THE LANTAU GROUP

China Watching Brief

Green Power Trading to Accelerate in China

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Background

Green power procurement activity both for and by power consumers has accelerated markedly since industry regulators allowed renewable generation to enter into the wholesale power markets last year. Several high-profile transactions have drawn particular attention. At the same time China's power supply crisis and global fuel market disruptions have prompted further industry reforms and heightened power customer focus on their exposure to power procurement costs. We take a look at how China's decarbonisation efforts are intersecting corporate green power procurement initiatives to drive momentum for green power trading in China.

BASF Signed a 25-Year Framework PPA to Power its Zhanjiang Site with 100% Renewables from Day One

On 22 March 2022, German multinational chemicals giant BASF announced that it had entered into a 25-year framework agreement with China's State Power Investment Corporation (SPIC) for the latter to supply renewable electricity (RE) from SPIC's offshore-wind-power projects in Guangdong Province to its Zhanjiang Verbund site, starting from its first planned day of factory operations in 2025.

Originally announced back in November 2019, the Zhanjiang Verbund site is BASF's third largest investment ever, with a total investment value expected to reach 10B Euro by the time of its completion in 2030. BASF made it known in a March 2021 press release that they planned to run the plant consuming 100% renewable energy to power the facility. Further to that end, BASF announced plans to install an emissions-saving electrified ethylene cracker on site, reducing associated emissions intensity by ~90% compared to a fossil-fuelled steam cracker[1], while boosting power demand to ~370MW (or ~3TWh/a).

Months after making their sustainability plans known in March 2021, BASF signed a 5-year RE procurement agreement with China Resources Power Corporation (CRP) to source 2.45GWh/a of wind power for the construction phase of the Verbund site. This CRP deal was the first renewable energy transaction of its kind in Guangdong Province[2], signalling a new era of green power procurement in China.

1 PROCESS [2021] Issue13/Dominik Stephan: The average energy intensity of a fossil-fuelled steam ethylene cracker is ~ 11,470MJ/t; the average emission intensity of that is ~0.7t CO2e/t.

2 China Resources Power made Guangdong's first green power deal with BASF

Industry Leaders Race for Carbon-zero Campaign

In 2018, Apple pushed its suppliers to invest in a USD $300M China Clean Energy Fund that was used to invest in wind power projects across China, comprising the bulk of its direct equity RE investments.

BASF is one amongst many industry leaders that has set climate neutrality goals and/or science-based emissions reduction targets in recent years. For instance, in 2020, Apple announced that it had already neutralised its Scope 1 and 2 emissions[3] at all its corporate offices, retail stores, and data centres worldwide, and would begin focusing on Scope 3 emissions, which would require extensive engagement with suppliers. Apple recently reported achieving 87% of its overall reduction via long-term renewable energy contracts and the remaining 13% via direct or equity investments[4].

For many multi-national companies (MNCs), China is a major impact market for meeting their carbon neutrality objectives. At the same time, China has [historically] been a challenging market in which to secure renewable energy contracts. Even now, although the demand for RE from MNCs is increasing in China and the options are also expanding compared to the past, China remains a challenging market due to regulatory complexity, rapidly changing energy markets, and the limited availability of market-traded renewables[5]. These companies will look to the central government for continued supportive policies to improve the renewable procurement environment.

Backing Policy 1: China Cancels Subsidies for New RE Projects and Pushes Them to Find Buyers in the Wholesale Markets

In 2021, China's wind power generation reached 652.6TWh, up 40.5% year-on-year, and solar power generation reached 325.9TWh, up 25.1% year-on-year, collectively supplying 11.8% of the country's total power demand. By the end of 2021, China had installed 328GW of wind capacity and 306GW of solar capacity[6], while still aiming to double total RE capacity to ~1,200GW by 2030[7].

