

RE100

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中華經濟研究院
CHUNG-HUA INSTITUTE FOR ECONOMIC RESEARCH



— Meeting demand with supply: renewable energy market briefing Taiwan



December 2020

01 Executive summary

Taiwan, one of the world's major manufacturing hubs, is now charting a path to becoming a clean energy centre in Asia-Pacific.

The last two years (2019–2020) have marked a significant shift in renewable energy development in the market, largely due to political and corporate leadership. Taiwan has committed to sourcing 20% of its generated power from renewable energy by 2025, a considerable challenge given that more than 95% of its energy is imported¹.

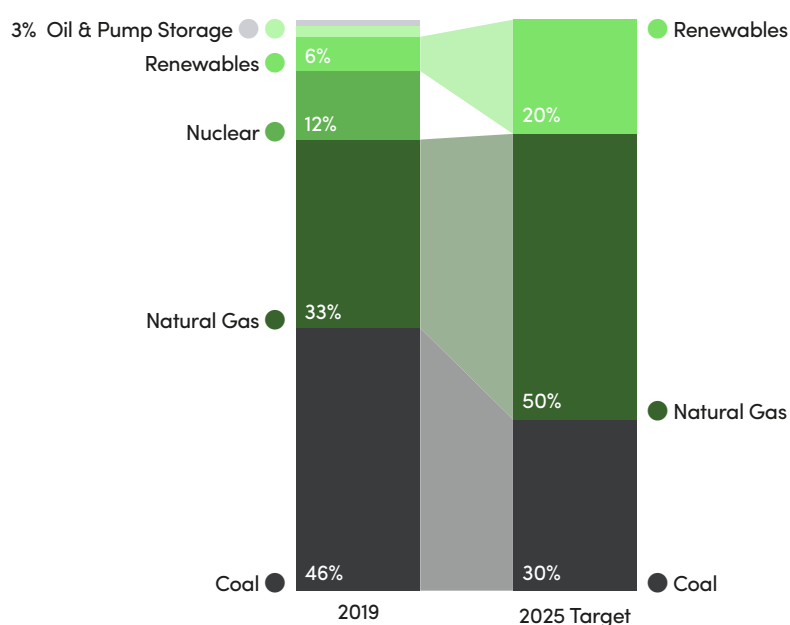
Recognising growing demand

The first half of this report reviews Taiwan's major policy achievements and their implications on corporate sourcing of renewable electricity. While these have provided opportunities for renewable energy development and procurement, renewables still only represent 6% of total electricity use – a rise of just 1% in the last two years^{2,3}.

Nevertheless, the Taiwanese authorities recognise that corporate demand for renewables is on the rise. RE100⁴, the global renewable energy initiative led by the Climate Group⁵ in partnership with CDP⁶, brings together more than 270 major companies that have committed to 100% renewable electricity globally.

RE100 members cite the Taiwanese market as one of the most challenging due to the limited sourcing options and high cost of renewable electricity. For example, the levelised cost of electricity (LCOE) for ground-mounted solar is above that in Australia, mainland China, India, and most EMEA markets⁷. Some factors for this include land restrictions, labour costs and local equipment manufacturing costs. It is difficult to find economical clean power, especially when compared to the market's cheap grid electricity.

Despite these challenges, corporate renewable electricity demand is on the up. In 2018, TCI was the first Taiwanese company to join RE100, and since then, four more have followed (as of this report's publication date). Among these is Taiwan Semiconductor Manufacturing Company (TSMC), which has signed the world's largest power purchase agreement. When considering those with international headquarters too, the Taiwanese market hosts a total of 85 RE100 member companies.

Figure 1: Sectoral composition of electricity supply²

Supply to meet demand

The latter half of this report looks at the renewable electricity demand of RE100 members and their suppliers. Calculations show that **Taiwan's renewable electricity generation should have been enough to meet direct RE100 members' demand in 2019 – but not that of their supply chains as well.**

The growing trend of companies engaging their suppliers to address scope 3 emissions⁸ is set to significantly increase demand in Taiwan, which has a large original equipment manufacturing (OEM) industrial base. Delivery of Taiwan's 2025 renewable electricity target will be vital.

