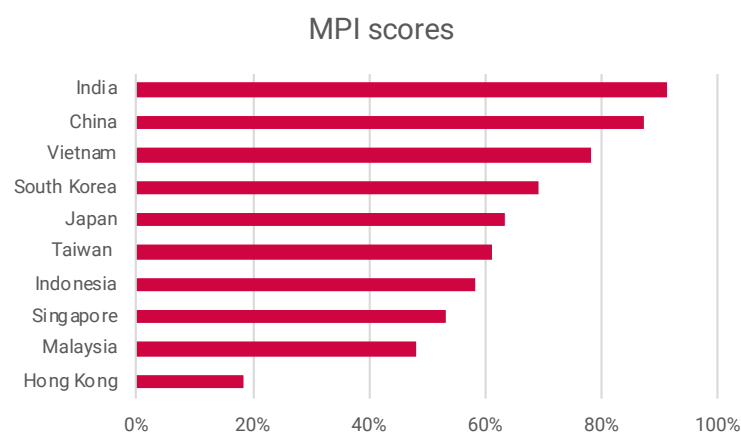
Market	AREC-Index Position	AREC scores
India	1	86%
China	2	81%
Japan	3	67%
Taiwan	4	65%
Vietnam	5	60%
South Korea	6	60%
Singapore	7	58%
Indonesia	8	51%
Malaysia	9	34%
Hong Kong	10	14%



The AREC-Index has two groups of component indicators: Market and Policy Indicators (MPIs), and Corporate Indicators (CIs). Table 2 is a combination of current MPI and CI factors and reflects the strength of market infrastructure and corporate sourcing behaviours in the identified markets. Tables 3 and 4 show sub-rankings and sub-scores which only consider these groups of indicators. The sub-scores are useful in developing market-specific narratives and show how the 'nexus of renewable electricity' (Figure 2) takes shape in each market.

Table 3. MPI Index and MPI Scores

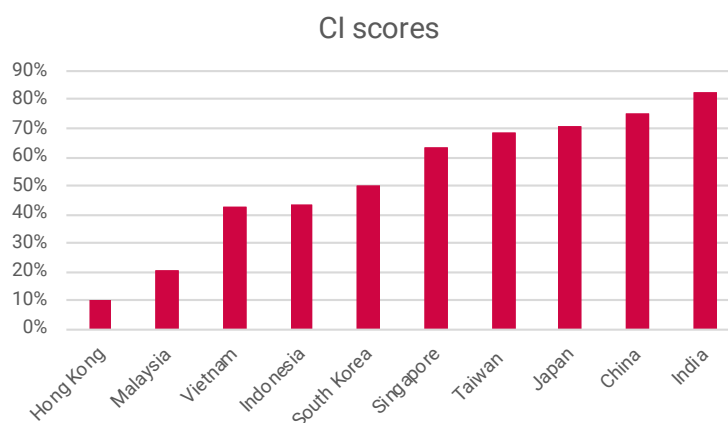
Market	MPI Index position	MPI scores
India	1	91%
China	2	87%
Vietnam	3	78%
South Korea	4	69%
Japan	5	63%
Taiwan	6	61%
Indonesia	7	58%
Singapore	8	53%
Malaysia	9	48%
Hong Kong	10	18%



The MPI scores provide a comparative assessment of current institutional frameworks, fiscal support mechanisms, and projected RE targets in underlying markets.

Table 4. CI-Index and CI Scores

Market	CI-Index C	I scores
India	1	82%
China	2	75%
Japan	3	70%
Taiwan	4	68%
Singapore	5	63%
South Korea	6	50%
Indonesia	7	43%
Vietnam	8	42%
Malaysia	9	20%
Hong Kong	10	10%



CI scores indicate corporate performance based on the data of 1,170 companies reporting to CDP on factors such as share of RE in total electricity consumption by individual corporates, use of RE sourcing options, RE self-generation and projected corporate RE targets. The AREC-Index places India, Mainland China and Japan at the forefront of RE performance in Asia. India and Mainland China dominate Asia RE if we assess per individual group, that is, MPIs or CIs, or a combination of the two themes.

PROFILING OF THE TOP THREE MARKETS IN AREC-INDEX

India

AMBITIOUS RE POLICY IN TANDEM WITH CORPORATE ACTION

#1

AREC-Index position

86%

AREC Score

India is the only market in AREC-Index's market sample to have implemented all eight key policies studied in the MPIs. Policy continues to evolve, however. India intends to reform its electricity infrastructure over the next 10 years to create business models at a retail level whereby off-takers can switch suppliers to enable independent sourcing and storage, known as "shepherding, carried and content"². Bids from Indian utility companies are now expected to go beyond generation into battery storage plants to manage demand and supply. Each state in India also has its own Renewable Portfolio Obligations (RPOs), encouraging the establishment of RE targets at a state level.

Currently, in India, corporate consumers cannot switch suppliers easily because there is a monopoly of state-owned distribution companies that supply power. Only a few states and cities have private distribution companies, but it is not standard practice. The central government has moved ahead with hybrid wind and solar bid tariffs and bids for RE twinned with thermal power. Foreign Direct Investment (FDI) is allowed with no official distinction between investing in foreign and local companies. FDI flows into India are significant. Anyone can buy and sell RE in India, and all companies pay the same energy taxes. At present, corporate consumers have an option to source electricity via bilateral PPAs. Off-takers refer to PPA deals where the off-taker is the company that receives RE and consumes it.

Table 5. Performance in the MPIs

Quantitative MPI	Rank among peer markets
2030 expected RE generation	2 nd place
2018 RE generation mix	3 rd place
CAGR in RE capacity for 2011-2020	7 th place
RE capacity investment (% of total)	3 rd place

Qualitative MPI	Does the policy exist?
Electricity targets	Yes
EACs	Yes
RPS	Yes
Net metering	Yes
RE tendering options	Yes
Public loans for RE	Yes
Investment of production tax credits for RE	Yes
FITs	Yes

Table 6. Performance in the CIs

CI	Rank among peer markets
Total electricity consumption by single-market corporates (MWh)	3 rd place
Single-market corporates' renewable share of total electricity consumption	3 rd place
Single-market corporates' self-generated renewable share of total electricity consumption	1 st place
Sourcing deregulation score	1 st place
Prevalence of corporate RE targets	4 th place
Prevalence of technology type disclosure	5 th place

CDP data also shows Indian companies leading in self-generation and in their use of liberalized procurement methods like PPAs.

MARKET HIGHLIGHTS

- ▶ India is the only market which has implemented all eight key policies studied by AREC-Index.
- ▶ Second highest RE generation share in 2030 in Asia, second only to Vietnam.
- ▶ The Indian market is developing corporate RE sourcing performance facilitated through wide ranging procurement methods and self-generation.

PROFILING OF THE TOP THREE MARKETS IN AREC-INDEX

Mainland China

RE INVESTMENT JUGGERNAUT WITH STRONG STATE-LED AMBITION

#2

AREC-Index position

81%

AREC Score

Solar energy is inexpensive in China because of a strong domestic manufacturing industry in photovoltaics. The market is almost singlehandedly responsible for the precipitous drop in the levelised cost of energy generated from photovoltaics in the past decade. In 2016 alone, China added more solar capacity than the United States in the technology's entire commercial history until that point.

Generators also raise revenue from selling energy attribute certificates for their generation (and can certify the same unit of generation under more than one certificate system). However, ringfenced investment funds are needed to create interest for companies working in China. Moreover, if the Chinese economy were to open to RE FDI, there would be huge interest driven by high local demand for electricity and the desire (at community, policymaker and foreign investor levels) to reduce air pollution from legacy electricity generators. In addition, a new policy for National Renewable Energy Certificates (RECs) as opposed to provincial RECs, as is the situation in 2021, would be an attractive revenue stream for investors.

China dominates global growth in RE, and this is reflected in its RE investment capacity, which, as of 2019, is more than that of all key Asian markets combined. China is considered to be well placed to gain technological competitive advantage from the transition to net-zero emissions³.

Table 7. Performance in the MPIs

Quantitative MPI	Rank among peer markets
2030 expected RE generation	3 rd place
2018 RE generation mix	2 nd place
CAGR in RE capacity for 2011-2020	4 th place
RE capacity investment (% of total)	1 st place

Qualitative MPI	Does the policy exist?
Electricity targets	Yes
EACs	Yes
RPS	Yes
Net metering	No
RE tendering options	Yes
Public loans for RE	Yes
Investment of production tax credits for RE	Yes
FITs	Yes

3. <https://www.energy-transitions.org/publications/china-2050-a-fully-developed-rich-zero-carbon-economy/>

Table 8 Performance in the CIs

CI	Rank among peer markets
Total electricity consumption by single-market corporates (MWh)	2 nd place
Single-market corporates' renewable share of total electricity consumption	2 nd place
Single-market corporates' self-generated renewable share of total electricity consumption	5 th place
Sourcing deregulation score	5 th place
Prevalence of corporate RE targets	3 rd place
Prevalence of technology type disclosure	4 th place

Reporting corporate data shows the prevalence of strong RE targets by companies to procure and consume RE. Page 34 identifies recommendations in Section 5 from the RE industry on how these ambitions can be further boosted with a focus on power purchase agreements (PPAs) and transparency surrounding Energy Attribute Certificates (EACs).

MARKET HIGHLIGHTS

- ▶ Dominates global investment in RE capacity.
- ▶ High policy-led commitment to RE generation, with a significant existing renewable grid capacity.
- ▶ Corporates already procure a significant amount of their electricity renewably and are comfortable setting targets to increase their renewable procurement.