This massive expansion and further planned buildout must naturally be underpinned by attractive and reliable power sales opportunities for project developers, no small feat considering the National Development and Reform Committee (NDRC) cancelled all national subsidies for new RE projects starting from 1 January 2021. The replacement solution for renewable developers has been to allow subsidy-free projects to enter into the open markets. This solution was implemented with the launch of the Green Power Trading Pilot Program, intended to further incentivise the buying and selling of renewable energy via economic supply and demand forces in the open market[8]. On 7 September 2021, the two state-level power exchanges, namely, Beijing Power Exchange and Guangzhou Power Exchange, co-chaired the first listing of green power purchase agreements (GPPA). Significantly, 259 companies in 17 provinces participated and traded 7.9TWh of renewable energy. We expect the transaction volume of GPPAs will further accelerate going forward, with attractive wholesale market prices providing the financial motivation for renewable developers to build and take advantage of this offtake channel.

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3 Green House Gases Protocol, the CO2 emission of an organisation shall be calculated by Scope-1 (emissions directly incurred by the production process and the fossil-fuel usage on site), Scope-2 (emissions incurred by the sourcing of fossil-fuelled power/ steam/heat/cold) and Scope-3 (emissions incurred by activities along the supply chain).

4 https://www.apple.com/environment/pdf/Apple_Environmental_Progress_Report_2021.pdf

5 Stepping up: RE100 gathers speed in challenging markets

6 NEA News Release on 2021 Renewable Industry Development

7 NEA Notification on the Development of Wind-/Solar-Projects in 2021 (NEA [2021] No.25)

8 Green power trading to boost China's green power consumption

Backing Policy 2: China Urges High Energy-intensity Industries to Shift to RE and Sets Minimum Consumption Standards

Although the power supply crunch in Q4 2021 led to reforms that most directly affected coal-fired power, the renewables sector also saw significant changes – generally beneficial for project developers.

In January 2022, the State Council, China's top administrative authority, mandated that all industries with high emissions and high energy consumption (the so-called "two-high' industries") must shift to RE, otherwise be subject to punitive power tariffs (i.e., 120-150% of the Base Price in some provinces)[9]. In addition, the government also provided policy incentives stating that incremental RE consumption by 'two-high industries' would not be counted against their total energy consumption quota[10]. Provincial governments were urged to set minimum RE consumption requirements for their two-high industries[11]. This comes on top of the already-existing renewable portfolio standard requirements for any large industries directly participating in the power market to procure power.

What has Hindered Green Power Trading from Rolling Out Rapidly in 2022?

Despite China proactively promoting RE development on the supply side and incentivising RE consumption on the demand side, market-driven RE trading is still in its infancy. In Jiangsu Province, for example, 924GWh of RE was traded in the 2022 annual bilateral PPA market, accounting for just 0.4% of total transaction volume, and only 1.5% of Jiangsu's solar and wind generation in 2021[12].

Three drivers contribute to the slow growth of RE's market penetration:

1. **Only a limited volume of RE capacity is eligible for trading:** RE generation must be unsubsidised in order to participate in the Green Power Trading Program, yet most wind/solar projects commissioned before the end of 2020 are subsidised and thus must be excluded.

2. **Lack of market mechanism to price the balancing services:** The grid operators need to procure services like millisecond frequency regulation and spinning reserve from flexible sources including coal-/gas-power units and battery storage to ensure system security. RE lacks self-adjusting capabilities and usually needs to either install on-site storage or pay for these services. It is not clear how to split such balancing costs between regulated RE trades and market driven RE trades. It is also unclear what the balancing fee levels are, as these vary across provinces.

3. **RE generators lack experience to competently trade in the power market:** In the old RE business model prevailing prior to China's recent power price reform in October 2021, RE generators would sell their output to the grid at the regulated Feed-in-Tariff/Base Prices[13]. Currently, most RE generators lack the marketing and trading competencies required to secure commercial and industrial (C&I) customers exposed to the mid-/long-term power market. They will continue relying on the

9 Energy Conservation and Emissions Reduction Working Plan (2021-2025)

10 China central economic work conference 2021

11 Promote Green Consumption Implementation Plan

12 2021 Energy Statistics of Jiangsu Province

13 The Feed-in-Tariffs are regulated by the NDRC; the Base Prices are regulated by the provincial-level pricing bureaus.

local grids to off-take the majority of their RE generation until they identify qualified GPPA aggregators or build up their in-house capacities to achieve a premium on top of the grid's offer[14].