Renewable energy generation was hampered by the COVID-19 pandemic this year, but capacity is already increasing. More than 100 foreign nationals gained entry to Taiwan for renewable energy development during the restricted-borders period, and solar PV and wind power supply made notable strides with a 59% and 64% increase, respectively⁹.

02 Policy context

In January 2017, Taiwan amended the Electricity Act to initiate the phasing out of nuclear energy by 2025. Although this deadline is no longer legally binding, Taiwan is still working towards eliminating nuclear power. Also in 2017, the authorities announced the 20% renewable electricity goal, which resulted in several more **policy changes enabling the development of renewables**.

2.1 Renewable Energy Development Act

The amendment to the Renewable Energy Development Act (REDA), which went into effect on May 1, 2019, is largely responsible for the increase in renewable electricity development. The REDA allows businesses, for the first time, to sell power through wheeling (transmission) and direct supply¹⁰, and supports solar, wind, biomass, geothermal, tidal and waste-to-energy power.

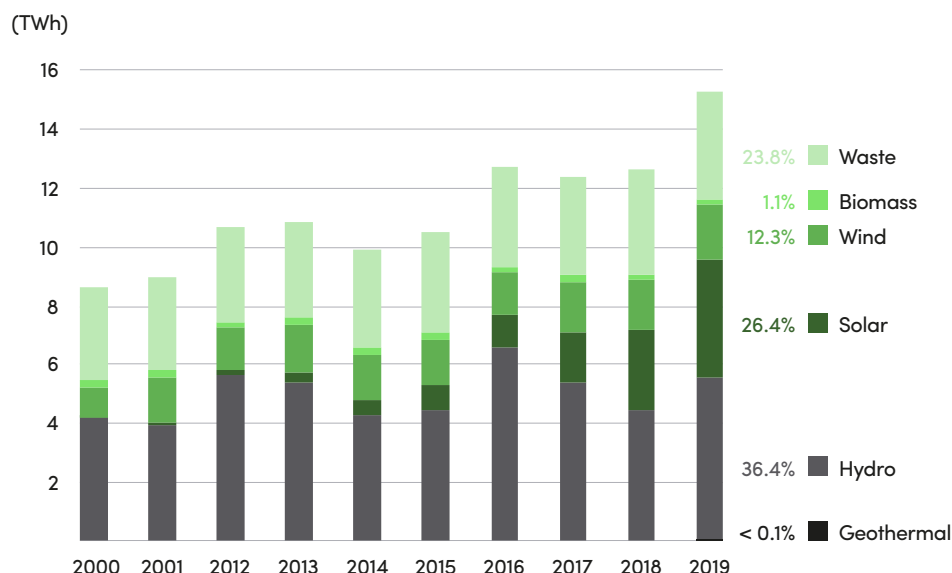
The REDA also requires companies consuming five megawatts (MW) or more of electricity annually to buy 10% of their power from renewable sources (bundled renewable electricity certificates and self-supply are applicable) within five years or make a cash payment.

This amendment will apply to approximately 500 businesses, representing over a quarter (26.8%) of Taiwan's total electricity consumption. Most of these large consumers are found in the petrochemical, steel, semiconductor, plastics and electronics manufacturing industries¹².

2.2 Feed-in-tariff (FiT) flexibility

The feed-in-tariff (FiT) is a policy tool used to encourage renewable electricity development by offering producers above-market prices for the generated electricity. Taiwan launched its FiT for all types of renewable energy in 2010. To date, this has not been as effective as it is in other parts of the world due to Taiwan's relatively low grid electricity prices and high cost of renewable electricity development.

Renewable electricity developers, therefore, rely on FiTs to fund projects, create economies of scale, and draw down costs. To create more flexibility, the REDA

Figure 2: Renewable energy power generation¹¹

now permits renewable power providers to switch between wheeling and the FiT system. This allows providers to supply specific companies without risk of getting shut out of the FiT system should economic uncertainties arise.

