

# 2023 Taiwan CPPA market report



PwC Taiwan - New Energy Business Services



# Executive summary

At the COP28 UN Climate Change Conference in Dubai in December 2023, 198 countries pledged to expedite the current energy transition and reduce their reliance on fossil fuels to achieve net-zero emissions by 2050. Although Taiwan was not a signatory to the pledge, it too faces pressure to accelerate its energy transition given its high electricity grid emission factors.

In 2023, Taiwan's electricity capacity rose by 2GW to a total of 64GW on the back of increases in solar power (2.7GW) and wind power (1.1GW), which offset drops in nuclear power (1GW) and traditional thermal power (0.7GW). Total electricity generation was down 2% in the year to 282.1TWh, with traditional thermal power accounting for 83%, renewable energy (RE) 9.5% and nuclear power 6.3%. Solar power generation grew by 21% yoy (2.2TWh) to 12.9TWh in 2023, representing 48% of total RE generation, while wind power generation jumped 73% yoy (2.6TWh ) to 6.2 TWh, or 23% of total RE generation.

Now in the fourth year since Taiwan liberalised its energy market in 2020, the volume of RE trading amounted to 1.7TWh in 2023, representing 6% of total RE generation. Solar power direct supply and wheeling volume increased by 200% yoy to 0.6TWh, indicating strong RE demand from local companies, especially in the high-tech, telecom, finance, and retail sectors.

To meet this growing RE demand and further stimulate the local Corporate Power Purchase Agreement (CPPA) market, in December 2023, Taiwan's Ministry of Economic Affairs relaxed its regulations on the RE wheeling of self-generated solar power through RE retailers. Once supply constraints are eased, the key challenge in relation to RE trading is expected to shift from concerns on power availability and price mismatching to how to better manage generation costs and wheeling efficiency.

# RE demand continues to grow amid wave of net-zero targets

## Source of demand



RE100 commitments



EIA commitments



ESG ratings



Rules on heavy electricity users



Supply chain requirements



Scope 2 emission reduction strategies

## Source of supply



Increasing number of generators and retailers



Phase 3 offshore wind zonal development tenders



Entry of self-generation solar projects through retailers

## RE trading challenges

01

Generation costs of RE projects are still higher than that of the public utility Taipower (TPC)

02

The capability and willingness of corporate buyers to enter into long-term CPPAs

03

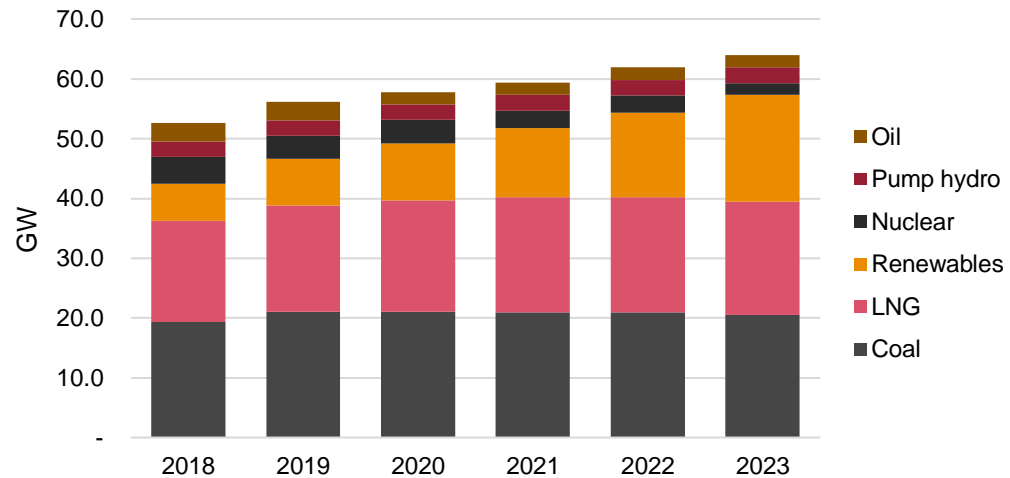
RE wheeling rules are rather complicated

04

Frequent changes in electricity and RE certificate regulations

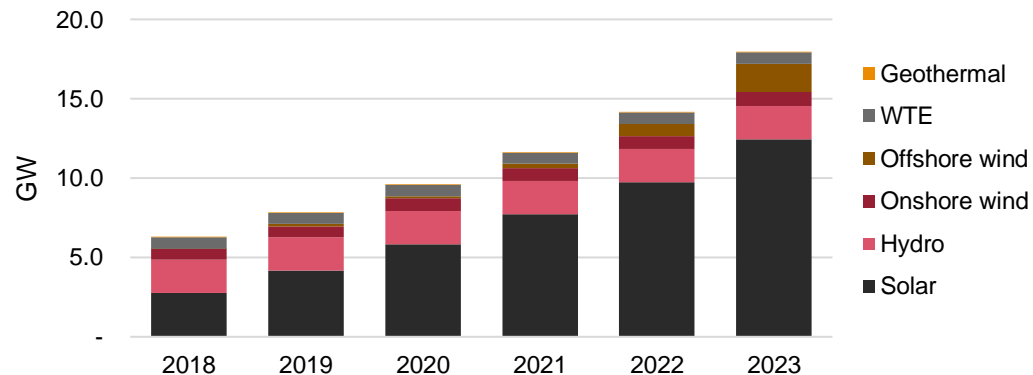
# RE accounted for 28% of 64GW total power capacity in 2023