PROFILING OF THE TOP THREE MARKETS IN AREC-INDEX

Japan

LEADER IN CORPORATE RE PROCUREMENT

#3

AREC-Index position

67%

AREC Score

In Japan, self-generation and on-site PPAs are accessible. Off-site PPAs will become accessible when the Feed-in-Premium starts in 2022. Japan started a deregulation process in 2000 and has long-standing Feed-in-Tariff (FiT) schemes to promote and enable the growth of its local RE industry. According to the Japanese government, deregulation of the electricity market has three key aims:

- 1) Securing a stable energy supply,
- 2) Cutting electricity prices, and
- 3) Expanding business opportunities for operators and the range of choices for consumers.

The liberalisation of the market will, in time, allow increased competition from many new market entrants. Deregulation began by enabling extra-high voltage consumers to choose their electricity suppliers, followed by deregulating high voltage customers to choose suppliers in 2004 and 2005.

In 2019, Japan had the second highest investment in installed RE capacity across key Asian markets⁴. Expanding on this ambition, in December 2020, Japan unveiled its 2050 low carbon strategy which will see the share of renewables at 50-60% of electricity demand⁵. Japan's policy rankings are lower in our estimate as compared to other markets such as Vietnam and South Korea. This is due to absence of policies with respect to net metering, Renewable Portfolio Standard (RPS) or tax incentives in relation to investment or production of RE.

Table 9. Performance in the MPIs

Quantitative MPI	Rank among peer markets
2030 expected RE generation	6 th place
2018 RE generation mix	3 rd place
CAGR in RE capacity for 2011-2020	6 th place
RE capacity investment (% of total)	2 nd place

Qualitative MPI	Does the policy exist?
Electricity targets	Yes
EACs	Yes
RPS	No
Net metering	No
RE tendering options	Yes
Public loans for RE	Yes
Investment of production tax credits for RE	No
FITs	Yes

4. https://www.ren21.net/wp-content/uploads/2019/05/gsr_2020_full_report_en.pdf

5. <https://asia.nikkei.com/Spotlight/Environment/Climate-Change/Japan-sets-sights-on-50-renewable-energy-by-2050>

Table 10. Performance in the CIs

CI	Rank among peer markets
Total electricity consumption by single-market corporates (MWh)	1 st place
Single-market corporates' renewable share of total electricity consumption	8 th place
Single-market corporates' self-generated renewable share of total electricity consumption	2 nd place
Sourcing deregulation score	4 th place
Prevalence of corporate RE targets	7 th place
Prevalence of technology type disclosure	2 nd place

MARKET HIGHLIGHTS

- ▶ Asia's biggest corporate electricity footprint reported to CDP.
- ▶ Second highest pool of RE investments in AREC-Index.
- ▶ Corporates perform well generating their own RE.

Japan has the biggest corporate RE footprint in Asia, as reported to CDP, representing the largest potential demand signal for RE in AREC-Index's sample of markets. Japan also performs well in self-generation. While the current share of RE in corporates' overall electricity consumption is not competitive in the index, corporates own much of their RE self-generation (rooftop PV systems are commonplace). Japan is second only to India in this regard. Japanese companies typically also have good data availability regarding the energy technologies in the content of their supplies and disclose this information to CDP.

REFLECTIONS ON AREC-INDEX'S METHODOLOGY AND RESULTS



Significance of AREC-Index rankings

- ▼ The selected markets are ranked based on trends in electricity grids, investment into renewable electricity, key policy, and reported corporate electricity sourcing behaviour. These dimensions have been selected as indicative of a market's attractiveness to investment in renewable electricity.
- ▼ The methodology is applicable to any sample of markets and corporate respondents.
- ▼ It is very easy to see how individual indicators impact a market's position in the ranking because the indicators are expressed in common units. It is easy therefore to develop intuitive narratives and recommendations for a market based on its performance in the indicators.



What the rankings do not indicate


- ▼ The index is mostly unaffected by market size. This allows, for example, Vietnam, with much smaller electricity demand than India, China, or Japan, to perform relatively well for its progressive RE policy environment.



Limitations of the rankings

- ▼ CDP corporate disclosure data has been limited in its use because the data needed for certain indicators is not per-market. For certain CIs, data from multinationals cannot be considered because their data is not collected per-market. This reduces the sample size of respondents available for CI assessments, and may mean that REsourcing practices which are unique to multinationals are not being reflected in the Index.
- ▼ Some CIs are affected by impacts unrelated to RE sourcing. For example, in some markets, disclosure rates by corporates may simply be lower.





QUALITATIVE SUMMARY OF THE RE MARKET READINESS OF EACH MARKET

QUALITATIVE SUMMARY OF THE RE MARKET READINESS OF EACH MARKET

It is pertinent to note that no market in Asia received a perfect score across the indicators identified under the AREC-Index. This is to be expected as markets are still enabling policies that promote the development of the RE sector. In many of these markets, companies are yet to fully grasp the implications of these current and upcoming regulations on the generation and consumption of RE. Variances also exist between low carbon ambitions, RE targets and implementation.

While AREC-Index presents data-driven results from desktop research and CDP data, its results should be complemented by evidence gathered from actors in AREC-Index's markets themselves. AREC-Index, for example, reveals where certain policies exist across the markets. Interviews with actors in those markets support this knowledge with invaluable insight into how those policies are actually viewed in those markets.



Ten market summaries have been prepared as a result of these interviews. The summaries give pragmatic recommendations from 36 stakeholders for policymakers, and important information for prospective investors in each market. The summaries consider:

- ▶ AREC-Index's results; and
- ▶ Input from local stakeholders against national targets for RE acceleration, who provided their insights and recommendations during the workshops and for some, supplemented in interviews.

It is important to note that these industry recommendations focus on incremental improvements in RE infrastructure in the context of the targets that each market has set for itself. Over subsequent series of this research, CDP would also like to incorporate views of policymakers and areas of involvement and improvement that they would like to see within their local RE industries.

Tables 1 and 2 present a subset of AREC-Index's MPis and CIs which are particularly relevant to the stakeholder discussions. Further details on these indicators are available in the Appendix from p.40.

Each market summary covers three elements. These are:

1. Policy ambition and key market strengths;
2. Current gaps in meeting ambition; and
3. Recommendations from stakeholders on how to bridge the gaps

Table 11. Selected market and policy indicators

For full data set on indicator findings of the AREC-Index, please refer to Page 35 in the Appendix.

Market	MPI_01 2030 expected RE generation	MPI_02 2018 RE generation mix	MPI_03 CAGR in RE capacity for 2011-2020	MPI_04 RE capacity investment (% of total), 2019	MPI_06 Existence of tradable energy attribute certificates (EACs)	MPI_07 Existence of a renewable portfolio standard (RPS)	MPI_09 Existence of RE tendering options	MPI_10 Existence of public loans for RE	MPI_11 Existence of investment or production tax credits for RE	MPI_12 Existence of feed-in tariffs (FITs)
China	35.0%	26.0%	14.3%	67.4%	Yes	Yes	Yes	Yes	Yes	Yes
Hong Kong	4.0%	0.0%	0.0%	0.0%	Yes	No	No	No	No	Yes
India	40.0%	19.0%	9.8%	7.5%	Yes	Yes	Yes	Yes	Yes	Yes
Indonesia	32.4%	17.0%	4.4%	0.3%	No	No	Yes	Yes	Yes	Yes
Japan	24.0%	17.0%	11.7%	13.3%	Yes	No	Yes	Yes	No	Yes
Malaysia	20.0%	17.0%	9.3%	0.2%	No	No	Yes	Yes	No	Yes
Singapore	8.0%	2.0%	17.1%	0.0%	Yes	No	Yes	Yes	No	No
South Korea	20.0%	4.0%	21.8%	1.9%	Yes	Yes	No	Yes	Yes	No
Taiwan	31.4%	4.0%	12.8%	7.1%	Yes	Yes	No	No	Yes	Yes
Vietnam	47.0%	35.0%	14.9%	2.1%	No	No	Yes	Yes	Yes	Yes

Table 12. Selected corporate indicators

Market	CI_02 Single-market corporates' renewable share of total electricity consumption	CI_03 Single-market corporates' self- generated renewable share of total electricity consumption	CI_04 Sourcing deregulation score	CI_05 Prevalence of corporate RE targets in the market
China	24%	0%	0.402	21%
Hong Kong	0%	0%	0.000	11%
India	16%	7%	0.589	16%
Indonesia	1%	1%	0.375	16%
Japan	3%	1%	0.404	13%
Malaysia	8%	0%	0.200	0%
Singapore	15%	0%	0.444	14%
South Korea	4%	0%	0.200	13%
Taiwan	3%	1%	0.566	24%
Vietnam	48%	0%	0.200	33%

MAINLAND CHINA

Policy ambition and key market strengths

China has pledged to increase the share of non-fossil fuels in its primary energy consumption to 15% in 2020 from just 6.8% in 2005, with plans to increase it to 35-40% by 2030⁶. China aims to expand its total installed wind and solar capacity to 1,200 GW by 2030⁷. By the end of 2020, China had 281.5 GW of wind generation capacity and 253.4 GW of solar. Solar energy has the highest profitability because it is locally produced. Asset holders may sell RE certificates to generate revenue from the buyers of RE, providing an attractive RE income stream.