According to BloombergNEF, the gap between FiTs and retail prices is likely to shrink as the former decreases and the latter increases, making corporate sourcing of renewables more feasible⁷.

2.3 Taiwan Renewable Energy Certification (T-RECs)

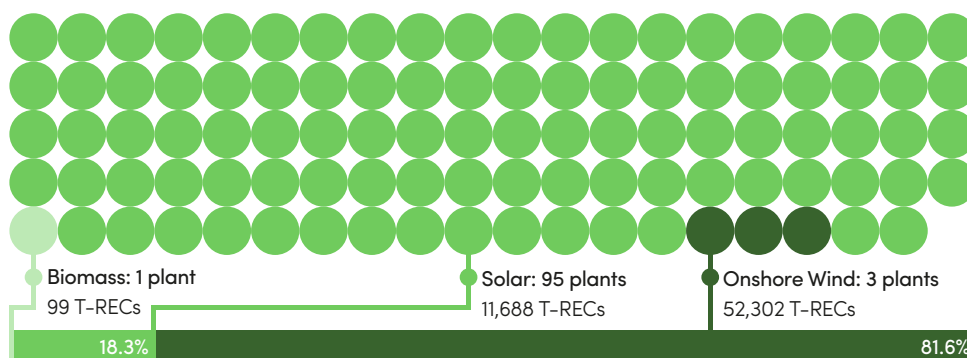
To support domestic renewable electricity purchases, the authorities established the Taiwan Renewable Energy Certificate (T-REC) programme. Previously, International Renewable Energy Certificates (I-RECs) and direct renewable energy purchasing through state-run Taiwan Power Company (Taipower) were the only available options.

The T-REC represents one megawatt-hour (MWh) of renewable electricity and is a

system that verifies renewable electricity sources and proof of purchase. Currently, only 'bundled' T-RECs are offered, wherein transactions must be done between the energy consumer and the energy producer.

Furthermore, participants in carbon offset schemes cannot apply to enter the T-REC platform, developers are prohibited from joining multiple subsidy schemes, and parties cannot trade certificates – which eliminates the possibility of secondary markets.

Figure 3: Number of energy plants and T-REC composition as of 2019¹³



*Note: As of 2019, nearly 100 power plants have been certified with over 71,000 T-RECs issued. The T-REC only covers wind, solar and biomass. No offshore wind sites are in the programme yet. Solar has the most power plants and traded T-RECs. One of the three onshore wind plants belongs to Taipower, and wind holds the most T-RECs, though none have been traded.

A preliminary look at 2020 shows that the number of T-RECs issued in the first three quarters is double that of the total T-RECs issued between 2017–2019, with all 39,000 traded certificates in 2020 coming from solar power¹⁴.

2.4 Power purchase agreements (PPAs)

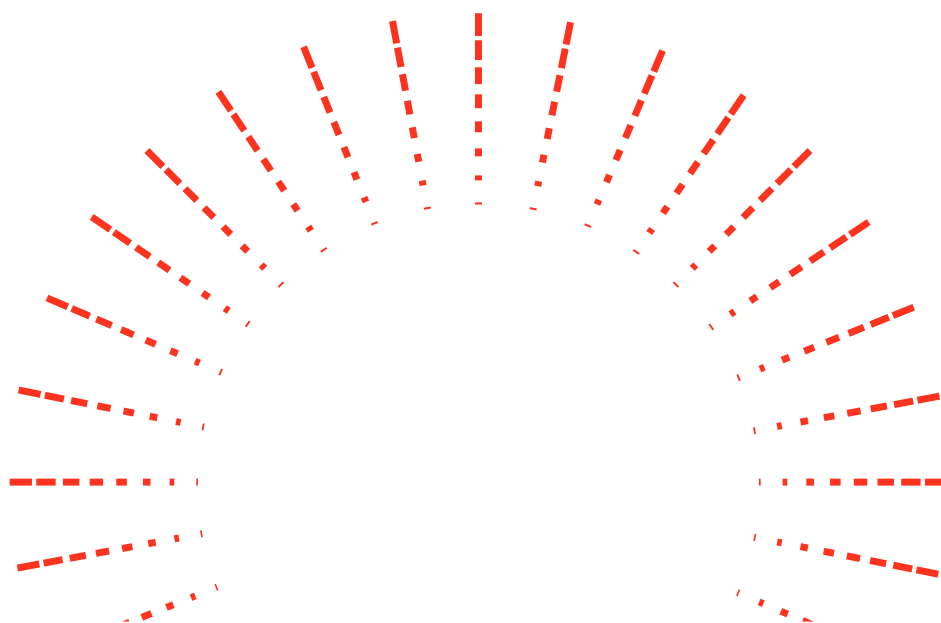
Aside from self-generation, a power purchase agreement (PPA), or contract signed between a supplier, buyer and Taipower, is the final option available for corporate renewable electricity sourcing. PPAs first became technically viable in 2019. Google was the first to announce a PPA for its data centre in Tainan¹⁵ which covers 10 MW of solar power.