## Total power capacity in Taiwan



- Taiwan's total installed power capacity grew by 2GW to a total of 64GW in 2023, primarily due to new RE power generation facilities coming on-line.
- Traditional thermal power, renewable energy and nuclear power accounted for 65%, 28% and 3% of total capacity, respectively, in 2023.
- Within the traditional thermal power sector, coal-fired units represented 20.5GW of total installed capacity and LNG units about 19GW. Due to some ageing nuclear plants being prepared for decommissioning, the installed capacity of nuclear power units fell by 1GW in 2023 to a total of 1.9GW.
- The total installed capacity of RE power generation facilities (including solar and wind power) increased by 3.8GW to reach 17.9GW in 2023.
- Solar power capacity grew by 2.7GW, or 30% yoy, to 12.4GW in 2023.
- Wind power capacity increased by 1.1GW to 2.7GW in 2023, mainly due to the addition of a new offshore wind farm in Changhua County.

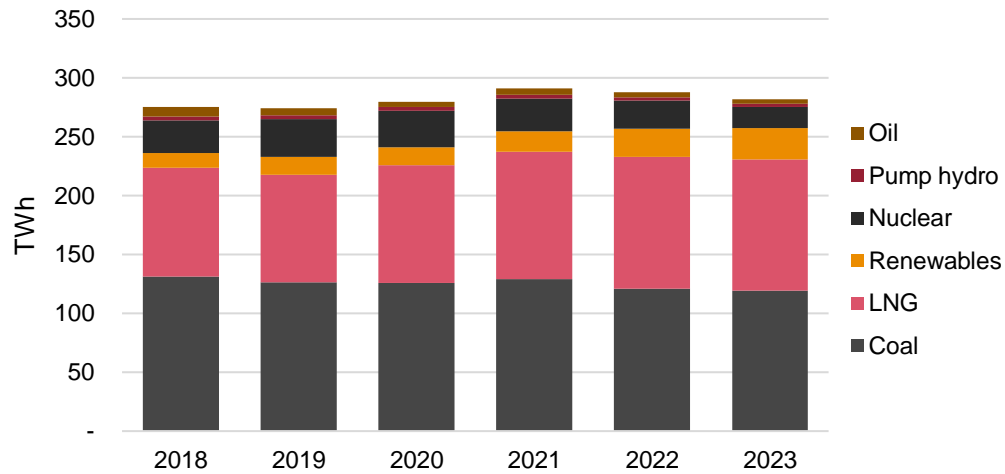
## Renewable energy capacity in Taiwan



Source: PwC analysis

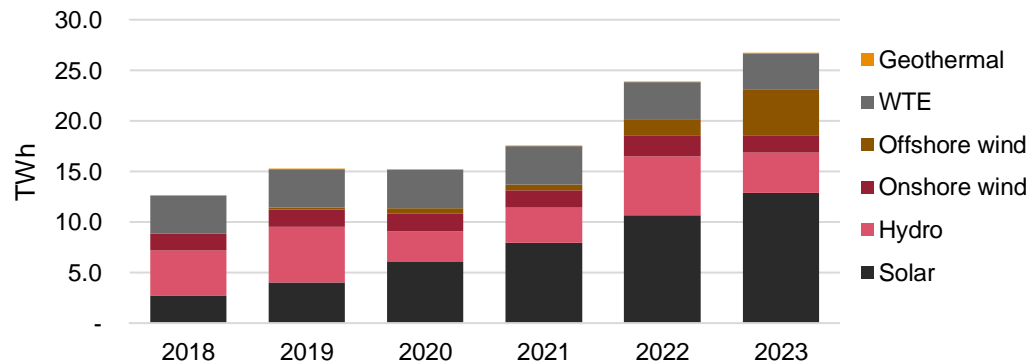
# RE represented 9.5% of 282TWh total power generation in 2023

## Total power generation in Taiwan



- Taiwan's total electricity generation fell by 2% to 282.1TWh in 2023, while total electricity demand decreased 1.4% in the year to 275.7TWh.
- Industrial power consumption, which comprises almost 60% of total usage, contracted 2.8% in 2023 amid sluggish economic and business conditions.
- Thermal power, including coal and LNG, accounted for 83% of total electricity generation in 2023.
- Nuclear power contributed 17.8TWh, or 6.3%, of total electricity generation.
- RE contributed 26.7TWh, or 9.5%, of total electricity generation.
- Solar power generation increased by 2.2TWh, or 21% yoy, in 2023 to reach 12.9TWh, accounting for 48% of total RE generation.
- Wind power generation increased by 2.6TWh, or 73% yoy, in 2023 for a total of 6.2TWh, due to the addition of new offshore wind facilities.
- Hydropower generation decreased to 4.0TWh in 2023, accounting for around 15% of total RE generation.

