THE LANTAU GROUP

Transitioning to Green Electricity Supply in Asia

The Lantau Pique

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In this new edition of Lantau Pique, we take a closer look at green power procurement and decarbonisation frameworks available to MNCs in Asia. We particularly direct our discussion toward some of the deeper and often overlooked or misunderstood challenges that must be overcome before the green energy space for MNCs in Asia can be catalysed and grow materially larger. We conclude that the "time is now" but much still needs to be done to achieve decarbonisation efficiently and equitably.

CSR Focus Shifts to Asia

In recent years, leading multinational companies (MNCs) have been shifting their sustainability focus from a simple compliance orientation towards one of strategic leadership. As noted recently by BlackRock's CEO, Larry Fink: "all investors, along with regulators, insurers, and the public, need a clearer picture of how companies are managing sustainability-related questions."[1] The expanding range of Environmental, Social, and Governance (ESG) scoring initiatives that aim to quantify Corporate Social Responsibility (CSR) activity—broadly with the intent to guide future investment—depend on robust frameworks capable of providing both comparable and timely data.

In Asia, however, opportunities for CSR-minded MNCs to invest in green energy procurement opportunities can be difficult to identify. Furthermore, the frameworks and transparent information access needed to support more robust investment are still evolving in most markets. As an increasing number of CSR-minded MNCs and leading regional companies—and their supply chain partners—work to meet ambitious and often high-profile Scope 2 and Scope 3 emissions targets by 2025 or 2030, they will need to do redouble efforts to meet those commitments in Asia.[2]

This shift in focus is starting to take hold in Asia. We observe—even amidst the stresses of the global Covid-19 pandemic—increasing corporate interest in strategies to identify and prioritise green energy procurement throughout the region. This strengthening trend was foreshadowed by growth of the RE100 initiative which, in 2019, "experienced its biggest year yet" with 241 member companies and with 40 percent of its growth coming from the Asia-Pacific region.[3] RE100 is the global corporate renewable energy initiative bringing together hundreds of large and ambitious businesses committed to 100 percent renewable electricity.[4]

Even as they shift their focus, MNCs face challenges advancing their renewable energy strategies in Asia. In most Asian countries, the available green procurement options are generally a mix of insufficient, complex, unclear, or unexpectedly expensive.[5] It is not surprising that many MNCs have been focussing in North America and Europe. Yet, without much greater progress in Asia, MNCs will not be able to meet their increasingly stringent global targets as members of initiatives such as RE100 or Science Based Targets.[6]

In this new edition of Lantau Pique, we take a closer look at green power procurement and decarbonisation frameworks available to MNCs in Asia. We particularly direct our discussion toward some of the deeper and often overlooked or misunderstood challenges that must be overcome before the green energy space for MNCs in Asia can be catalysed and grow materially larger. We then take a fundamentals-based look at emerging frameworks and some of the associated challenges in Mainland China. Policies, politics, and commercial opportunities will periodically deviate from economic fundamentals for understandable reasons, but the longer-term implications generally tie back to those fundamentals.

The Time is Now

The RE100 commitment and similarly oriented initiatives are growing, but they still represent nothing close to the level of overall activity and interest across the corporate sector required to achieve science-based decarbonisation objectives.[7] An emerging realisation is the dramatic extent to which corporate commitment to CSR activity must further increase to move the needle on decarbonisation.

Accordingly, one has to at least consider that there will, or at least should, be faster growth in the focus on renewable energy over the next decade—and this increase must not simply offset growth in electricity demand, but it must start materially *displacing conventional generation at an increasingly faster rate*.

The obvious consequences for costs and associated risks feed into more difficult and nuanced questions of who pays, when do they pay, and how much will it all cost. One can reasonably expect a step-change in the complexity and materiality of the associated commercial, policy, and regulatory challenges for energy system stakeholders. But how might this play out?