Current gaps in meeting ambition

CI 05 shows that over 20% of the 500+ companies in Mainland China that report to CDP have RE targets. While these figures are encouraging, CDP believes structural gaps exist which have the potential to slow further target setting by corporates.

Private companies operating in China find it difficult to arrange power purchase agreements (PPAs) to procure RE directly because the energy sector is highly regulated.

Although EACs are available through the Green Electricity Certificate (GEC) system, several issues exist with their design. GECs cannot be used to make credible claims of RE use because they may be one of several certificates issued to a unit of generation (including greenhouse gas offsets and other EAC systems available in China). This may lead to potential double-counting of energy attributes. Buyers of GECs must therefore hold all other attributes of generation in addition to the GECs, in order to use GECs credibly.

GECs are also only issued to generators that receive Feed-in-Tariffs (FiTs), government-led incentive programmes designed to promote the uptake of renewable and low-carbon electricity generation technologies. The GECs have a price floor equal to the FiT level and, therefore, might not be available at their most competitive price. However, FiTs are being phased out. While FiTs may no longer be necessary for mature technologies, they could still be important for emerging REs, such as hydrogen.

Recommendations from stakeholders to bridge the gaps

- 1 China should overhaul its RE certification systems. GECs should be issued exclusively so that no attribute aggregation is required of GEC buyers. GECs should also be issued to all generators rather than only those that also receive FiTs. This could allow their price to be set by market forces.
- 2 China should make PPAs more accessible. Given the presence of multinationals, especially manufacturers, joint ventures with local players could make PPAs more attractive.
- 3 China should consider keeping FiTs for emerging technologies such as green hydrogen.

6. Reuters, 10 February 2021. China plans to raise minimum renewable power purchase to 40% by 2030

7. <https://www.carbonbrief.org/analysis-chinas-new-2030-targets-promise-more-low-carbon-power-than-meets-the-eye>

HONG KONG

Policy ambition and key market strengths

Hong Kong considers itself, officially, to have modest RE potential and policy ambition. These will likely increase as technologies develop. Current technology could allow Hong Kong to generate 3-4% of its electricity renewably from potential wind, solar and waste-to energy resources that could be exploited between now and 2030⁸.

There is good availability of feed-in tariffs in Hong Kong. Non-governmental electricity consumers with who install distributed RE systems at their premises with a generating capacity of up to 1 MW are eligible for feed-in-tariffs (FiTs). These must come from either of the two power companies (CLP or Hong Kong Electric) and the system must be connected to that power company's grid⁹. Larger systems are also considered on a case-by-case basis. The two utility companies have offered to issue EACs since 1 January 2019. Corporates can also enter virtual PPAs (vPPAs) with Mainland China.

Policymakers are developing long-term decarbonisation strategies, such as the Clean Air Plan for Hong Kong 2035. In the Waste Blueprint for Hong Kong 2035, a plan to develop waste-to-energy technologies, policymakers cite Hong Kong's 2050 carbon neutrality target¹⁰.

Current gaps in meeting ambition

Hong Kong currently only generates around 1% of its electricity renewably.¹¹ While offshore wind capacity is being developed, it is slowed by lengthy permitting processes from current planning authorities. Utility stakeholders have called for the permitting process to be streamlined.

The virtual PPAs (vPPAs) with China into which corporates in Hong Kong can enter are equity investments in RE, but they do not decarbonize Hong Kong's grid itself.

Recommendations from stakeholders to bridge the gaps

- 1 Hong Kong should streamline the permitting process for land use and for electrical utility on-site licensing which, at present, can take several months or more to achieve, depending on the size of the project.
- 2 Hong Kong should join hands with corporates in exploring floating solar facilities, offshore wind, land reclamation, and continue pursuing waste-to-energy technology¹². They are technically feasible¹³ and policymakers with industry support can develop them at scale.
- 3 Hong Kong should also explore newer technologies that can overcome land constraints, including energy from ammonia and hydrogen.

8. <https://www.info.gov.hk/gia/general/201910/23/P2019102300390.htm>

9. <https://www.gov.hk/en/residents/environment/renewable/feedintariff.htm>

10. https://www.emsd.gov.hk/energyland/en/energy/energy_use/energy_scene.html

11. https://www.emsd.gov.hk/energyland/en/energy/energy_use/energy_scene.html

12. <https://re.emsd.gov.hk/english/energy/energy.html>

13. <https://www.tpark.hk/en/>

INDIA

Policy ambition and key market strengths

India is one of the largest FDI markets for RE investing¹⁴ and has a high level of policy ambition, with a national target of 175 GW from RE by 2025 and 450 GW from RE by 2030¹⁵. India's total electricity generation capacity stands at 383 GW (CEA, March 2021). Renewables account for 37% of this capacity (25% if large hydro is excluded). The market generated 1234 TWh of electricity in 2020-21 (April to March), of which about 12% of generation is from renewable energy sources.¹⁶

Policy support and institutional frameworks are crucial in encouraging investment in the renewable energy sector in India. This has resulted in dedicated market institutions such as The Ministry of New and Renewable Energy (MNRE) - a nodal agency of the Government of India; Solar Energy Corporation of India Limited (SECI) – a government-owned enterprise that facilitates the implementation of renewable energy projects, including the National Solar Mission (NSM); and The Indian Renewable Energy Development Agency (IREDA) – a non-banking financial institution who work towards the promotion of renewable energy.

Current gaps in meeting ambition

Both the central government and state governments are responsible for policy for and regulation of the electricity sector. While this decentralisation between national and state regulations suits some functions of energy policy, it can result in misalignment between the two. It is particularly the case of inter-state open access (inter-state PPAs), especially between non-utility buyers. Within the states, regulatory provisions like Open Access, which provide non-discriminatory provision for the use of transmission lines/distribution systems for corporate buyers to procure electricity under the bilateral PPA, need streamlining. Open Access regulations must be made more coherent for corporations to better use bilateral PPAs.

Electricity distribution companies (DISCOMs) are key stakeholders in India's RE sector. They are the key buyers of RE and also facilitate bilateral transactions of RE through the open access mechanism. The poor financial health of state-owned DISCOMs is adversely impacting the RE sector as a whole. For example, there are increasing delays in the payment to RE generators by DISCOMs and in granting open access for bilateral PPAs.

The Electricity Act 2003 and the National Tariff Policy 2006 put Renewable Purchase Obligations (RPOs) on the DISCOMs and Open Access customers (known as obligated entities). The 2020 national RPO was 20%, with a higher target expected to be introduced. However, national RPOs have not translated well at state level. State RPOs are defined according to the RE generation potential of states. A RPO is also a consumption target, not a generation target. States with low RE potential can have ambitious RPO targets and meet them via procuring RE from RE-rich states.

However, at present, states with low RE potential have developed less ambitious targets instead of innovating on RE trade practices with other states. This has created less demand for RE. Further, enforcement of RPO across states is also a key issue. State-owned DISCOMs are debt-ridden and find it difficult to pay for RE to meet their RPOs.

Recommendations from stakeholders to bridge the gaps

- 1 As a priority, India needs to address the financial health of DISCOMs through greater operational efficiency and financial assistance.
- 2 Visibility for Open Access charges should be provided for 5 - 10 years as frequent changes to Open Access charges creates uncertainty in the RE market and discourages long-term investment in new RE capacity.
- 3 Individual states should set sub-national targets in line with national ambitions for a more cohesive roll-out of RE policies as well as focus on ease of doing RE business by streamlining land acquisition and set-up processes to remove inefficiency caused by lengthy permitting and licensing for RE.

14. <https://www.weforum.org/agenda/2020/01/india-new-hotspot-renewable-energy-investors/>

15. <https://www.investindia.gov.in/sector/renewable-energy>

INDONESIA

Policy ambition and key market strengths

Indonesia recently announced bold plans to increase the proportion of its RE to at least 48% of overall power by 2030. Simultaneously, the market's state-owned utility, Perusahaan Listrik Negara (PLN), announced its intention to become carbon neutral by 2050, signalling the determination to move away from its current dependency on fossil fuels. Indonesia currently uses less than 2% of its renewables' potential and, with its abundance of solar and tidal energy, remains uniquely well placed, resource-wise, to meet its RE commitments.

Current gaps in meeting ambition

While Indonesia has announced its commitments to RE, a lack of synchronised, stable RE regulation has stymied the growth for RE funding and demand. Different ministries and administrative units approach RE mandates from diverse perspectives, which does not necessarily lead to a cohesive approach for RE uptake in the market. Licensing of RE projects, procurement options and RE contracts are also at nascent stages as utility companies, financiers and corporates navigate a sometimes challenging RE policy landscape.

Recommendations from stakeholders to bridge the gaps

- 1 Indonesia should consider setting up a cross-ministerial agency to establish a cohesive RE policy that will demonstrate consistent direction to implement its RE commitments. Implementation plans should consider a one-stop-shop licensing and monitoring regime for PE projects as well as validate current and upcoming procurement options.
- 2 Currently, no corporate RE sourcing options are available other than off-grid and on-site self-generation. Provisions for the bilateral transaction of electricity is recommended through providing access to the electricity grid and necessary supportive policy.
- 3 While the recommendations above may take longer to streamline, as an intermediate step, Indonesia should encourage stronger collaboration between utilities such as PLN and independent power producers (IPP). It should also revisit the tariffs established in 2017-2018 to improve uptake of partnerships between PLN-IPPs and revive the growth of IPPs in the market.