TCI, the first Taiwanese company to join RE100, aims to reach 100% renewable electricity by 2030. TCI has been proactive in purchasing T-RECs and self-supplying, and in October 2020, successfully signed a PPA¹⁶. That said, medium-sized enterprises, such as TCI, generally face challenges in developing PPAs. With renewables in high demand and in limited supply, developers have high premiums, and therefore, prioritise larger energy users.

More recently, in July 2020, TSMC announced the world's largest PPA, a 20-year fixed-price contract with Ørsted for 920MW from Greater Changhua offshore wind farms¹⁷. **In just two years, Taiwan went from experimentally offering PPAs to being the site of the largest ever deal.**

This PPA, however, is a unique agreement in that it could only be offered to companies that have very large stable electricity loads, such as TSMC. At around 13 terawatt-hours per year (TWh/yr), TSMC has one of the highest electricity demands in the RE100 membership.

For now, PPAs remain relatively complex and, due to multiple cost drivers in the market, will likely only make economic sense for large power users. Unlike in other parts of the world, PPAs cannot be signed bilaterally, but must also include the central power grid authority, Taipower. In addition to this, PPAs are high in price due to wheeling and delivery costs, renewable electricity supply shortage, high FiTs and local content rules.



03 RE100 impact estimation

3.1 RE100 members' demand

The RE100 members list continues to grow, and this year's RE100 reporting shows that by the end of 2019, 85 out of 228 member companies had operations in Taiwan, including Taiwanese companies TCI, 3dL, Hair O'right and Grape King Bio. Looking at the total membership, roughly **38% of RE100 members will depend on Taiwan to achieve 100% renewable electricity for their global operations.**

RE100 members are evidence of an existing market that is eager for greater supply and access. The addition of 60 more RE100 members in 2020 alone is an indicator of the fast, dynamic evolution of the corporate sourcing movement.

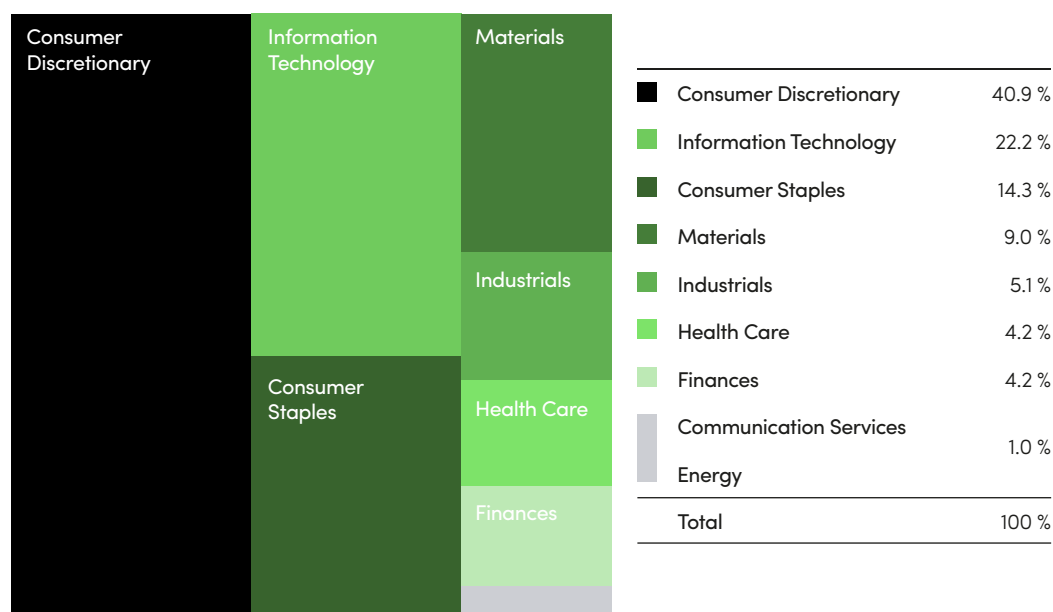
The latest data shows that in 2019 the information technology (IT) sector, which includes technology and semiconductor equipment industry groups, had the most members with local operations (most of Taiwan's electricity is used for industrial and manufacturing purposes).