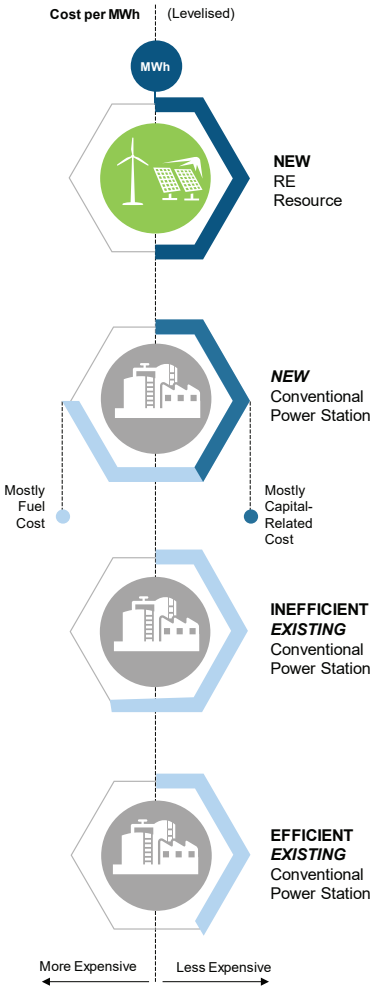
Early adopters stand to gain more than slower adopters in the same way that the swift can win in a game of musical chairs.[8] These advantages include the possibility of lower cost options; more informed integration of renewable energy certificates and green attribute certificates in general; and greater certainty in relation to future cost exposure. Additionally, early adoption offers opportunities to influence the development of renewable energy and green attribute certificate arrangements as they evolve.

The Future Cost Curve is ... Complex

When the cost and performance of new renewable energy technologies are compared directly to the prospect of building new conventional technologies, renewable energy options are getting closer and closer to being "in the money" where they are not already. The economics of offsetting incremental growth or displacing the most expensive peaking resources on a system, however, are very different from the economics of displacing relatively more efficient existing generation, a point illustrated in Figure 1.

New renewable energy resources are most likely to be "in the money" in an economic sense when they compete with the cost of developing ***additional*** or ***replacement*** conventional energy resources.[9] With a continuing push for more and more renewable energy, however, new renewable energy resources ***must*** begin to displace existing efficient generation capacity or wait for such capacity to break-down or retire. The speed and extent of this replacement / displacement process determines the

Figure 1: Project Economics are Relative (Illustrative)



cost-related-risks facing stakeholders during the energy transition.

The initial development of renewable energy resources at scale requires comparatively high subsidies, often in the form of Feed-in-Tariffs (FiTs). As illustrated conceptually in Figure 2, the result was a dramatic reduction in cost and an improvement in performance over time. In retrospect this was effectively Stage 1.

Stage 2 is where much of Asia is now or is soon approaching. Each year there will be more opportunities for renewable energy development that have reached "grid parity" or that can otherwise be developed with minimal or no subsidies.

Stage 3 is where some Asian countries (or regions within countries) are moving, and where we expect to see increasing focus and interest. Stage 3 is attained when new renewable energy resources displace generation from ***existing*** conventional generation resources. Accordingly, renewable energy resource development depends on the supplemental revenues from green attribute certificate sales, DPPA arrangements, or special tariffs (e.g. subsidies).[10]

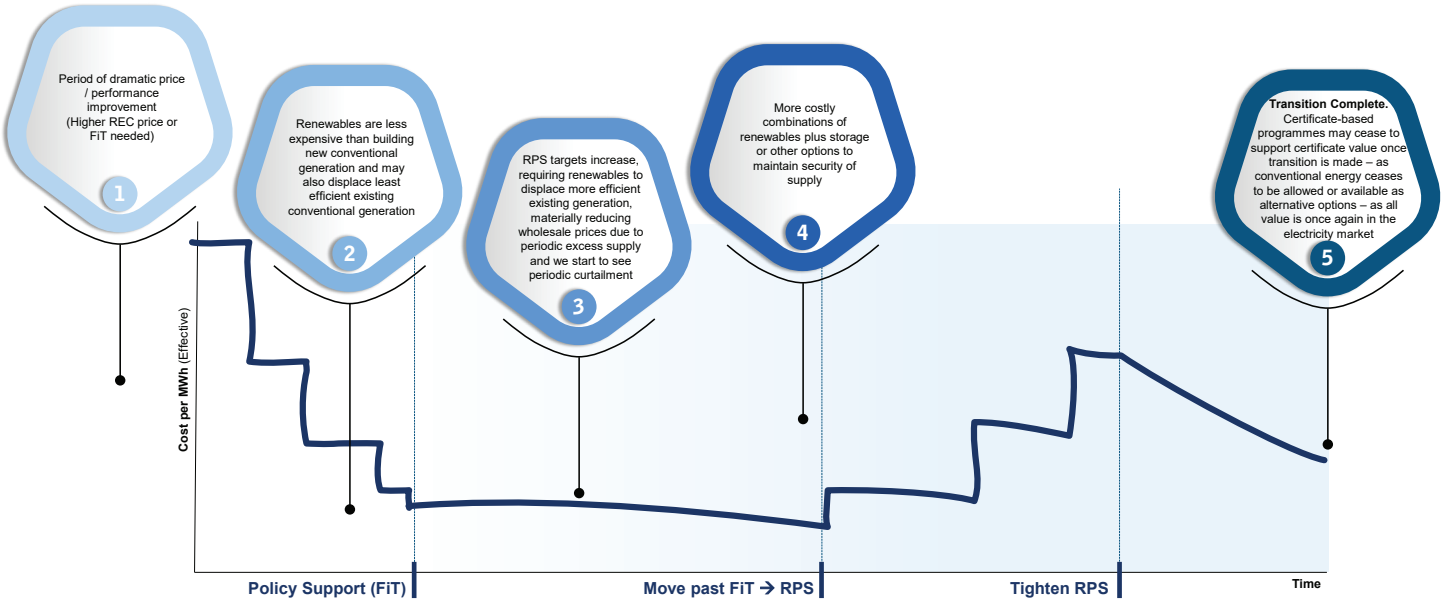
Stage 4 is reached when the penetration of renewable energy hits such a high level in a location that some volume of electricity that ***could*** be generated must be wasted due to constrained system conditions. Whenever more renewable energy is available than the system can safely and securely accept at a location or point in time, then some renewable energy generation resources must be curtailed (limited). Additional costs such as battery storage must then be incurred to enable recovery of this curtailed power and maximised renewable energy generation potential.