Policy ambition and key market strengths

Japan's Green Growth Strategy provides for substantial expansion of renewables, accounting for 50-60% of overall electricity demand by 2050¹⁷. In the near term, this would mean renewable power to increase from 19% to 24% by 2030¹⁸. One of the notable features of Japan's renewables' strategy is its commitment to double the share of solar and other RE sources in its power grid and reduce the share of coal to less than half by 2030. The Japanese government has been actively reforming the electricity market since 2011, including the electricity bill in 2020 which aims to spur greater investments in transmission and distributed networks.

Current gaps in meeting ambition

Despite its large-scale deregulation reforms since 2000, Japan remains dependent on fossil fuels as its primary energy supply¹⁹. Structural issues surrounding land use have also limited the uptake of RE. For example, local governments have introduced new rules restricting large-scale solar power plants for environmental and scenery reasons. Obtaining consensus and permission from the local communities will also be an issue due to historic opposition to onshore wind projects when the turbines are close to residential areas.

More importantly, however, Japan does not provide prioritised access to the grid for RE. As per the Electricity Business Act, existing power plants, for example, nuclear and coal-fired power plants, are given priority in Japan ("first come basis"). This limits the opportunities for RE producers to grid access. On corporate RE sourcing, there are options available for corporates such as self-generation, green electricity products offered by electricity retailers and energy attribute certificates (through three systems, i.e., Non-Fossil Fuel Certificate, Green Electricity Certificate and J-Credit for Renewables).

Non-Fossil Fuel Certificates (NFCs) are currently being issued for the RE generated from power plants connected to the grid and selling power to utilities at Feed-in-Tariff (NFC FiT). The government is also in the process of issuing NFCs to non-FiT Renewables. Currently, NFCs are not properly tracked from the point of generation to the point of consumption. Energy Attribute Certificates (EACs) should be tracked electronically through a tracking system, which increases robustness and enables credible RE usage claims by the users.

Recommendations from stakeholders to bridge the gaps

- 1 Reconsider the grid connectivity rule that presently prioritises coal and nuclear over RE. If it is not possible to deprioritise coal and nuclear, CDP recommends that Japan consider RE on an equal footing for grid access to improve the competitiveness of RE in the market.
- 2 CDP welcomes the focus on new technologies such as hydrogen, as identified in the Green Growth Strategy. In the interim, as these technologies evolve, stakeholders also recommend Japan's utilities consider investments in existing technologies that provide a precise prediction of output for variable renewables. The focus on these interim and long-term technology solutions may help alleviate some of the current issues limiting uptake of RE, especially surrounding land use constraints.
- 3 Currently, direct purchase of RE in Japan through power purchase agreements (PPAs) is only possible through tri-party contracts, i.e., generator, retailer and consumer. However, high wheeling costs – the amount charged by transmission owners for use of its systems – make such contracts unviable. Through our consultation process with stakeholders, it was suggested that the Japanese government undertake a pilot project to explore ways to reduce wheeling costs and determine operating models that will result in more viable PPAs.
- 4 RE use claims must be substantiated by attributes that have been reliably tracked from a generator to a consumer. Therefore, it is recommended that a nationwide tracking system should be adopted in Japan for all RE being generated and consumed.

17. IEA. 2021. https://iea.blob.core.windows.net/assets/3470b395-cfdd-44a9-9184-0537cf069c3d/Japan2021_EnergyPolicyReview.pdf

18. <https://www.power-technology.com/comment/japan-power-2021-2030/>

19. <https://renewablesnow.com/news/japan-to-lift-2030-renewables-goal-to-36-38-cut-fossil-fuels-748374/>

MALAYSIA

Policy ambition and key market strengths

The Malaysian government has revised its initial 2025 target of 20% installed capacity to 31%, further raising this to 40% by 2035. It also estimated that solar would contribute to the majority of Malaysia's RE mix and introduced the ambition to install battery energy storage systems from 2030²⁰. If these targets are achieved, carbon emissions in the power sector will be reduced by 60% from 2005 levels (see footnote below:). Malaysia has historically run annual tenders to help achieve renewable generation targets of 7 GWh by 2025. Electricity tenders issued by the Malaysian Sustainable Energy Development Authority for solar, biogas, and small hydropower projects have driven the development of RE, in addition to providing fiscal incentives to boost RE generation.²¹

Current gaps in meeting ambition

Whilst national policies demonstrate the progress being made in market development, CDP's data shows low uptake of RE in Malaysia among corporates. Corporates also do not enter PPAs or self-generate RE, preferring instead RECs (Malaysia's system for energy attribute certificates). Certification of RE generation is currently voluntary in Malaysia, so the quality of RECs depends on the diligence of issuers. This raises concerns over possible double-counting RE generation or consumption. Certain RE generators in Malaysia use palm oil biogas, which, while inexpensive, has potentially adverse ecological impacts.

Recommendations from stakeholders to bridge the gaps

- 1 Capacity building for corporates to understand options to source RE as well as the competitive advantages to access RE over other power sources is key to improving RE demand in Malaysia. The Joint Committee for Climate Change (JC3), a cross-sector agency set up in Malaysia and co-chaired by Securities Commission (SC) and Bank Negara Malaysia (BNM), could be particularly instrumental in capacity building as this would link with the many initiatives that JC3 is already implementing locally for corporates. This will also assist in promoting a dialogue on RE financing.
- 2 Stakeholders also recommend streamlining licensing and permit processes to accelerate RE demand, supply and increased grid connectivity in the market. This would also ensure RE options such as PPAs and self-generation are used in addition to unbundled energy attribute certificates (EAC).
- 3 RE generated from palm oil biogas has ecological footprints characteristically different in comparison to other RE sources. If used, CDP recommends the energy attribute certificates (EACs) clearly mention the RE source and technology used so buyers understand the type of RE they purchase.

20. <https://www.mida.gov.my/mida-news/malaysia-aims-31-re-capacity-by-2025/>

21. [https://www.st.gov.my/contents/files/download/112/Energy_Malaysia_18_\(Online\).pdf](https://www.st.gov.my/contents/files/download/112/Energy_Malaysia_18_(Online).pdf)

SINGAPORE

Policy ambition and key market strengths

Singapore's Green Plan charts ambitious targets over the next 10 years, strengthening previous commitments made under the UN's 2030 Sustainable Development Agenda and the 2015 Paris Agreement. The Green Plan will increase solar energy capacity to 1.5 GWp by 2025 and 2 GWp by 2030 (it was 352 MWp at the end of 2019). The Singapore government is currently examining the use of hydrogen and carbon capture, utilisation, and storage technologies²². Policymakers recognise that new technology will play an important role in developing Singapore's RE capacity: current technologies' land requirements put the market at a significant disadvantage.

Current gaps in meeting ambition

Renewable electricity is currently very expensive for corporates to actively source. There is also a distinct supply shortage of EACs due to lack of sufficient installed RE generation capacity primarily related to land constraints.

Voluntary procurement of RE has significant constraints in Singapore due to the unavailability of RE resources. Corporates are exploring options to buy RE from neighbouring markets such as Malaysia. However, due to the lack of harmonised electricity markets, corporates do not have credible RE sourcing options to secure consumer claims associated with direct RE usage.

Recommendations from stakeholders to bridge the gaps

Singapore remains one of the most challenging markets for RE, given its land constraints. Speaking with stakeholders, we believe this market is exploring possible short and long-term avenues currently available to improve its RE capacity.

- 1 We agree on Singapore's Green Plan focus to assess and prioritise emerging RE technologies such as hydrogen, which are not limited in capacity by the available land.
- 2 For market-based reporting and reporting requirements of initiatives like RE100, the ability to demonstrate and claim use or delivery of RE on a shared electricity distribution network (grid) is crucial. This can be achieved if Singapore expands its market boundary by joining its electricity market with other neighbouring markets through a harmonised regulatory framework, inter-market grid connectivity, and recognition of each other's market instruments.
- 3 Singapore is already in negotiations with ASEAN on power integration projects with greater access to RE. We recommend that Singapore also considers the harmonised ASEAN regulatory framework needed for a single RE market to form.

SOUTH KOREA

Policy ambition and key market strengths

South Korea aims to increase its RE capacity by 77.8 GW by 2034²³. This is nearly four times its existing RE capacity. South Korea's recent Green New Deal has also made near-term targets more ambitious: a previous target of adding 29.9 GW²⁴ in solar and wind power by 2025 has been increased to 42.7 GW. The market's Hydrogen Economy Act, which came into force in February 2021, is the first of its kind globally. It is already associated with significant private sector investment in hydrogen²⁵.

In 2004, unsuccessful investments in solar energy led to changes in the energy technologies considered for development by policymakers in South Korea. According to stakeholder interviews, the investment outlook for RE in South Korea²⁶ has since improved. State-owned enterprises (SOEs) are viewed by financial stakeholders as good business operators. This is not expected to change, meaning deregulation of the electricity market is not expected or desired. While the pathway for foreign investment in RE is still unclear, private finance is available from domestic financial institutions.

Current gaps in meeting ambition

South Korea's geography limits its potential to develop onshore solar and wind power. Changes to land use risk displacing farming. Foreign direct investment in RE capacity remains a challenge in South Korea.

Only 3% of South Korean companies that responded to CDP report any sourcing of RE using PPAs. For those companies, most of their electricity use still comes from other procurement methods. PPAs in South Korea are not standardised or bankable, with high default rates. Generators experience financial losses from hedging against prices and the changing tax landscape.