Three Mature Channels are Available to C&I Customers in China to Achieve 100% Renewable Power Consumption

1. Installation of On-site Renewable Generation Facilities

C&I customers can install behind-meter on-site renewable generation facilities, such as roof-top solar panels and/or distributed windmills. The RE consumption is clear and direct, and the project economics are strong and attractive, particularly as the prime solar generation hours usually overlap with peak time-of-use tariffs for the power consumer.

By 2021, the installed capacity of distributed solar facilities had already reached 108GW, accounting for one third of China total solar-power installations[15]. In 2021, newly built behind-the-meter solar panels accounted for 55% of all incremental solar capacity. This trend is expected to continue in the coming years as distributed solar projects demonstrate strong economics against rising power tariffs and potential increases in transmission and distribution (T&D) tariffs. T&D tariff increases are expected given the government's plans to upgrade the grid system to accommodate the higher penetration of renewables.

Most on-site RE facilities are developed by third-party investors under energy management contracts (EMCs) with publicly available prices. The latest published EMC price was USD 735/kW in March 2021[16]; assuming the retail power tariff in Guangdong stays around USD108/MWh for the next decade, the payback period will be roughly 8-9 years.

Unfortunately, on-site RE facilities usually only meet around 5% of C&I customers' power demand on average. To achieve a higher share of RE consumption, customers will need to source RE in the open market.

2. Procurement of Renewable Electricity in the Power Market

By March 2022, seven provincial power exchanges had released local green power purchase agreement (GPPA) trading rules, namely, Guangdong, Guangxi, Beijing, Zhejiang, Shanxi, Shaanxi and Gansu.

Generally, a GPPA includes the following key terms:

- On the sell-side, only non-subsidised utility-scale renewable projects are eligible to participate.
- On the buy-side, only C&I customers connected to 10kV+ grid transformers are eligible to sign GPPA, either directly with RE generators in the wholesale power market or indirectly through power suppliers in the retail power market.

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14 NDRC's Reply on State Grid's Cross-provincial Spot Market Trading Rules. Beijing Power Exchange published the <Inter-Province Spot Power Transaction Rules (Temporary)> in November 2021 which formalises the spot trade process, for both RE and coal-power, from output forecast, dispatch planning, system security check, price offering/bidding, transmission capacity booking, trade execution, clearing and settlement, etc. Only a few traders who worked as dispatchers before are confident to trade RE in spot market, including send forecast generation curve to system operator.

15 2021 solar power incremental and total capacity

16 29 February 2022 https://guangfu.bjx.com.cn/news/20220207/1202669.shtml

- GPPA pricing formula shall have a floor of Base Price*80% and a ceiling of Base Price*120%.
- GPPAs shall be registered in the local/state power exchanges for execution.
- GPPAs shall enjoy top priority in the merit order dispatch.
- GPPAs will be settled in the same way as the existing thermal mid-/long-term PPAs in the market on a monthly basis.
- Bundled Green Energy Certificates (GECs) will be issued by the National Renewable Information Management Canter to GPPA buyers via a state-level power exchange upon the settlement of monthly power bills.

It is observed that two types of RE pricing models are adopted in different business contexts:

1. **Fixed Pricing Model** = Base Price + a fixed RE premium, which is common in short-/mid-term (1-3 years) GPPAs.
2. **Floating Pricing Model** = Market Price Cleared in Power Exchange + a fixed RE premium, which is seen in longer-term (5+ years) corporate power procurement agreements.

For C&I customers who are not eligible to participate the Green Power Trading program and/or having difficulties identifying competitive RE supplies in the market, they may achieve 100% renewables by procuring the NDRC-recognised Green Energy Certificates (GECs).

What do these terms mean in this context?

- **Base Price** refers to the on-grid tariff for coal-fired power plants (CFPPs) regulated by the local pricing bureau.
- **Market Price Cleared in Power Exchange**, including but not limited to, annual bilateral trades, monthly auction trades, intra-month listed trades, day-ahead trades, etc.
- **RE Premium**, is subject to negotiation with by considering the renewable development cost, the environmental attributes' value, and the additional balancing costs required by the intermittent RE generation. The RE premium was quoted at USD3-5/MWh in March 2022 in Guangdong.