Stage 5 is reached after the decarbonisation target has been sufficiently satisfied that there are no longer any carbon-emitting options left for consideration. At this point, if it is no longer permissible or economic to develop further conventional generation resources, there would be no further need for green attribute certificates with any value linked to CO_2.[11]

The speed with which a power system traverses these stages and, of course, their precise shapes, depend on a combination of technological progress, the degree of policy pressure, and the collective impact of MNC activity. It can be more cost-effective (and predictable) to lock-in long-term renewable energy resources at the earlier stages of this development trajectory.

Additionally, these stages are neither strictly sequential nor mutually exclusive. Depending on the physical and electrical limitations of the transmission or distribution networks, it is possible to be at Stage 4 with curtailment in certain locations given the nature of renewable energy resource availability (better wind or solar resources can be geographically concentrated), while being at Stages 2 or 3 in other locations.

Figure 2: Stages of Renewable Energy Relative Cost



Power systems are complex and their underlying economics highly location specific. At any of the above stages, there may be a need to build out or otherwise augment transmission or distribution network capacity, or to cover the costs of ancillary services to maintain system security (due to renewable resource intermittency). The policy settings for how to attribute these costs (who pays)—whether using a causer or beneficiary pays framework, or in some other manner—become important as well. What might initially be thought as politically and commercially "easy" renewable energy strategies and policies, can quickly become much more complex over time.

The intersection of renewable energy and power system operations and economics results in a much more complex beast to tame; one that unfortunately rears its head exactly when and where stakeholder interest in renewable energy and sustainability is most desirous of simple, attractive, and easy to understand solutions.

The (Types of) Options Must Increase

The options available in each market depend on underlying commercial and regulatory structures that vary widely in terms of sophistication, commercial opportunity, third-party access rights, tariff levels and structures, and policy and regulatory settings (including level of deregulation across the electricity industry value chain). In Asia, only Singapore and the Philippines have well-developed electricity wholesale and retail markets.

Japan has wholesale and retail markets which support green energy contracting, but Japan's electricity markets operate within several structural and institutional constraints that limit effective competition. South Korea has a working wholesale market and an RPS (Renewable Portfolio Standard) system that supports a renewable energy certificate (REC) market. However, these operate within an overall Single Buyer structure centred around KEPCO. Customers have neither a choice of supplier, nor can they purchase directly from the wholesale spot market. Consequently, there are no DPPA arrangements available in Korea at present.