The consumer discretionary sector had the highest actual demand (see figure 4), reflected by the high number of international stores (one international brand has over 400 stores in the Taiwanese market).

The total RE100 electricity demand in 2019 was less than 1% of the electricity generated in Taiwan in 2019. But TSMC alone consumes around 5% of the market's electricity, and once added to the picture (it joined RE100 in 2020), all other sectors shrink markedly in comparison (see figure 5).

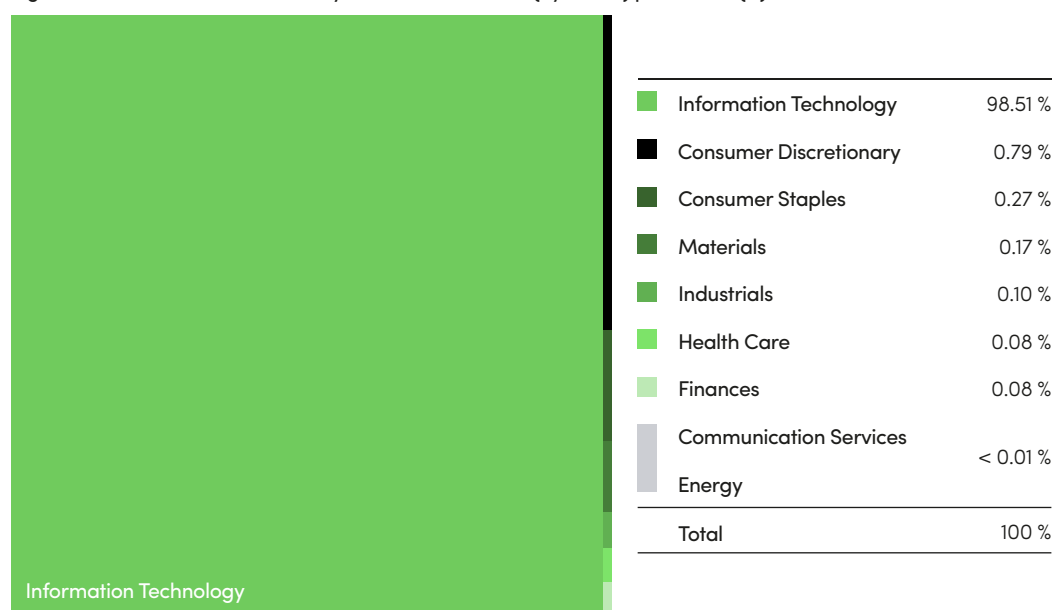
A change such as this shows the importance of maintaining updated reports on the status and forecast of renewable electricity, and underscores the ability for demand to skyrocket, especially given the REDA amendment on large electricity consumers.

Figure 4: RE100 members' electricity demand (by sector) in 2019 (%)



*Note: The demand for renewable electricity for all RE100 members that operate in Taiwan is grouped by sector, as defined by the Global Industry Classification Standards (GICS)[®].