3. Procurement of unbundled Green Energy Certificates (GECs)

China's GEC is a type of renewable energy certificate (REC). Officially launched by the Renewable Information Management Centre (RIMC), a subsidiary of National Energy Administration (NEA) in July 2017, GEC is a blockchain-based digital code to establish and track a MWh of electricity produced from a renewable source. Purchasing a GEC allows the buyer to claim consumption of 1MWh of renewable energy or neutralisation of its Scope-2 equivalent- emissions. GEC can originate from solar/wind projects; and it can be transferred only once: from a renewable generator to a buyer. In other words, GEC is only saleable once and subsequently non-tradable.

GECs are categorised into 3 groups with differing characteristics and attractiveness:

- Subsidy-Alternative GECs, which are issued to projects with subsidised RE generation[17].
- Grid-Parity GECs, which are issued to the grid-parity RE projects.
- Bundled GECs, which are bundled with GPPAs and issued by the power exchanges.

Subsidy-Alternative GECs are offered at their respective subsidy level, respective of project vintage, between USD 32-95/MWh[18]. Historically this price point has significantly exceeded buyers' price expectations, considering alternatives like Carbon Disclosure Project (CDP)-endorsed I-RECs[19] were being quoted as low as USD 1/MWh in 2021.

17 Most RE projects commissioned prior to December 2020 are entitled to some state/local RE subsidies. The RE subsidy corresponding to a GEC will be written off from RMIC's Subsidy Payable Book upon the entitle transfer of such GEC from the RE generator to the buyer.

18 China GEC Registry

19 I-REC Standard - The International REC Standard Foundation (irecstandard.org)

Subsidy-Alternative GECs have overall been received poorly by the market and the cumulative transaction volume up to March 2022 was only 78,894MWh.

Grid-parity GECs were introduced right after the NEA cancelled the subsidy program for all newly built onshore solar-/wind-power projects in January 2021. Grid-parity GECs are offered at around USD 8.0/MWh in April 2022.

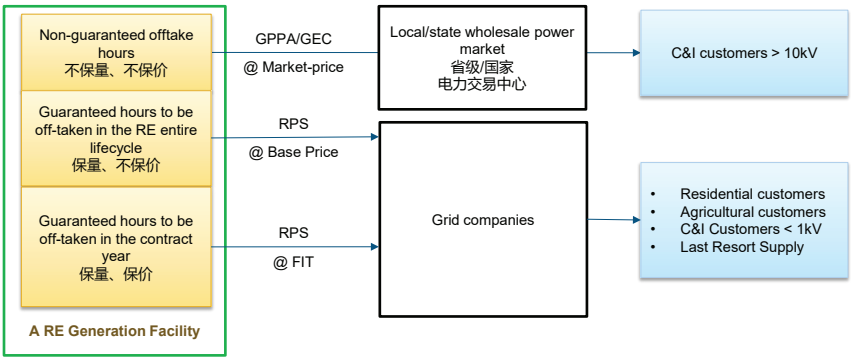
Many Chinese I-RECs purchased by multinationals in China in the past were likely double-counted with other renewable compensation schemes and certificate programs.

Concern over RE environmental attributes being double-counted by GEC and I-REC persists. Things became more complicated after the NEA introduced the Renewable Portfolio Standard (RPS) in May 2019[20] and the Beijing Power Exchange introduced Renewable Consumption Certificate (RCC) in January 2021[21] as the ownership of environment attributes overlaps.

Having realised this double-counting issue, the NDRC decided that GECs shall be recognised as the sole REC proof in the Green Power Trading program[22] and RCCs shall be unified with GECs upon the completion of database synchronisation by 2022. RPS is not a tradable product in China green power market, instead it is used as a performance indicator to evaluate the local government in the development of renewable energy industry.