Establishing an underlying wholesale market should be viewed as a significant head start in the race towards integrating more renewables efficiently into power systems.[12] The price signals from wholesale electricity markets can be used to guide more efficient use of technologies that influence demand, integrate storage, and signal the value of using renewable energy to displace conventional generation resources more efficiently. After all, the world is moving towards digitalisation as well as decarbonisation, and big data solutions are seeing application in a wide variety of industries, including electricity. Markets that use data to produce more accurate price signals can support deeper and more effective integration of new demand, supply, and storage technologies.[13]

Most Asian electricity pricing is still regulated, and few Asian countries have markets to signal the economic or commercial value of wholesale electricity supply at any point in time. In situations where there are no wholesale markets, it is important to develop a proxy value based on the fuel savings and other costs that are avoided at the instant a MWh of renewable energy is generated and fed into the system. A wholesale market will have a wholesale market price that can be used as one measure of this "avoided cost." Systems without wholesale electricity market arrangements can utilise a value built up from the estimated system marginal cost as a practical measure of "avoided cost."

If the wholesale price (where it exists) or the estimated avoided cost proxy (where it must be calculated) is not enough to justify the renewable energy investment, then some other source of value is needed. Once a foundational "value" is available via a market or proxy arrangement, it is much easier to structure and evaluate additional commercial structures and options.

Benefits and Costs Need to be Understood

The adoption of more renewable energy can reduce CO_2 emissions but that is not the only positive impact. When assessing different policies and approaches, the wider range of benefits and costs may also need to be considered. One of the major benefits of the original US sulphur dioxide emission regulations that set up a trading market in emission "allowance" (much like renewable energy certificates) was that many of the same efforts to reduce SO_2 emissions resulted in reductions of other types of emissions, especially particulates (which were later shown to constitute a material health risk). In the case of renewable energy, CO_2 is the emission type likely to see a significant reduction. The benefits of renewable energy in Asia are thus also a function of the environmental standards applicable to existing conventional generation resources.

On the other side of the ledger, there is the question of what (if anything) renewable energy resources pay (or should pay) for access to the transmission or distribution system and for ancillary services that are required to manage system security. Various market designs around the world address these types of issues differently. From an economic efficiency perspective, the main challenge is to identify how to assign costs in ways that achieve a balance.

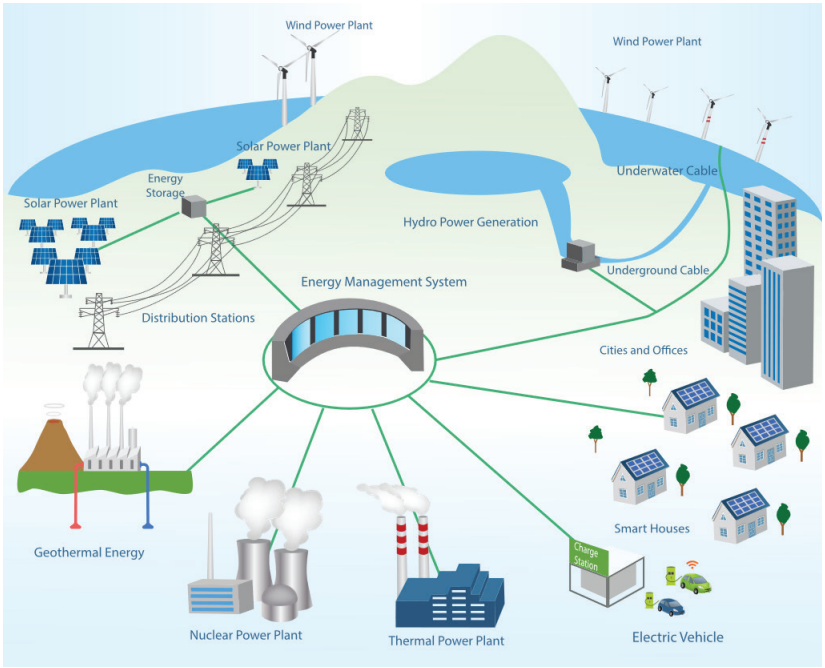
In competitive wholesale markets, significant adoption of renewable energy tends to depress wholesale prices, resulting in a potential transfer of value from some generators to customers that can take advantage of the wholesale market. This can result in stranded generation costs. Most electricity markets in Asia, however, are regulated such that any reduction in fuel costs may eventually be passed through to customers whereas the costs of the capital invested in conventional power stations are still regulated and are recovered through tariffs. Who pays for such "stranded" costs is a key question, particularly given the extent of cross subsidisation in many electricity tariffs in Asia. At the same time, the extent that conventional generation benefits from subsidies of any sort should also be considered.