Figure 5: RE100 members' electricity demand estimation (by sector) plus TSMC (%)



3.2 RE100 supply chain impact

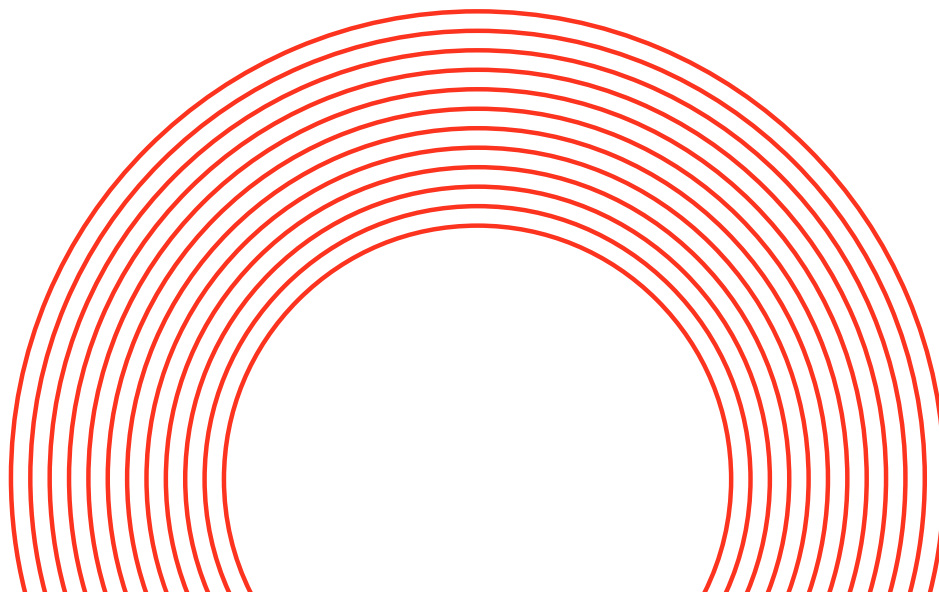
It's not only the renewable electricity demand of RE100 members that matters, but also that of their supply chains. Known for its electronic, computer and textile manufacturing, Taiwan's OEMs consume large volumes of electricity. **RE100 members are increasingly asking them to switch to renewables.**

There are three scenarios for estimating potential renewable electricity demand along RE100 supply chains in Taiwan:

Scenario 1: Demand of (55) suppliers to RE100 members that have already achieved 100% renewable power.

Scenario 2: Demand of suppliers to RE100 members that have achieved 100% renewable power, plus all technology companies that supply to RE100 members – 63 in total.

Scenario 3: All (81) suppliers to RE100 members.