Recommendations from stakeholders to bridge the gaps

- 1 To improve RE technology options in South Korea, we recommend the market consider buddying programmes between foreign and local partners (through international chambers of commerce or joint ventures), which could create opportunities for corporations to find international finance and technology backing.
- 2 South Korea should consider setting up standardised PPAs. This would also help provide a better understanding of the trigger events for defaults and compensation for the interruption to an agreed supply. South Korea should also consider hedging mechanisms for RE generators and consumers to better adapt to changes in law and tax regimes.
- 3 For RE generators to connect to the power grid, we recommend South Korea considers the shallow allocation of connection costs. This involves allocating expenses related to the network connection required by the generator and will assist in reducing the level of financial risks that generators currently undertake.

23. <http://taiyangnews.info/markets/south-korea-to-aim-for-42-re-share-by-2034/>

24. <https://www.rapidtransition.org/stories/building-back-better-south-korea-shows-the-challenge-and-opportunity-of-green-stimulus-spending-for-covid-recovery/>

25. <https://ihsmarkit.com/research-analysis/south-korean-conglomerates-to-invest-38-billion-to-boost-hydro.html>

26. <http://www.koreaherald.com/view.php?ud=20200412000143>

TAIWAN

Policy ambition and key market strengths

Taiwan has a target to generate 20% of its electricity renewably by 2025. FiTs have been available since the 2009 Taiwan Renewable Energy Act. They have added 2 to 3 GW in solar capacity, 400 MW of onshore wind capacity. 5 GW of offshore wind capacity is in development. As with several other developed markets in the region, land use is constrained, making offshore wind a focus for policy. While an overall renewable energy target does not exist past 2025, Taiwan plans to add 1.5 GW in offshore wind capacity per year between 2026 and 2035, for a total capacity of 21 GW by 2035.²⁷

Current gaps in meeting ambition

Policymakers are liberalising the energy market. It is now possible for off-takers to source RE without ceilings to their volumes. Taiwan's market allows for foreign investment and, over time, has led to the availability of well-trained human resources with strong technical capabilities. RE demand in Taiwan remains high due to mandatory demand created through RPS. The market also has a stable market for voluntary RE demand. However, on the supply side, RE players face a significant administrative burden. Similar to other markets such as India and Japan, land issues for the development of RE can be locally challenging for large-scale development.

Recommendations from stakeholders to bridge the gaps

- 1 Policy interventions in the past, for example, with wind power, have shown that Taiwan can move fast to introduce different RE technologies. Similarly, we recommend Taiwan considers accelerating the administrative process to provide a common agency for RE approvals as approval responsibilities are currently spread across numerous ministries and agencies.
- 2 We recommend Taiwan considers mechanisms to phase out subsidies such as FiTs for mature technologies, including wind and solar, to encourage economic efficiency and competitive pricing, especially for PPAs and green tariffs.
- 3 Over the long term, and considering technical capabilities in the market, Taiwan may consider becoming a hub for emerging technologies in the region.

VIETNAM

Policy ambition and key market strengths

Policymakers have plans to scale up RE, but electricity and environment stakeholders look forward to greater ambitions. Wind and solar capacity additions substantially exceeded their 2017-2019 targets. Installed capacity for wind and solar is already more than 10 GW, driven by utilities and rooftop solar. Policymakers did not predict this level of growth, so the 2020-2030 target has lowered ambitions as Vietnam's transmission lines are at full capacity or overloaded²⁸. The new wind target is 18-19 GW by 2030, and 19-20 GW for solar.²⁹

With an inviting market for buying and selling RE, and a grid to support these markets, stakeholders look forward to a well-designed roadmap for RE. There is support for corporate buyers to procure more RE, but policymakers need to classify the different types of RE scales between self-generation vs. utility level.

Current gaps in meeting ambition

The state owns the national grid, making it a difficult environment for independent power providers (IPPs) to operate in. The government is piloting independent power producers, but state ownership and the limited capacity of the grid curtails uptake of RE. The government is announcing a new RE market purchasing scheme of direct PPAs from the national grid. This is because "virtual PPAs" that dictate increases in the electricity grid to overcome bottlenecks in wind and solar oversupply are not yet able to supply. However, stakeholders believe that it may be possible to source offsite RE via direct PPA financing.

Bankability of PPAs in Vietnam is another challenge for RE participants as costs remain high due to governing laws, lack of international arbitration and difficulties with accessing international finance.

Recommendations from stakeholders to bridge the gaps

- 1 Stakeholders recommend that Vietnam addresses the issue of the high cost of capital for RE projects. One area of consideration would be for Vietnam to set up a government-backed fund for PPAs to improve bankability and attract more efficient types of financing.
- 2 Considering its ambitious targets, one area of consideration for Vietnam is establishing Energy Attribute Certificates (EACs) and developing a robust tracking system.
- 3 Vietnam recently approved legislation to improve its grid capacity to accommodate renewables³⁰. While expansion of transmission lines is a much-needed solution to absorb RE, in the short term, we recommend Vietnam considers allowing self-generation for corporates to maintain its RE targets.

28. US Energy Information Administration (EIA). <https://www.eia.gov/todayinenergy/detail.php?id=48176>

29. <https://www.eco-business.com/news/renewables-are-booming-in-vietnam-will-the-upswing-last/>

CONCLUSION

We are today experiencing energy transition at an unprecedented scale. Asia's role in the advancement of renewables is a crucial factor in meeting the objectives of a net-zero world. For their part, Asian economies have risen to the challenge by implementing policies that aim to meet their Paris Agreement goals.

We identify five key recommendations across all Asian markets for renewables to become the dominant source of electricity over the coming decade:

- 1 Policy for RE must be unambiguous and cohesive.** It must include targets and be technology specific. In markets where targets are set by sub-national governments, there must be alignment with national policy. This provides **clear regulatory support** to financiers and electricity suppliers and consumers and reduces policy-related transition risks in the market.
- 2 Licensing regimes, financial incentives and renewable electricity sourcing options should be streamlined.** Guides to what is and is not possible in each market will improve transparency and monitoring of progress against targets.
- 3 Adoption of standardized and credible tracking mechanisms for RE from its generation to its consumption** must happen for corporates to better leverage their demand signal for renewable electricity.
- 4 Capacity-building remains essential to driving corporate renewable electricity demand in some Asian markets.** CDP's work shows that certain technologies are being tested for feasibility, and their sourcing options are still in their nascent stages. Providing guidance to corporates on sourcing options, tax or credit incentives and financing opportunities will help RE technologies succeed.
- 5 Markets should pair their emissions reduction targets with renewable electricity targets,** and targets to phase out subsidies to fossil fuels.



Our global pathway to renewables is irreversible. However, the success of an orderly transformation will depend on the agility and pace at which underlying markets and their economic systems can translate aspirations into robust market infrastructures with renewables at the heart of energy systems. Key markets in Asia such as India, Mainland China, and Japan demonstrate that a combination of policy and corporate resolve is needed to meet our systemic goal of decarbonisation.

Through subsequent iterations of the AREC-Index, and acting as a conduit between RE participants, CDP will continue to refine our understanding for best practice and establish the blueprint for renewables in Asia.



A low-angle photograph of a blue metal pole supporting a solar panel array against a cloudy sky. The pole is the central focus, extending from the bottom right towards the top left. The solar panels are visible in the background, creating a grid pattern. The sky is filled with soft, white clouds. A red rectangular box is overlaid on the right side of the image, containing the word 'APPENDIX' in white, bold, uppercase letters.

APPENDIX

APPENDIX

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01 INTRODUCTION TO THE METHODOLOGY

The energy sector is the source of around three-quarters of greenhouse gas (GHG) emissions today. Electricity generation is the single largest source of energy-related GHG emissions, accounting for 36% of total energy-related emissions. Thus, the transformation of the electricity sector is critical to achieving climate goals. Renewable energy is a rapidly advancing field and will likely support the growing global electricity demand. It also plays an important role in anthropogenic climate change mitigation.

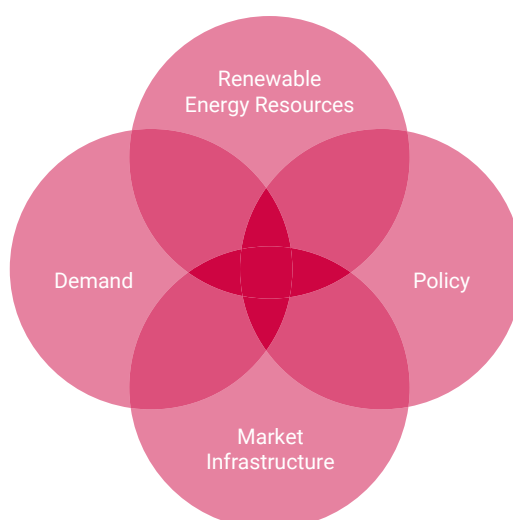
The International Energy Agency (IEA) released a report³¹ laying out a comprehensive pathway for the global energy sector to reach net-zero carbon dioxide emissions by 2050. It examines what actions are needed from governments, companies, investors, and citizens to decarbonise the energy sector and limit the global temperature increase to 1.5 degrees Celsius.

As per the report, electricity accounts for almost 50% of total energy consumption in 2050. It plays a key role across all sectors – from transport and buildings to industry – and is essential to produce low emissions fuels such as hydrogen. To achieve this, total electricity generation increases over two-and-a-half times between today and 2050. The share of renewables in total electricity generation globally increases from 29% in 2020 to over 60% in 2030 and nearly 90% in 2050. This requires all governments to significantly strengthen and then successfully implement their energy and climate policies.