Another issue is the relative *time profile* of collective MNC renewable energy targets versus the pace that a country might have adopted on its own. The faster that MNCs seek to reach 100 percent renewable energy for their Scope 2 emissions (and the more pressure MNCs place on their supply chain partners to reduce emissions), the more aggressively these companies will implicitly "compete" for a proportionately larger share of the commercially available renewable energy at any point in time. Such competition within a given market is one part of the challenge. The other part is that each market will develop at different rates, with some being more progressive than others. If MNCs must match renewable energy procurement with their local usage within each grid, MNCs will likely find themselves stuck with few options in some markets whilst others have options that they cannot take advantage of. Visions of future energy worlds (Figure 3) invariably appear more orderly than practical realities allow.[14]

Summary

As the focus of many CSR-minded MNCs shifts more intensively towards Asia, there's no time like the present to establish a strategy for meeting objectives whilst recognising and either mitigating or working around the challenges in the region. This extraordinary period marked by falling renewable energy prices and increasing performance is not coming to an end anytime soon, but as power systems display increased penetration rates for renewable energy during the run-up to 2030, more complications will emerge, potentially leading to higher system integration costs. Accordingly, waiting for future developments or clarity involves exposure to potentially volatile future costs versus taking steps now that lock in reasonable outcomes over a longer time frame.

Figure 3: Visions of a New Energy World Abound



At the same time, the absence of practical or viable options in many countries creates pressure for change. New policies and markets will need to be developed and pricing will need to become more dynamic, while tariffs will need to be restructured. Information and reporting standards must also mature and become sufficiently transparent and robust that the information reported properly reflects the underlying contribution to sustainability that is the ultimate intent.

A variety of options will be needed. Currently DPPAs are widely seen as preferred instruments—almost as one-stop solutions to the green energy procurement challenge. More flexible REC-based options will also be needed over time especially as CSR activity extends throughout supply chains. Flexibility and profile matching become increasingly more valuable the closer one gets to a 100 percent target, which many MNCs are proposing to reach in less than a decade. There will be a need to balance renewable energy supply and demand through trading and through smarter signals that robustly support storage and integrate smarter energy usage technologies.

A key risk for policymakers is that the temptation to introduce attractive-sounding green policies in the short run loses sight of the 'big picture' need to implement coherent and comprehensive restructuring over the long run. Unfortunately, poorly developed policies that overlook fundamental economic realities may create opportunities for green energy development that unintentionally benefit green stakeholders at the expense of all others, setting up much more difficult problems for later.

Along the way, ESG reporting and scoring has a natural and increasingly important role in guiding future developments. ESG reporting standards and scoring are intended be based on actual contribution to sustainability and not just adoption of specific mechanical compliance instruments. If those instruments are founded on poor quality or unreliable or mis-conceived information, then they will support poorer decision-making and less effective outcomes. The fundamentals matter. At the same time, waiting for perfection is a bit like waiting for Godot.[15]

The challenge is to find the right practical balance while still getting to green.

Green Attribute Certificates

Overview

A green attribute certificate—sometimes called a renewable energy certificate (REC)—is an instrument that represents the legal property rights to the environmental attributes associated with a specific MWh of electricity produced. Buying a certificate does not require the consumption of the associated electricity—in that sense the certificate is 'unbundled' from the electricity. Information on a certificate generally includes the generating site, the environmental attributes (e.g. renewable electricity or carbon emissions reduction), and its vintage (year issued). The credibility and relevance of the information on the certificate determines its value from a CSR perspective.

In this section, we focus on *green attribute certificates* as an unbundled product, rather than as part of a DPPA arrangement involving a bundled offtake of electricity and the green attribute (whether such attribute is in a formal REC or just a stated right to the attribute). We consider that it will not be possible to maximise the rate of decarbonisation without both instruments. DPPAs will struggle to be suitable for smaller customers without a costly tier of aggregation and management given economics of scale of renewable energy project development—much of which is intended to be solved by smarter green attribute certificate arrangements. Conversely, if green attribute markets do not continue to consolidate and evolve, their weaknesses will eventually limit their usefulness and value—constraining the potential to further expand opportunities for DPPA arrangements. Mainland China is a good example of the problems of emerging green attribute certificate markets and is the subject of a mini-review in the final section.