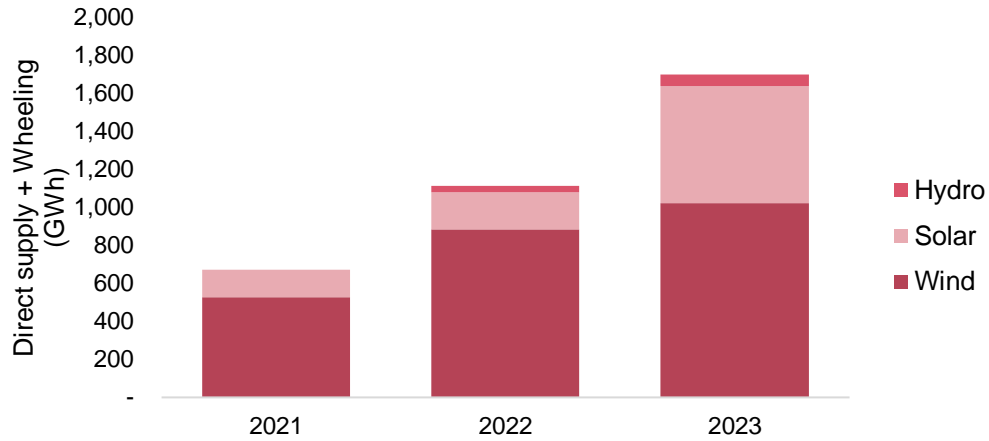
## Renewable energy generation in Taiwan



Source: PwC analysis

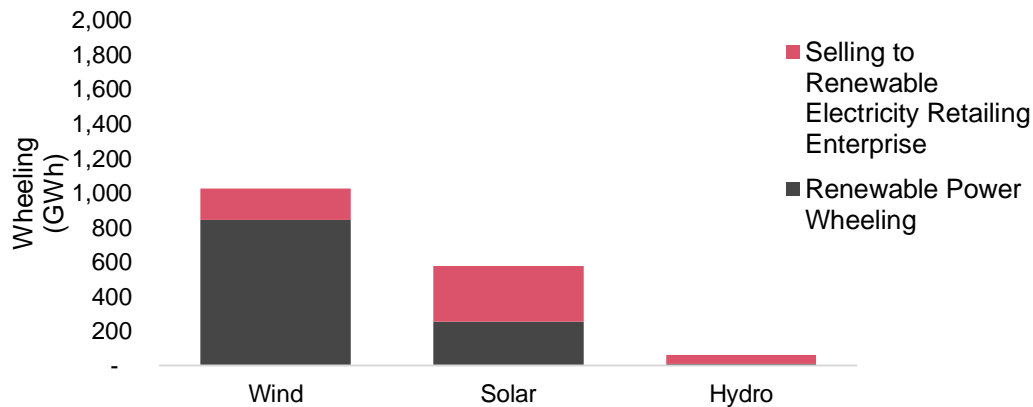
# RE trading volume grew 49% to 1.7TWh in 2023

## Total direct supply/wheeling for RE



- RE generation facilities (including onshore wind, solar and hydropower) with low feed-in-tariffs have increasingly entered into CPPAs with corporate offtakers since the liberalisation of Taiwan’s electricity market in 2020.
- RE trading, including direct supply and wheeling, is steadily growing. In 2023, the overall volume of RE trading increased by 49% yoy to 1.7 TWh, with wind power accounting for around 60% of the total and solar PV 36%.
- In 2023, the total direct supply and wheeling volume from solar facilities jumped 200% yoy to 617GWh, mostly supported by RE retailers, particularly in the high-tech, telecom, finance, and retail sectors. The trading volume through RE retailers grew more than fivefold to a total of 322 GWh in 2023.