Analysing the factors that favour or hinder the growth of RE in the region will be a crucial starting point for our understanding of the ambition gap that currently exists between our determination and our ability to meet the goals of the 2015 Paris Agreement. To achieve this, a competitive index has been developed for 10 selected markets in Asia to identify the readiness of these markets for RE. The AREC-Index will be important in advancing our understanding of the development of RE in the region, recognising the leading RE markets, and establishing the future potential of RE investment.

Building on the findings in the index, the above report has been prepared to provide in-depth analysis of RE supply and demand, barriers, and drivers in various markets. This will present recommendations required by the markets to improve RE infrastructure. To produce the AREC-Index CDP, with support from HSBC and input from a variety of other stakeholders, developed this methodology by defining and agreeing overarching requirements and principles, including source data from quality sources for the year 2020. It allows its readers to understand the reasoning behind the methodology.

Figure A1: The Nexus of Renewable Electricity Market Readiness



02 SCOPE

The methodology developed although not exhaustive, provides an insight into market attractiveness, and evaluates the ease of doing RE business in selected Asian markets.

03 DESIGN REQUIREMENTS

The following requirements were considered in the design of the Index methodology:

- ▼ The Index intends to highlight the critical role that national climate/energy goals and policies are playing in the energy transition. As such, the Index will not “name and shame” but rather “name and fame” markets for their actions in supporting renewable energy;
- ▼ The Index aims to provide a broad overview of market infrastructure across the selected markets in Asia and support further analysis on conditions and policy contexts that accelerate or constrain the adoption of RE;
- ▼ The Index will provide a broad view of corporate sourcing of RE across 10 selected markets;
- ▼ The Index shall be based on verifiable data reported by organisations even if the data itself has not been subject to external third-party verification.

The consistent application of methodological principles has been fundamental to ensure the individual metrics are genuinely comparable and the resulting Index and ranking to be a fair, accurate and dependable analysis and assessment.

The methodology design principles are:

- ▼ **Relevance:** The Index is developed based on publicly available data and self-reported company data that helps assess the current state of both demand and supply side of RE.
- ▼ **Verifiability and repeatability:** The data required for the assessment should be verifiable from official and reputable sources. This analysis could be re-run with the same datasets or later new datasets as they become available.
- ▼ **Consistency:** Consistency has been maintained within datasets across yearly reporting, in this case 2020 data.
- ▼ **Transparency:** The methodology, data and methods are intended to be transparent, to those markets profiled in the index. The Index has been developed using publicly available policy and RE data alongside the RE data voluntarily disclosed by organisations to CDP.

The resulting analysis, market information and index will provide the following to corporate users and RE and policymakers in formulating conducive RE policy:

- ▼ A potential decision support tool for government strategy and policy formulation, the assessment of capacity building needs, and the ability to estimate and mobilise private investments or attract international donor funding;
- ▼ Create an “index” to allow comparison and benchmarking;
- ▼ Disseminate information to a broad range of industry stakeholders including end-users, practitioners, policymakers, and investors;
- ▼ Ascertaining the future potential challenges for rapid renewable electricity adoption.

04 METHODOLOGY

There are **four** main elements to the methodology:

1. Input data
2. Index indicators
3. Scoring for index indicators
4. Input from stakeholders

05 SELECTION OF THE MARKETS – EVALUATION CRITERIA

The starting point of the methodology is the identification of selected markets to be included in the analysis.

The following selection criteria were used:

- a) Producer / consumer of RE;
- b) Developed/developing market status;
- c) Size of economy (GDP size);
- d) Volume of electricity consumed;
- e) Share of renewable electricity in the total electricity mix;
- f) Electricity demand of companies reported to CDP from that market;
- g) Voluntary renewable electricity targets reported by companies from those markets (including RE100 targets); and
- h) Priority markets as determined by CDP and HSBC.

Through applying the above criteria to a starting list of xx markets in Asia, a short list of ten markets were selected to be included for this project. These markets provided a holistic view of the renewable electricity ecosystem in Asia and the availability of basic potential of corporate renewable electricity procurement practices as a strong indicator to reflect market readiness.

The markets are listed in the **Appendix Table 1**, together with one RE highlight and reason for their inclusion:

Appendix Table 1: Selected markets in the index

Country	Short description
1. China	Asia's largest producer / consumer of RE
2. India	Asia's 2 nd largest producer / consumer of RE
3. Japan	Asia's largest developed market increasing RE usage
4. South Korea	Asia's 2 nd developed market increasing RE usage
5. Taiwan	Developed market with long history of RE
6. Indonesia	Seen as potential future market for RE development
7. Vietnam	Small but potential policy implementation test case
8. Malaysia	Potential for new market development and expansion
9. Hong Kong	Potential for offshore wind, marine & biomass RE
10. Singapore	Growing urban development focus on RE

The index benchmarking and ranking is based on both quantitative and qualitative metrics

The quantitative KPIs are based on readily available data from reputable public datasets (ideally government statistics, inter-governmental organizations, industry associations, and CDP's database). The data comprises of the following:

- ▼ **Data collected from CDP respondents:** The data was captured from all corporates in the sample markets that source RE and responded to the CDP climate change questionnaire (in the investor and supply-chain programs for 2020).
- ▼ **Publicly available datasets:** These include data from credible sources such as International Energy Agency (IEA), International Renewable Energy Agency (IRENA), national-level electricity ministries, electricity authorities, and national and international-level industry associations, alongside electricity news from the selected markets.

For CDP responders, companies were allocated to a market according to where they are headquartered

To prevent double-counting, companies are identified by name and a unique identifier number, e.g., CDP account numbers. However, the sample has three important design characteristics inbuilt that should be noted:

- a) Its coverage is mainly of large publicly listed companies that have reported from the market they are headquartered in. Companies that have reported from their headquarters market but also included electricity consumption data for other markets where they have international operations are totally excluded from the sample. Coverage is for companies that have reported accurate electricity consumption data. All companies that have obviously reported wrong electricity consumption data have been removed from the sample as a precautionary measure to avoid distortions. More details on this are provided below.
- b) The sample coverage is mainly for companies that have reported RE consumption data.

The analysis therefore focuses on big single-market corporates (i.e., it does not capture unlisted companies or any companies with operations in multiple markets). It also tries to focus on those companies providing accurate reporting. While these design limitations exist, the analysis still provides a detailed narrative of the market experience by 1,170 companies operating in the studied 10 markets which included those organisations purchasing RE and self-generating their own RE.

06 OVERVIEW OF DATA COLLECTED FROM CDP DISCLOSURES

Overview of data collected from CDP disclosures

CDP owns and controls the largest database of primary corporate environmental data in the world. CDP's climate change disclosure program covers electricity-related data via a separate section on 'Electricity' and other key relevant sections such as 'Targets and Initiatives' in the climate change disclosure program questionnaire. The electricity data provided by reporting companies is consistent with their business models aka organizational boundary and follows greenhouse gas accounting and reporting standards such as the GHG protocol, and ISO14064. These data points were collated from two main CDP disclosure programs: The investor led climate change disclosure program and the supply chain

Data coverage period

Unless otherwise indicated, data disclosed by CDP-reporting companies relates to the year 2020. Usually, this data corresponds to activity that took place throughout the reporting period (e.g., financial year), and occasionally supplemented by more reason recent updates.

Data quality control and procedures

To ensure the quality of the source data, quality checks have been conducted to clean the input data, and if necessary, exclude the use of some of it.

The following measures are taken to maintain data quality:

1. Internal consistency checks are used for every company to verify that each data point aligns with the other information that the company has reported. For example, if the company has reported RE consumption, the company should have provided details on electricity consumption in its responses to CDP.
2. The checks for internal consistency are used to remove incorrect data inputs, i.e., miscalculated ex-post data points that have been misreported ex-ante to exclude RE data that was double counted or used incorrect units, e.g., GWh when referring to MWh. Large outliers can distort analysis; therefore, it is critical to identify companies that may be misreporting data. A criterion was developed to identify outliers based on common quality checks such as comparing total reported electricity consumption and industry average electricity consumption, etc. Any data points that are identified as outliers are then investigated in detail by thoroughly reviewing key data points across the companies' responses.
3. Public data information was sourced from online policy documents and renewable electricity reporters such as IRENA, IEA, et al. Where market energy consumption was reported in TWh/MWh and percentage RE was stated but output not presented as TWh or MWh this was then calculated as the true percentage of total electricity reported per market. Occasionally, RE output reported in the media per market were higher than actual electricity consumption reported by RE sites, so this data was re-analysed by using the percentages reported for current RE and proposed RE targets.

07 INDEX INDICATORS

To capture the complexity of the electricity market and the transition towards RE, multiple indicators were considered to understand how electricity policy and market infrastructure supported development of both supply and demand (here meaning capacity needs and percentage RE generated). The Index is made up of two themes comprising a total of 19 indicators:

1. **Market and policy indicators (MPIs):** These indicators are intended to provide an overview of various market fundamentals within which the renewable electricity sector operates and is set to develop over time.
2. **Corporate indicators (CIs):** This set of indicators is intended to provide an overview of current corporate practices in each market using data collected by CDP.

Working from the bottom-up to address a top-down question of global significance, these indicators track renewable electricity use across industries, voluntary renewable electricity consumption, generation-related commitments, and business models to source renewable electricity opted by industrial users.