A Growing Certificate Market(s)

To date, there is no single trading and accounting framework to support a global REC market (nor even one that contemplates how to make such a global market work). There are no suitably robust and accepted mechanisms to support REC inter-changeability, or even standardisation of reporting and tracking. Nor do we seem to be heading very quickly if at all in an international trading-oriented direction from a policy development or commercial implementation perspective.[16] This is unfortunate as standardisation and simplification are important to the longer-term success of market-based green attribute options.

The absence of robust standardisation has been well noted. For example, the International REC standard (I-REC) is an attempt to develop a global "energy attribute tracking systems" emphasising information transparency to motivate standardisation (and acceptance). I-RECs are available to be issued in many Asian countries and regions, including Mainland China, India, Indonesia, Malaysia, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, and Vietnam. Notwithstanding the number of countries in which I-RECs can be issued, activity in most is still low.

Despite the efforts of I-REC and many others, each country tends to pursue its own initiatives as well, helping to keep the overall market balkanised. In addition to standardising around a well-recognised green attribute certificate, it would be useful to more clearly and logically define relevant regions within which green resources can be developed with the support of the financial flows linked to the green attribute certificates. For example, the market for European

Guarantees of Origin (GOs) operates as a hybrid market in which some can utilise GOs from anywhere within Europe while others may be limited to securing GOs from specific countries. Such a hybrid approach could at least allow stakeholders with relatively more financial resources but with relatively less local access to renewable energy projects to use their financial resources more efficiently.

European countries share electrical interconnections and electricity trading arrangements. Singapore is a good example of a situation where physical limitations of local land resources and limited international electricity transmission interconnections have confounded the process of renewable energy development in ASEAN, whereas a hybrid approach could help move things along faster. RE100 standards require that renewable energy purchased needs to be in the same location as the electricity consumed. Physically this could mean that renewable energy resources are located anywhere on an interconnected electricity grid (provided the physical transmission capacity exists with which to actually accommodate a hypothetical transaction). Commercially and from the perspective of regulation and policy, however, there may be no way to implement such arrangements without electricity market reforms.

There is clearly much work to be done, but first it helps to understand REC pricing.

The Wacky World of REC Pricing

From an economic perspective, the concept of a REC is straightforward. All the difficult problems that may arise are associated with the details of how RECs are implemented—including how to establish and maintain a transparent and credible linkage between a given REC and the CSR claims it is intended to support. Perception matters. If RECs are viewed as inferior by stakeholders, then for CSR purposes they ***are*** inferior, as part of the benefit for CSR-minded MNCs is that their actions be perceived positively as an example for others.

Not All RECs are Created Equal

Voluntary RECs have relevance from a CSR perspective if they are issued by projects that are not otherwise receiving a subsidy.[17] The absence of a subsidy is key—if a project is being supported by some other green-related support scheme, then the green attributes associated with the project should not logically be attributable to the REC purchaser unless or until the REC purchaser also buys-out the other subsidy as well.

Compliance RECs are specifically utilised to comply with certain obligations, such as specific RPS requirements. The value of a compliance REC is strongly influenced by the size of the penalty. The value of a compliance REC is often higher than a voluntary REC because failure to comply typically involves a penalty. A REC registry should set out the details of the underpinning REC source in a way that assures—together with the standard set by the corresponding issuer and registry—that the REC purchaser is gaining clear ownership of the green attributes.

In voluntary REC markets, the lowest REC price may involve lesser degrees of location matching, timing of generation (i.e., vintage) against timing of use, or guarantees that the projects are not double dipping in other possible registries or green funding sources. Double dipping would invalidate the creditability of MCN's CSR claims—the key objective of sustainability initiatives. A project that is cost-effective to develop without any subsidy could also choose to issue voluntary RECs and attempt to raise even more money as a result. There is little that can or should be done to stop this, however, as the true problem is likely to be that the demand for RECs is too low, rather than that some suppliers might make additional profit under certain conditions. The point is not to stop at some modest, non-disruptive level of renewable energy but to continue pushing past lower levels that would otherwise be commercially viable on their own to reach levels that actually displace lower cost conventional generation (and thus need additional value support to do so). Otherwise, the pace of decarbonisation is strictly limited to meeting demand growth and the retirement profile (natural or forced) of conventional generation resources. That hardly seems to be an optimal or sensibly structured framework for ***getting to green*** at anything close to least cost.