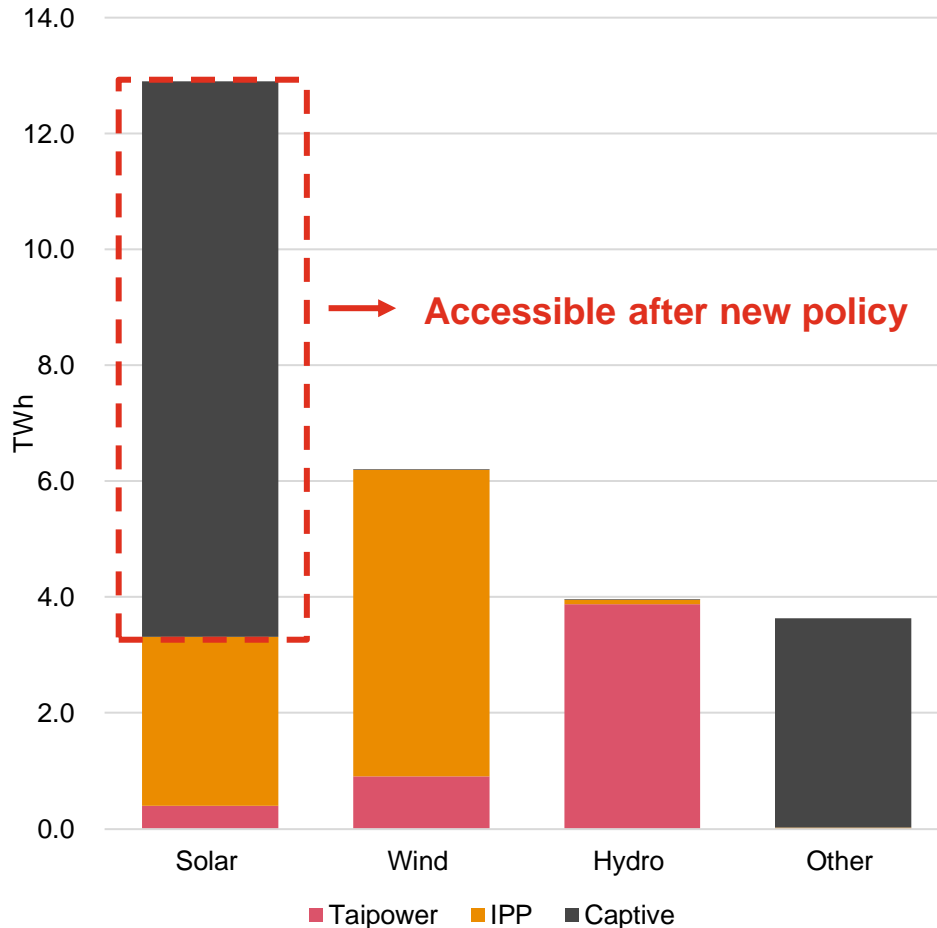
## RE channel of wheeling in 2023



Source: PwC analysis

# Rules eased on RE wheeling of solar power

## 2023 renewable energy generation



In December 2023, Taiwan's Ministry of Economic Affairs announced an easing of its rules on the RE wheeling of solar power from self-generated solar facilities (Types II and III) through RE retailers. Previously, electricity from such facilities could only be consumed by the facilities themselves or sold to TPC.

The expected implications of the relaxed regulations are:

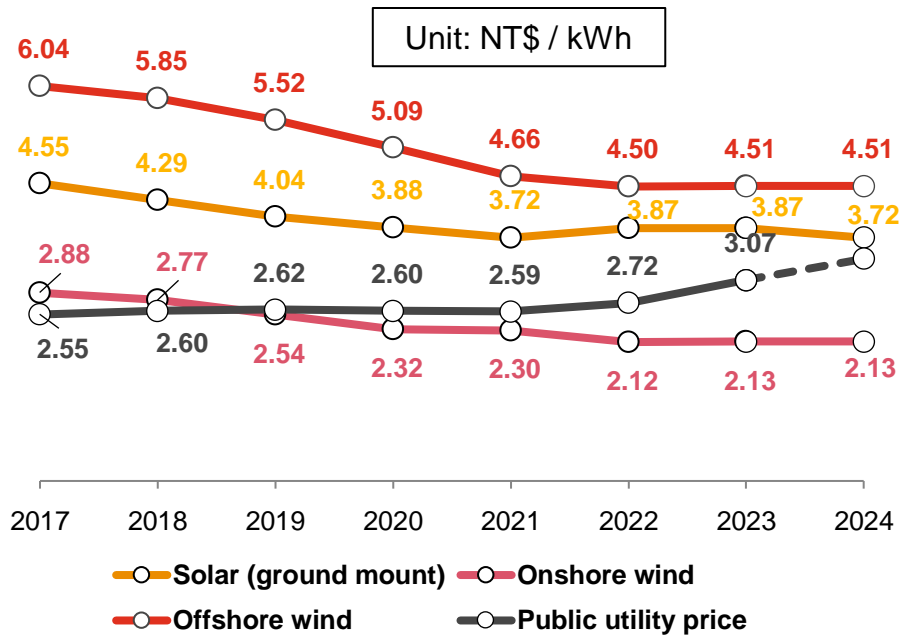
- **More RE supply:** The new rule is expected to contribute an additional 9.6TWh of green power to the CPPA market, which is equivalent to 36% of the total RE generation in 2023. The total renewable power from private generators available for wheeling, using 2023 as benchmark, could increase to 18TWh, equivalent to more than 12% of industrial user consumption.
- **Less concern over RE inflation:** Due to a supply-demand mismatch, corporates have grown increasingly concerned about RE inflation. But it is estimated over 70% of new supply will have a FiT less than NT\$5 per kWh.