Market and policy indicators

MPI_01: 2030 expected renewable electricity generation

Name	2030 expected renewable electricity generation
Description	MPI_01 considers the market's generation (not capacity) potential for 2030 to indicate the medium-term ambition for the renewable electricity sector in that market.
Remarks	<p>Sometimes markets do not publish targets exactly for 2030. Where targets are not for this year, the closest target year is chosen. With the current or most recent available generation mix data, an estimate for a 2030 target is produced using linear interpolation. Furthermore, some markets only publish capacity targets: India is a famous example. India's 2030 capacity target from its NDC is used as a proxy for a generation target.</p> <p>The value for the MPI is a national target in policy, if one exists in the market. If the market does not have one (reflected in MPI_05), a secondary source on the expected level is used.</p>
Expressed as	A percentage.

MPI_02: 2018 renewable electricity generation mix

Name	2018 renewable electricity generation mix
Description	MPI_02 considers the market's generation mix for 2018 to indicate the current performance of renewable electricity in that market.
Remarks	None
Expressed as	A percentage.

MPI_03: CAGR in renewable electricity capacity over 2011-2020

Name	Compound annual growth rate (CAGR) in renewable electricity capacity over 2011-2020
Description	MPI_03 considers the market's compound annual growth rate (CAGR) in renewable electricity capacity additions seen over 2011-2020 to indicate the current momentum of the renewable electricity sector in that market.
Remarks	None
Expressed as	A percentage.

MPI_04: Market investment in renewable electricity capacity in 2019

Name	Market investment in renewable electricity capacity in 2019
Description	MPI_04 considers the market's investment in renewable electricity capacity in 2019 as a share of the entire ten markets' investment in renewable electricity capacity in 2019 to indicate that market's relative contribution to renewable electricity capacity growth in the Southeast Asia.
Remarks	None
Expressed as	A percentage.

MPI_05: Existence of renewable electricity targets

Name	Existence of renewable electricity targets
Description	MPI_05 considers whether the market has a national renewable electricity target to indicate a favourable policy environment for growth of renewable electricity.
Remarks	None
Expressed as	1 (the policy exists) or 0 (the policy does not exist).

MPI_06: Existence of tradable EACs

Name	Existence of tradable energy attribute certificates (EACs)
Description	MPI_06 considers whether the market has tradeable EACs to indicate a favourable policy environment for businesses sourcing their own renewable electricity.
Remarks	None
Expressed as	1 (the policy exists) or 0 (the policy does not exist).

MPI_07: Existence of an RPS

Name	Existence of a renewable portfolio standard (RPS)
Description	MPI_07 considers whether utilities in the market are subject to RPS legislation to indicate a favourable policy environment for growth in renewable electricity.
Remarks	None
Expressed as	1 (the policy exists) or 0 (the policy does not exist).

MPI_08: Existence of net metering

Name	Existence of net metering
Description	MPI_08 considers whether the technological and regulatory infrastructure for net metering exists in the market to indicate a favourable policy environment for businesses sourcing their own RE.
Remarks	None
Expressed as	1 (the policy exists) or 0 (the policy does not exist).

MPI_09: Existence of RE tendering options

Name	Existence of RE tendering options
Description	MPI_09 considers whether RE tendering options exist in the market to indicate a favourable policy environment for businesses sourcing their own RE.
Remarks	None
Expressed as	1 (the policy exists) or 0 (the policy does not exist).

MPI_10: Existence of public loans for RE

Name	Existence of public loans for RE
Description	MPI_10 considers whether public loans for RE in the market are available to indicate a favourable policy environment for growth in RE.
Remarks	None
Expressed as	1 (the policy exists) or 0 (the policy does not exist).

MPI_11: Existence of investment or production tax credits for RE

Name	Existence of investment or production tax credits for RE
Description	MPI_11 considers whether investment or production tax credits for RE are available in the market to indicate a favourable policy environment for businesses sourcing their own RE.
Remarks	None
Expressed as	1 (the policy exists) or 0 (the policy does not exist).

MPI_12: Existence of FiTs

Name	Existence of Feed-in Tariffs (FiTs)
Description	MPI_12 considers whether Feed-in Tariffs are available in the market to indicate a favourable policy environment for businesses sourcing their own RE.
Remarks	None
Expressed as	1 (the policy exists) or 0 (the policy does not exist).

Corporate indicators

CI_01: Total electricity consumption by single-market corporates

Name	Total electricity consumption by single-market corporates
Description	CI_01 considers the total electricity consumption reported by corporates in a market to indicate the potential demand signal from corporates shifting to RE in that market. It also indicates the size of the corporate RE, which may be important information for an investor wishing to invest in it.
Remarks	CDP's data does not include per-market totals, so multinationals must be excluded from the analysis in this indicator
Expressed as	MWh.

CI_02: Single-market corporates' renewable share of total electricity consumption

Name	Single-market corporates' renewable share of total electricity consumption
Description	CI_02 considers the total RE consumption reported by corporates in a market as a share of their total electricity consumption to indicate the current performance of corporates in that market.
Remarks	CDP's data does not include per-market totals, so multinationals must be excluded from the analysis in this indicator.
Expressed as	A percentage. .

CI_03: Single-market corporates' self-generated renewable share of total electricity consumption

Name	Single-market corporates' self-generated renewable share of total electricity consumption
Description	CI_03 considers the total self-generated RE consumption reported by corporates in a market as a share of their total electricity consumption to indicate the current performance of corporates in that market.
Remarks	Self-generation of a large amount of renewable energy is indicative of a liberalised RE sector free of barriers to self-generation. CDP's data does not include per-market totals, so multinationals must be excluded from the analysis in this indicator.
Expressed as	A percentage. .

CI_04: Sourcing deregulation score

Name	Sourcing deregulation score
Description	CI_04 considers the volumes of electricity consumption through different sourcing options reported by corporates in a market to indicate the tendency for more deregulated sourcing options to be available in that market.
Remarks	The score is derived from how much electricity corporates tend to source through unbundled EACs, bundled EACs, and PPAs. Corporates are awarded more points if more of their RE is sourced through deregulated procurement methods (like PPAs). If RE is being sourced but no sourcing method is being disclosed, one point is awarded. The score is normalised based on the number of corporates in the market. CDP's data does not include per-market totals, so multinationals must be excluded from the analysis in this indicator.
Expressed as	A dimensionless number. A small value indicates that corporates in that market tend to source most of their RE using unbundled EACs, while a large value indicates that corporates in that market tend to source the majority of their RE using PPAs.

CI_05: Prevalence of corporate RE targets

Name	Prevalence of corporate RE targets
Description	CI_05 considers the tendency of corporates to have RE consumption or production targets active in a market to indicate whether corporates feel confident in increasing their consumption or production of RE in that market.
Remarks	Multinationals which set organisation-wide targets may be considered by this indicator. Single-market corporates setting RE targets of any kind are also considered. The number of respondents reporting targets is divided by the total number of respondents in that market.
Expressed as	A percentage.

CI_06 Prevalence of technology type disclosure by single-market corporates

Name	Prevalence of technology type disclosure by single-market corporates
Description	CI_06 considers how frequently corporates report on the technologies used to generate the RE they are sourcing to indicate data availability around RE in that market.
Remarks	The number of respondents reporting technology types is divided by the total number of respondents in the market. CDP's data does not include per-market totals and so multinationals must be excluded from the analysis in this indicator.
Expressed as	A percentage.

Combining the indicators to produce the index

The indicators are measured through different units, and some show significant spread. The indicators must be combined to produce a simple and intuitive, all-inclusive score. Ranking of the sample markets was chosen to express all the indicators in common units and eliminate the variability in the indicators' values themselves. A market's performance in one indicator is compared with the other markets in the sample and is ranked.

The rankings were then weighted so that where a market is leading among its peers in an indicator, it is awarded 100%. The market in 2nd place receives 90%, and so on. If there is no data for the indicator, the market is awarded 0% in that indicator. This creates a smooth statistical performance distribution of descriptive data on categorical variables and applies the same across all markets.

The index is created by a straightforward averaging of each market's rank across all the indicators, with every indicator carrying the same weight. A high KPI index value for a market should be thought of as that market's tendency to be leading across all the indicators.

Figure A3: The two themes of indicators used in the index



Market and Policy Indicators (MPIs)

- ▼ 1 2030 expected renewable electricity generation
- ▼ 2 2018 renewable electricity generation mix
- ▼ 3 CAGR in renewable electricity capacity over 2011-2020
- ▼ 4 Market investment in renewable electricity capacity in 2019
- ▼ 5 Existence of renewable electricity targets
- ▼ 6 Existence of tradable EACs
- ▼ 7 Existence of a renewable portfolio standard (RPS)
- ▼ 8 Existence of net metering
- ▼ 9 Existence of renewable electricity tendering options
- ▼ 10 Existence of public loans for renewable electricity
- ▼ 11 Existence of investment or production tax credits for renewable electricity
- ▼ 12 Existence of feed-in tariffs (FiTs)



Corporate Indicators (CIs)

- ▼ 1 Total electricity consumption by single-market corporates
- ▼ 2 Single-market corporates' renewable share of total electricity consumption
- ▼ 3 Single-market corporates' self-generated renewable share of total electricity consumption
- ▼ 4 Sourcing deregulation score
- ▼ 5 Prevalence of corporate renewable electricity targets
- ▼ 6 Prevalence of technology type disclosure by single-market corporates



The significance of these rankings and benchmarking

The rankings give the sample markets a ranked performance across trends in electricity grids, investment into RE, key policy, and reported corporate electricity sourcing behaviour. These dimensions have been selected as indicative of a market's attractiveness to investment in RE. It should be noted, however, that the index does not account for market size. This allows, for example, Vietnam, with a much smaller electricity demand than India, Mainland China, or Japan, to perform relatively well. This is because it is rewarded for its policy environment alone. CDP corporate disclosure data has been limited in its use because it is not per market. Some corporate indicators cannot use data disclosed to CDP from multinationals because they represent multiple markets, and the purpose of this assessment is to assess markets individually. This significantly reduces the availability of certain data points and may mean that RE sourcing practices which are unique to multinationals are not being reflected in the index. Some corporate indicators from CDP data may be affected by sector and market-specific impacts unrelated to RE sourcing. For example, in some markets, disclosure rates by corporates may simply be lower, and in others, specific sectors in which procurement behaviour is different may be reported on more widely.