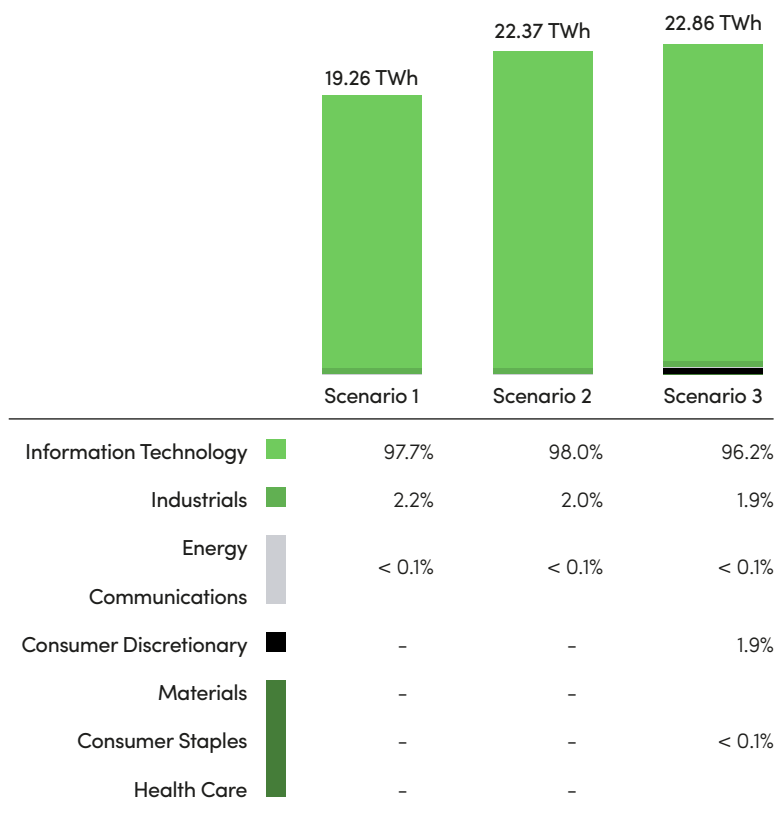


Figure 6: Sector consumption by scenario based on 2019 data (%)

*Note: The electricity amounts analysed were proportionate to what suppliers use for their operations for RE100 members according to the Bloomberg Terminal. Total revenue of scenario 1, scenario 2, and scenario 3 was approximately US\$137 billion, US\$167 billion and US\$171.4 billion, respectively.

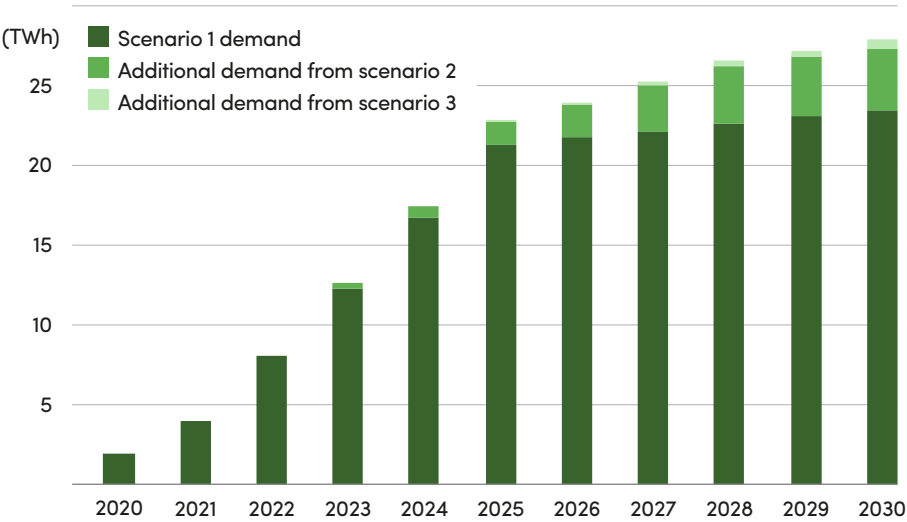
For Scenario 1, the total electricity consumption was over 19.2 TWh in 2019, which exceeds Taiwan's current renewable electricity supply by around 4 TWh. Apple Inc.'s suppliers – around one in three of its manufacturing partners – accounted for 85% of this demand¹⁹.

Scenario 2 presents a total demand nearly 1.5 times greater than the current renewable electricity supply.

Suppliers in Scenario 3 accounted for 9% of Taiwan's current total electricity consumption. These suppliers also make up 15% of the market's total industrial sector, as of 2019.

To forecast a more practical timeline of renewable electricity growth and demand, figure 7 assigns suppliers in each scenario six years to reach 100% renewable electricity for their operations for RE100 members. As renewable electricity supply and the number of companies addressing scope 3 emissions will likely increase over time, it is also assumed that suppliers’ commitments to the use of renewable electricity will occur incrementally.

Figure 7: Renewable electricity demand forecast of supply chain scenarios



Note: Scenario 1 begins transitioning to renewable electricity in 2020, Scenario 2 begins in 2023, and Scenario 3 in 2025. For each scenario, the renewable electricity demand for the first year is 10% of its total demand, the second year sees an additional 10%, and all years proceeding that, an additional 20%. A 2% annual electricity demand growth rate is also assumed.

If Taiwan reaches 20% renewable electricity supply by 2025, it would have over double the supply of renewable electricity than is estimated to be needed by the suppliers that year, according to these estimates. Although Taiwan’s annual renewable electricity generation targets are sufficient, it has not achieved these targets for the past two years, and so, the concern is how it will meet its 2025 goal.