**Once the revised regulation takes effect**, the supply-demand mismatch will likely be somewhat mitigated. The next challenge for RE retailers will then be how to mix and match supply and demand in their portfolios to create differential pricing and reduce surplus power.

Source: PwC analysis

# Feed-in tariff and public utility price trends

## Public utility price and feed-in-tariffs



### Notes:

- Public utility prices include transmission and distribution costs, while RE FiT rates only cover only energy costs.
- The 2023 public utility price is the full-year average.
- The Solar PV FiT rate excludes supplemental rates, i.e., high-efficient modules, grid connection subsidy, etc..
- Offshore wind FiT only applies to Phase II projects; the tender ceiling price for Phase III projects is set at NT\$2.49 per kWh

Source: PwC analysis

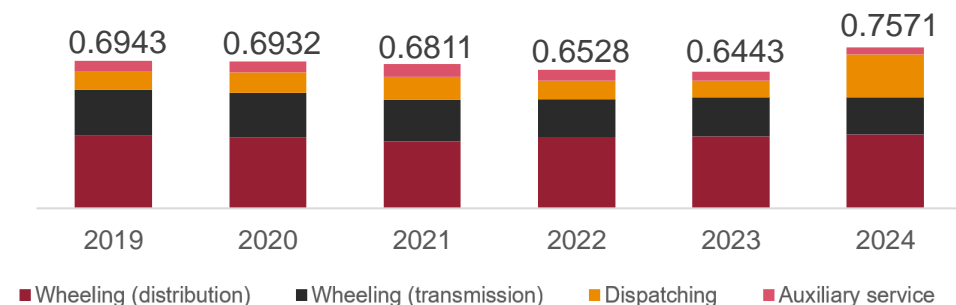
- Following the enactment of Taiwan's Renewable Energy Development Act in 2009, feed-in-tariff (FiT) rates are reviewed annually by an independent panel under the Energy Administration of the Ministry of Economic Affairs, which takes into consideration technology, construction, operation and maintenance costs.
- FiT rates tend to decline as technology matures. However, competition for new RE projects has driven up development and grid connection costs. In the past two years, global raw material inflation has led to slight upward adjustments in FiT rates. For 2024, the FiT rates for wind and solar PV power remain the same or modestly decline, according to the Energy Administration.
- Public utility prices have increased at a lower pace than costs as part of the government's efforts to control inflation. The average public utility price rose 12% to NT\$3.07 per kWh in 2023, while electricity costs, including transmission costs, were NT\$3.95 per kWh. Generation costs from TPC thermal generation, private thermal generation and private renewables were NT\$3.52, NT\$4.17, and NT\$5.2 per kWh, respectively, in 2023. Public utility prices will likely be adjusted in the near future, which will help narrow the gap with RE prices.

TPC's Time of Use (TOU) prices range between NT\$1.83 and NT\$6.58 per kWh in the summertime. Depending on the RE generation schedule, users can achieve savings by replacing the TPC's TOU with renewable power.

# Electricity wheeling fee to gradually rise as RE wheeling grows

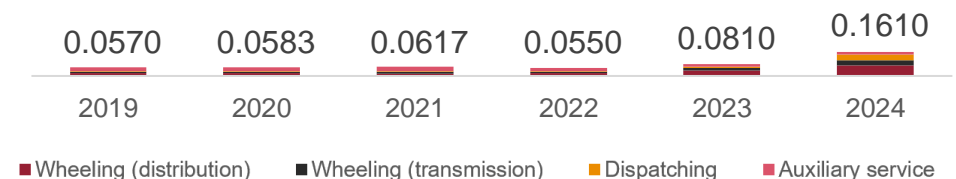
## Average wheeling fee

Unit: NT\$ / kWh



## Wheeling fee of carbon-free renewables

Unit: NT\$ / kWh



Source: PwC analysis

The electricity transmission and distribution fee covers applicable auxiliary services, dispatch services, and transmission and distribution services. Wheeling Cost Discount Rules were established by the regulator to provide discount rates to encourage the adoption of carbon-free renewables.