However, the methodology applies to any sample of markets and corporate respondents. It is straightforward to see how individual indicators impact a market's position in the ranking because the indicators are expressed in common units. Therefore, the ranking provides an accessible tool to develop intuitive narratives and recommendations for a market based on its performance in the indicators.

08 INPUT FROM STAKEHOLDERS

To ensure the robustness of the methodology, CDP conducted two focus group sessions (online due to the Covid-19 pandemic) to review the current methodology and improve upon the indicators based on feedback from the focus groups. Participants invited to these focus groups were selected on the basis of their technical expertise and on-the-ground know-how in the selected markets. During these focus groups, CDP presented current methodology indicators and justifications of these rankings.

The focus group participants were provided with information packs in advance of the focus sessions and asked to review and provide feedback on the methodology. During the discussions, participants were invited to provide input on:

1. Whether they agree with the initial rankings;
2. Indicators that participants feel we should remove or modify from the current methodology and reasons for modification or exclusion; and
3. Any other indicators that should be included/considered in the overall methodology, bearing in mind data availability for all selected markets.

In collating the data from stakeholder workshops and follow-up one-to-one interviews, metrics were established based on what RE stakeholders stated was required for RE development in each market. Input for market recommendations was collected from 36 stakeholders involved in RE and operating within the 10 selected markets. These sessions consisted of two webinar workshops with corporate speakers from utilities, financial institutions, and NGO RE policy experts, respectively, with 12 follow-up one-on-one interviews for the 10 selected markets. This input has been assimilated into the commentary for each market included in the report.

09 AREC-INDEX RANKING INDICATOR FINDINGS

MARKET AND POLICY INDICATORS

Country	MPL_01 2030 expected RE generation	MPL_02 2018 RE generation mix	MPL_03 CAGR in RE capacity for 2011-2020	MPL_04 RE capacity investment % of total), 2019
China	35.0%	26.0%	14.3%	67.4%
Hong Kong	4.0%	0.0%	0.0%	0.0%
India	40.0%	19.0%	9.8%	7.5%
Indonesia	32.4%	17.0%	4.4%	0.3%
Japan	24.0%	17.0%	11.7%	13.3%
Malaysia	20.0%	17.0%	9.3%	0.2%
Singapore	8.0%	2.0%	17.1%	0.0%
South Korea	20.0%	4.0%	21.8%	1.9%
Taiwan	31.4%	4.0%	12.8%	7.1%
Vietnam	47.0%	35.0%	14.9%	2.1%

CORPORATE INDICATORS

Country	CI_01 Total electricity consumption by single-market corporates	CI_02 Single-market corporates' renewable share of total electricity consumption	CI_03 Single-market corporates' self-generated renewable share of total electricity consumption	CI_04 Sourcing deregulation score	CI_05 Prevalence of corporate RE targets in the market	CI_06 Prevalence of technology type disclosure by single-market corporates
China	32,987,275	24%	0%	0.402	21%	9%
Hong Kong	2,313,583	0%	0%	0.000	11%	0%
India	15,769,929	16%	7%	0.589	16%	7%
Indonesia	4,225,862	1%	1%	0.375	16%	0%
Japan	41,158,335	3%	1%	0.404	13%	32%
Malaysia	196,263	8%	0%	0.200	0%	0%
Singapore	237,930	15%	0%	0.444	14%	50%
South Korea	11,301,510	4%	0%	0.200	13%	18%
Taiwan	14,598,340	3%	1%	0.566	24%	3%
Vietnam	64,721	48%	0%	0.200	33%	0%

MPI_05 Existence of renewable electricity targets	MPI_06 Existence of tradable energy attribute certificates (EACs)	MPI_07 Existence of a renewable portfolio standard (RPS)	MPI_08 Existence of net metering	MPI_09 Existence of RE tendering options	MPI_10 Existence of public loans for RE	MPI_11 Existence of investment or production tax credits for RE	MPI_12 Existence of feed-in tariffs (FiTs)	Score
1 (exists) or 0 (does not exist)	1 (exists) or 0 (does not exist)	1 (exists) or 0 (does not exist)	1 (exists) or 0 (does not exist)	1 (exists) or 0 (does not exist)	1 (exists) or 0 (does not exist)	1 (exists) or 0 (does not exist)	1 (exists) or 0 (does not exist)	%
1	1	1	0	1	1	1	1	87%
0	1	0	0	0	0	0	1	18%
1	1	1	1	1	1	1	1	91%
1	0	0	0	1	1	1	1	58%
1	1	0	0	1	1	0	1	63%
1	0	0	0	1	1	0	1	48%
1	1	0	1	1	1	0	0	53%
1	1	1	1	0	1	1	0	69%
1	1	1	0	0	0	1	1	61%
1	0	0	1	1	1	1	1	78%

GLOSSARY

ASEAN	Association of Southeast Asian Nations established in 1967 by Indonesia, Malaysia, Philippines, Singapore and Thailand. Brunei Darussalam joined ASEAN in 1984, Vietnam on 28 July 1995, Lao PDR and Myanmar in 1997, and Cambodia on 30 April 1999.
CAGR	CAGR stands for the Compound Annual Growth Rate. It is the measure of an investment's annual growth rate over time, with the effect of compounding considered. It is often used to measure and compare the past performance of investments or to project their expected future returns.
CDP	Originally the Carbon Disclosure Programme (now includes forestry, green finance, climate change and renewable energy).
CIs	Corporate indicators of commercial sourcing or generation of RE.
CO₂	Carbon dioxide is a heat-trapping (greenhouse) gas released through natural processes such as respiration and volcanic eruptions and human driven deforestation and burning fossil fuels.
CCUS	Carbon capture, utilisation and storage
DPPA	DPPA mechanisms (also known as corporate PPAs), the DPPA mechanism refers to a power purchase agreement arrangement in which the power purchasers (off-takers) are private power consumers.
EAC	Energy Attribute Certificates are certificates whereby companies can claim the environmental benefit of renewable energy production in their own electricity consumption. EACs do not represent the electricity itself (they are usually unbundled from the production).
FDI	Foreign Direct Investment is an investment made by a firm or individual in one market into business interests located in another market.
FIT	The Feed-in Tariffs (FIT) scheme is a government programme designed to promote the uptake of renewable and low carbon electricity generation technologies and issued to generators for an agreed amount added to electricity supply.
G20 nations	The G20 is the international forum that brings together the world's major economies. Its members account for more than 80% of world GDP, 75% of global trade and 60% of the population of the planet.
GDP	Gross domestic product (GDP) is the standard measure of the value added created through the production of goods and services in a market during a certain period.
GECs	Green Electricity Certificates allow companies to claim the environmental benefits associated with renewable energy generation.
Grid	Electricity is generated at power plants and moves through a complex system, or the grid, of electricity substations, transformers, and power lines that connect electricity producers and consumers.
GWh/GW	One gigawatt-hour equals one billion (1,000,000,000) watt-hours, one million (1,000,000) kilowatt-hours.
IEA	The International Energy Agency works with markets around the world to shape energy policies for secure and sustainable energy.
IRENA	The International Renewable Energy Agency (IRENA) is an intergovernmental organisation supporting markets in their transition to sustainable energy.
LNG	LNG is a clear, colourless and non-toxic liquid which forms when natural gas is cooled to -162°C, and as a gas is burnt for heat or to generate electricity.
MPIs	Market and policy indicators or government policies and market instruments that support and promote the use of RE.
MWh	A megawatt hour (MWh) is equal to 1,000 Kilowatt hours (Kwh). It is equal to 1,000 kilowatts of electricity used continuously for one hour.
NGO	Non-governmental organisations (energy and environment).

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Authors

Shailesh Telang

Technical Manager - Renewable Energy,
CDP India

Nicholas Fedson

Senior Analyst - Renewable Energy,
CDP Worldwide

Alastor Coleby

Senior Manager - Renewable Energy,
CDP Hong Kong

Pratima Divgi

Regional Director,
CDP Hong Kong

Mariana Daykova

Senior Manager - Renewable Energy,
CDP Europe

Andrew Glumac

Senior Manager - Renewable Energy,
CDP Europe

Media enquiries

Crystal Chow

Communications Manager, CDP Hong Kong
crystal.chow@cdp.net

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7/f, Cheung Hing Industrial Building,
12P Smithfield Road,
Kennedy Town, Hong Kong

+852 3905 2899

hk.sea@cdp.net (Hong Kong & Southeast Asia)
australianz@cdp.net (Australia & New Zealand)