In some instances, REC pricing is particularly difficult to put in context. It has been, for example, possible to buy hundreds of thousands of wind I-RECs in Mainland China from dealers at a price less than US 50 cents per MWh in voluntary market, technically making it almost immaterial (relative to their baseline electricity costs) for a company to claim 100 percent renewable energy. At best, however, this pricing reflects a plain vanilla I-REC from a wind farm that is not ***supposed*** to be receiving any forms of subsidies. Such projects may indeed not be receiving any FiT, but they may nevertheless enjoy additional revenue (relative to, say, Mainland China's standard "on-grid coal price") from other sources designed to promote green energy in particular locations. The specifics of these situations are rarely transparent, necessitating almost project-by-project due diligence and the associated costs.

In contrast, an "LGC" (a green attribute certificate from a large renewable generator) in a compliance market in Australia could cost around AUD 30-40 (around USD 21-28) in 2020 per MWh (which in turn is half the price of two years ago). Similarly, Mainland China's own domestically issued and traded Green Electricity Certificate (GEC) is currently priced at around USD 25 per MWh from wind resources. This price accords roughly with what is required to obtain green attributes from a project otherwise expected to receive a subsidy payment under the FiT scheme.

It is difficult to sustain confidence in REC market products unless they are fundamentally transparent and credible.

The extremely low prices for wind-based I-RECs in Mainland China suggest a lack of confidence in the origin of the lower cost I-RECs. This is due to limited transparency across various voluntary REC/emission platforms, combined with the potentially high cost of private compliance assurance checking (verification/validation costs) as would likely be required to confidently recognise these I-RECs under the RE100 framework. When pricing anomalies or transparency exist, the question will invariable emerge: "what is one getting" for a given expenditure on a particular type of REC? When this question has no clear answer, or when it can only be answered clearly after undertaking separate, expensive validation tracking efforts, then the overall marketplace is not (yet) working.

Consider again the Australian LGCs, and Chinese GECs. These certificates derive their value from fundamentally different dynamics versus voluntary I-REC market in Mainland China. The Australian LGC price is intended to support build-out of renewable energy in the Australian market, where wholesale electricity market revenues on their own were not enough to support new renewable energy projects at the time the government set out the LGC obligation for electricity retailers. The Chinese GEC price is higher because the GEC is intended to replace much higher subsidy payments expected to be received by already existing projects.[18] The system is meant to collect funds from voluntary corporate/individual contributors to close the subsidy fund deficits. For RE project developers, GEC is an option to receive the regulated FiT at a negotiated discount at present, rather than waiting for the long-delayed payment.

The oversubscribed and delayed subsidy fund payments have indirectly become the key driving force behind GEC pricing. Understanding the underlying dynamics helps to assess the strategic value of acting earlier versus waiting for further market developments, with a focus on the instruments available or expected at any point in time.

Figure 4 highlights differences in REC pricing across different REC markets, including those that are driven by compliance requirements (linked to RPS targets) and those that clear voluntarily.[19] The differences highlight the very localised nature of REC pricing dynamics as explained in the next section.

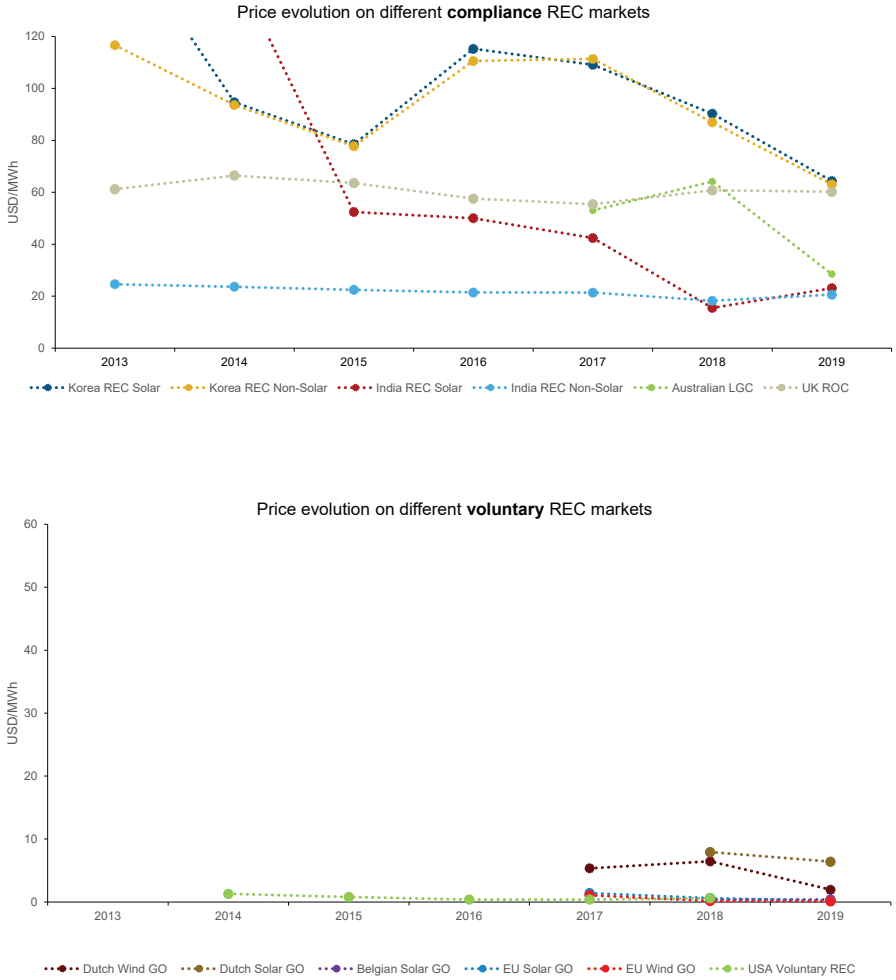
Why the Big Differences?