04 Moving forwards

Taiwan's shift towards renewables over the past few years has been dramatic. Nevertheless, the years ahead will require further support as more companies continue to join RE100 and influence their suppliers to do the same. **To retain the local operations of prominent global companies, Taiwan must increasingly offer renewable energy.**

The 2019 demand of all RE100 members' suppliers exceeded the current renewable electricity supply. To develop renewable electricity at a rate that will match demand, Taiwan must overcome multiple barriers:

High cost of renewables

Widespread voluntary sourcing of renewable electricity will depend on the policy regime evolving to structurally drive down the cost of renewables. The authorities and developers should work together to evaluate pathways for cost reduction for renewables deployment, then translate those cost reductions into lower prices for voluntary buyers of renewable electricity.

Lack of transparency

On renewable electricity procurement; the authorities should improve the sharing of procurement information, such as price and strategies, to better understand the market.

On renewable electricity data; the authorities should encourage the sharing of data on renewable electricity consumption, demand and supply to better respond to evolving needs. This will also improve the ability to track and compare present and future demand and supply with greater accuracy.

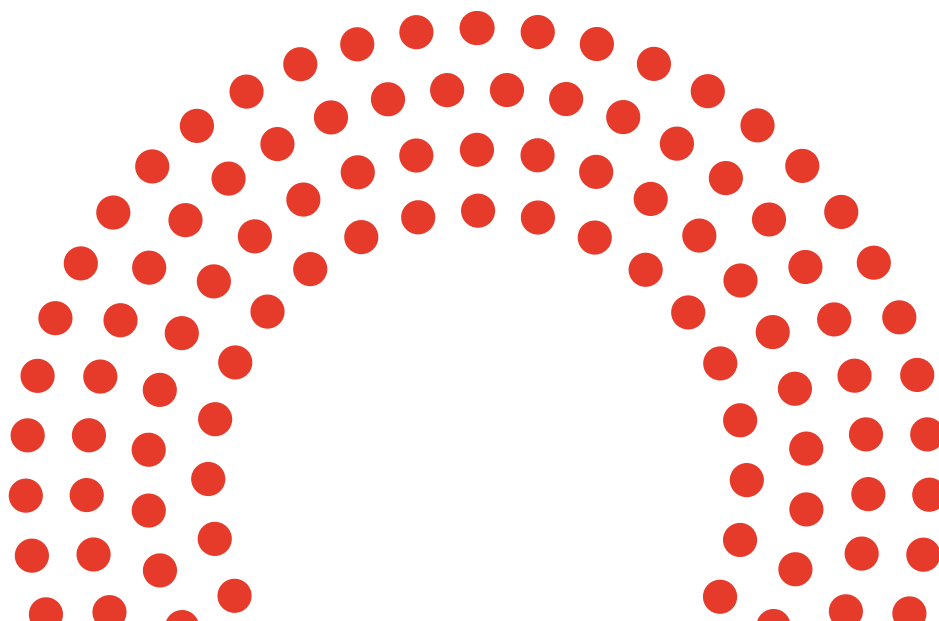
Difficulties in procurement for small and mid-size enterprises (SMEs)

Due in part to the cost of renewables, PPAs are currently only feasible for large power users. The generally more accessible unbundled T-RECs are also not available. Therefore, SMEs and corporations in the commercial sector should receive assistance in renewable electricity procurement.

Scarcity of direct purchasing

Large power users should be encouraged to source clean electricity through PPAs now that direct supply and wheeling is available. The IT and industrial sectors are well placed to drive this. Corporations should also provide renewable electricity procurement support to suppliers.

However, Taiwan's 2025 renewable electricity target is satisfactory, and if the authorities continue to adopt policy changes in response to ever-changing needs, **this budding market has great potential to become a clean energy centre.**



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Thank you to TCI Co. for financially supporting this report. TCI develops and produces health and dietary supplements, functional beverages, and skin care cosmetics. It is the first company in Taiwan and one of the first contract manufacturers in the world to join RE100. TCI has committed to sourcing 100% renewable electricity by 2030.

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