## Average wheeling fee

- The average wheeling fee, as announced by the Energy Administration, has been increased for 2024 due to rising international fuel prices, line losses and depreciation from new transmission and distribution projects.
- The wheeling fee for carbon-free renewables, such as solar and wind, would be around NT\$0.1610 kWh for 2024 if auxiliary services, dispatch services, and transmission and distribution services are included.

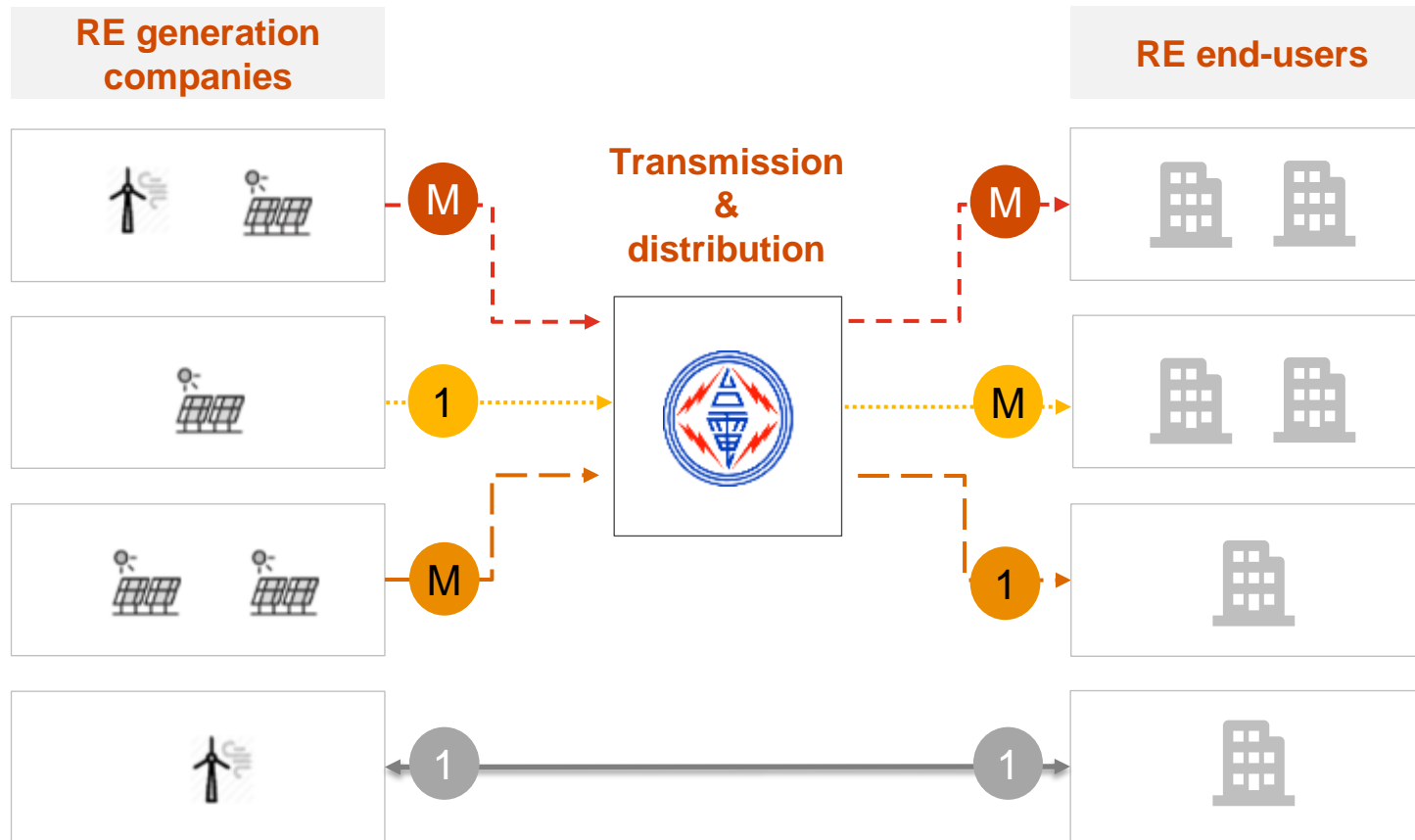
## Wheeling fee discount

- Under the Wheeling Cost Discount Rules, carbon-free RE receive a basic rate discount that will be phased out gradually from 2027 onwards.
- Benchmarking against the 2024 cost structure, the total wheeling fee will be an estimated NT\$0.36 per kWh by 2027 once the discount phases out.

Consider the wheeling fee when comparing RE and public utility prices.