In January 2023, I-REC will change its issuance criteria in China to exclude subsidised generation facilities entirely and include non-SOE generation facilities. The concern of overlapping attributes ownership of Subsidy-Alternative GEC and I-REC should be eliminated.

Figure 1: Indicative Illustration of Green Power Trading Pilot Program



Recommendations on Green Power Procurement

According to China's 14th Five-Year-Plan on Modern Energy System[23], billions of dollars will be invested in developing nine renewable energy production bases in North/West/Southwest China and 60GW flexible UHV transmission lines linking such RE production bases to the demand centres in the coastal areas.

Incremental RE supplies will enable industry leaders to achieve their social responsibility targets via the following means:

20 Notice on Establish Renewable Power Portfolio Standard RPS Quota is a standard set by Central Government to the provincial administrative entities on the share of RE consumption against total power consumption.

21 Beijing Power Exchange Renewable Power Portfolio Standard Trade Rules RCC issued by power exchange in accordance with the actual renewable power consumption purchased through green power trading of a reporting company.

22 NDRC Approval of Green Power Trading Pilot Program (NDRC [2021]No.1260)

23 Modern Energy System Planning (2021-2025)

About The Lantau Group

The Lantau Group (TLG) provides strategy and economic consulting services focused on the Asia Pacific's energy, network, and infrastructure sectors. We are the region's largest group of its kind. We offer a unique in-house resource pool equipped with experience and expertise in economic, commercial, financial and strategic aspects of the region's fuel-to-power value chain. We provide our clients with economic and regulatory consulting services, transaction support, asset valuation, and assistance in the development and evaluation of business strategy. Entrusted clients include leading multinational corporations, industry organizations, investor-owned utilities, generators, power pools, transmission companies, distribution companies, gas businesses, electricity and gas retailers, large power users, industry regulators and governments. Our detailed understanding and insights into each major market within the Asia Pacific region is a distinctive core competency. Our access is unparalleled through our offices in Hong Kong, Singapore, Korea, Mainland China, Australia, Thailand, Malaysia and with team members and affiliates across the world.

About the Author:

Jenny Zhang is the Director of Sustainability for China at The Lantau Group. With 24-years of experience at leading energy companies, Jenny has been involved in developing pipelines, storage projects, imported and exported product and basic polymers. Prior to joining TLG, Jenny was Deputy General Manager of ENGIE Energy Management, where she planned and drafted the finalisation of major tenders (particularly PPAs), sourced electricity and renewables, and was heavily involved in renewable asset trading.

1. **On-site Renewable Installations**

   For all C&I customers who own their operational properties and have no plan to move sites within the next two decades, on-site renewable installations are the most straightforward renewable solution, bringing customers environmental attributes but also energy savings over the long run.

2. **Green Power Trading Program**

   For C&I customers who are operating in provinces where GPPAs are accommodated by the local power energy market, this is an ideal way to get green power. In March 2022, green power is being offered at the same price as coal-fired power in some coastal provinces, thanks to the dispatch cost of coal-fired power hitting the regulated ceiling against soaring steam coal prices.

   For C&I customers who are operating in the markets with limited non-subsidised RE supplies, mid-term (1-3 years) mixed renewable/traditional power supply portfolios are available for the transitional period to 2025.

   Customers can opt for a fixed or floating RE pricing model depending on their risk appetites. The negotiation of an RE Premium may refer back to the most recent GPPA trades cleared in the local/state power market.

   We don't recommend targeting a long-term corporate power procurement agreement for 5+ years, since the Green Power Trading program is still evolving rapidly in China and the system is bound to change.

3. **Green Energy Certificates**

   For C&I customers not yet eligible to enter into GPPAs, Grid-Parity GECs could play a role as a short-term compromise.

   If C&I customers intend to claim 100% renewables by purchasing China-based I-RECs, stringent due diligence must be conducted by a qualified independent 3rd-party to avoid any overlapping with any already-issued GECs.

The situation is changing rapidly, but we anticipate the interest from companies with carbon-zero commitments and the desire to power their operations with 100% renewable energy will continue to grow. TLG is ready and available to discuss what the changing environment means for your power procurement efforts and help you with strategies and solutions to achieve your sustainability goals.