# Appendix 1

# RE wheeling through Taipower based on meter serial numbers

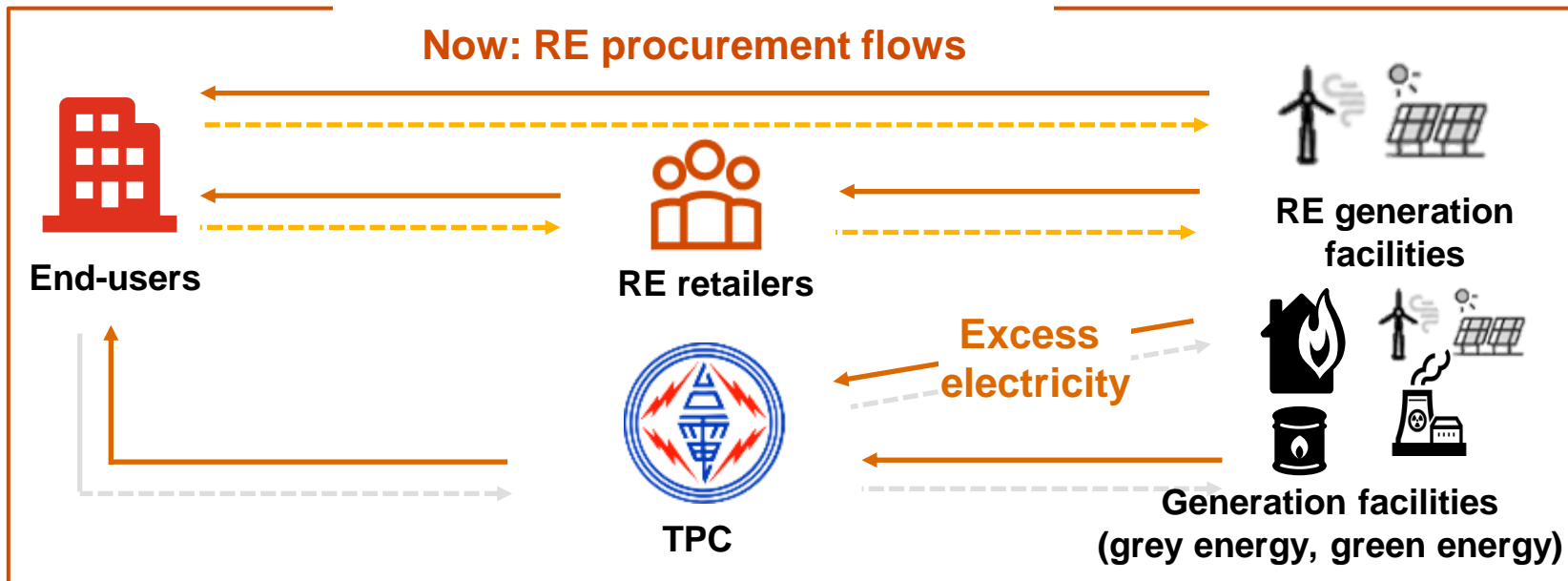
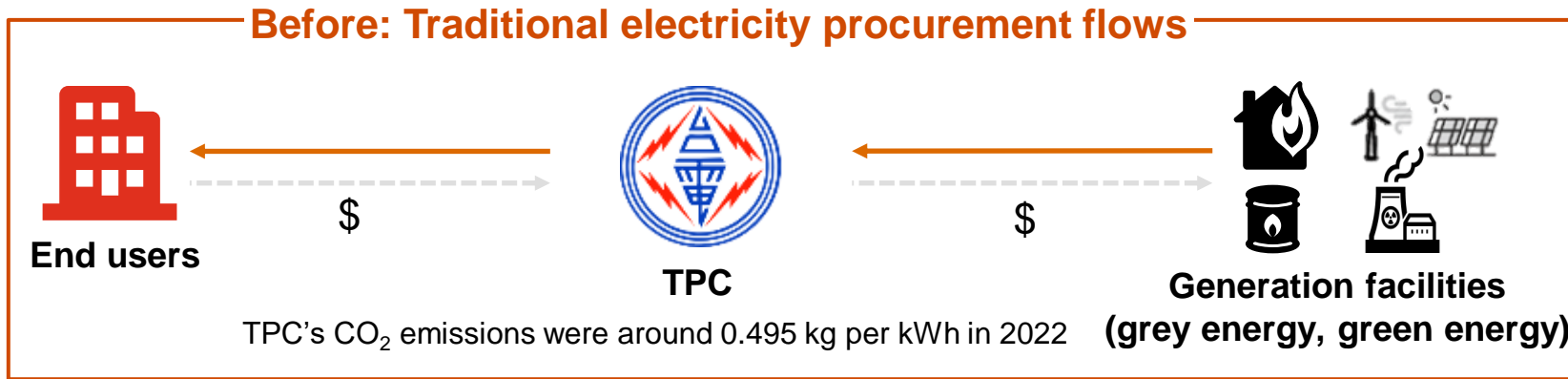


In Taiwan, physical PPAs are used in the wheeling scheme. Electricity is distributed through the TPC, based on meter serial numbers (MSNs). Currently, RE wheeling takes place via the following four methods:

- Many-to-many (M-M): Multiple power plants wheeling based on MSNs.
- One-to-many (1-M): One power plant wheeling based on MSNs.
- Many-to-one (M-1): Multiple power plants wheeling based on a single MSN.
- One-to-one (1-1): One power plant wheeling based on a single MSN.

Source: PwC analysis

# Electricity procurement flow process



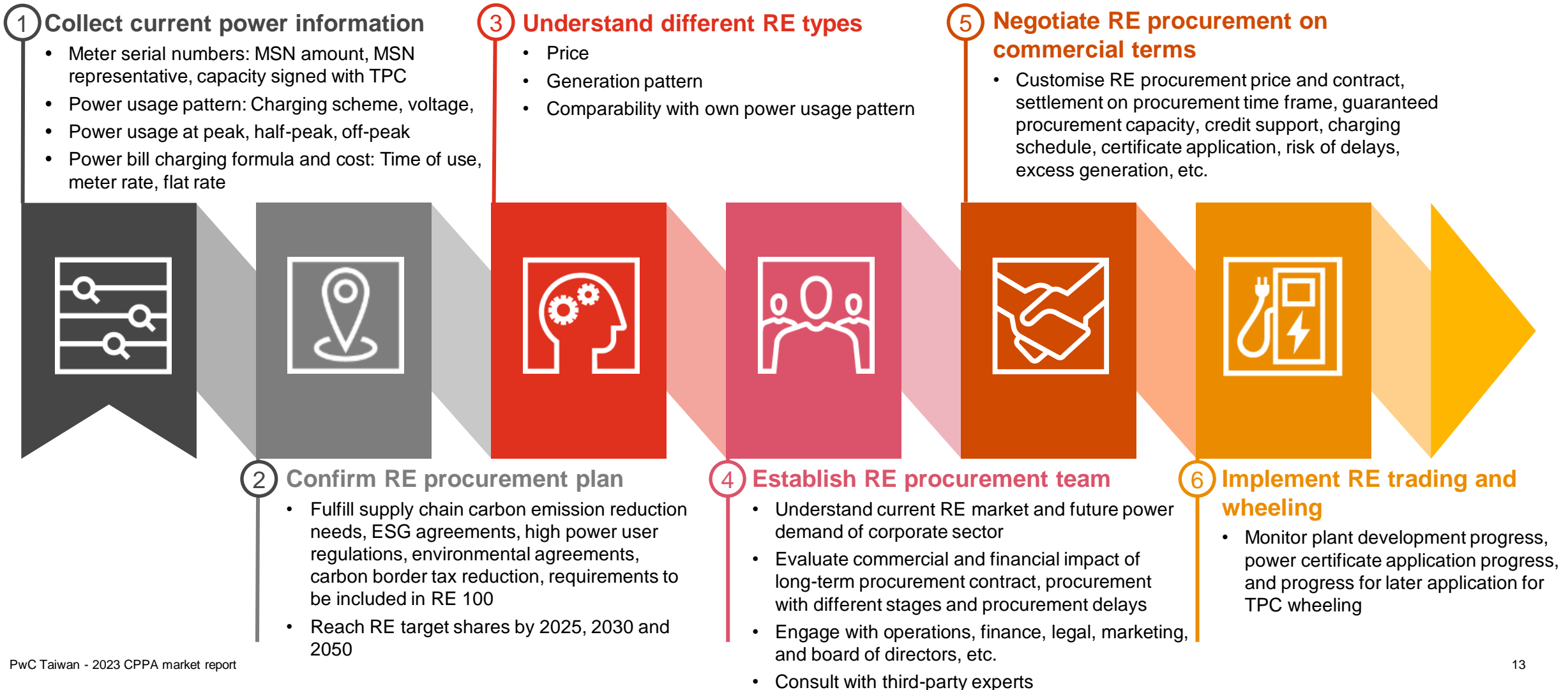
- Prior to liberalisation of Taiwan's energy market in 2020, the TPC solely supplied electricity to all end-users, except for self-generators.
- End-user electricity costs were based on Time-of-Use (TOU) prices.
- All electricity sold by self-generators to TPC was at regulated tariff rates.
- After liberalisation, end-users could directly purchase power from RE generation facilities or through RE retailers at bilaterally agreed tariffs.
- Whenever RE supply is insufficient to meet end-user demand, TPC will make up the deficit at TOU prices.
- Whenever RE supply exceeds end-user demand, the surplus may be sold to TPC at pre-agreed prices.

Source: PwC analysis

→ Electricity    
 - - - - - Negotiated price    
 - - - - - Regulated tariff

# Guidance on RE procurement

Advice road map from the RE Buyers Alliance (REBA) to companies on RE procurement



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