As hinted in the last section, REC prices vary because the value of a REC depends on what specific requirement give rise to the need for the REC in the first place, and these requirements also vary. When analysing REC pricing in the United States, Barbose (2017) noted:

> *RECs used for RPS compliance have different pricing than RECs used for voluntary purposes. Prices for RECs used for compliance purposes tend to be higher due to RPS programs that require regulated entities to source RECs from specific states or regions. These restrictions limit the supply of eligible RECs while ensuring demand from load-serving entities, causing upward pressure on prices for RECs. This upward pressure on REC prices translates to higher prices for compliance-based and voluntary RECs in states with RPS. As a result, RECs (both compliance-based and voluntary) tend to exhibit higher prices in the states with the strictest RPS requirements and lower prices in states with low or no RPS.*[20]

RECs represent one part of the overall flow of value to the renewable energy project developer. The other part is the money received for the electricity that the renewable energy resource produces. The developer would pursue the project if and only if these sources of revenue cover the costs of developing and operating the project. Accordingly, the more money a project expects to receive from producing electricity, then the less it needs to receive from RECs.

Figure 4: Compliance and Voluntary REC Prices Evolution in Different Markets



Conversely, if a REC in a location has a very high price, it should be because the electricity that corresponds to that REC is at a much lower price. In an extreme case, the price of the REC could cover the entire cost of the resource with the result that the electricity is paid zero value in the wholesale market.[21] This implies an opportunity to develop battery storage that taps into the very low or zero-priced wholesale electricity and time-shifts that electricity for use in another period where the wholesale price is much higher. Such a relationship does not necessarily apply consistently in practice, however, as few Asian countries have underlying electricity wholesale markets that vary dynamically with overall supply and demand.

If the value available for the electricity generated by a renewable energy resource is high enough, then investors may propose and develop green energy resources without any additional source of revenue. This can be great when it happens, and very desirable. However, if there is value in decarbonising even *faster*, then once a given renewable energy technology is "in the money" in a particular region or at a particular point in time, the target for total renewable energy adoption should be increased accordingly – providing on-going support for REC pricing whilst also managing the impact of increasing renewable energy on the energy market (and all of its other stakeholders). Clearly this means that REC pricing is inextricably tied to policy choices concerning the speed with which a country decarbonisation.

All of this highlights a very useful feature of DPPA arrangements. DPPAs can be structured as a single price that bundles electricity and corresponding RECs together from the perspective of both the seller and the purchaser—which mitigates risk. DPPA arrangements depend on how all other aspects of electricity systems that still need to be paid are recovered from the buyer and the seller, as appropriate.

Local Not Loco

One of the challenging issues with RECs and with DPPA arrangements is that the location of the resource and the location of consumption are not always the same. These issues have been particularly relevant in Mainland China where the best wind and solar resources are often located thousands of kilometres from consumption centres. In recent times, Mainland China's transmission system could not handle the renewable energy being generated and the resources had to be curtailed. Location matters, but an overly strict focus on location can also delay global decarbonisation.

Throughout Asia, an even larger problem is that while most countries have electrical grids that are interconnected with neighbouring countries, these interconnections are barely used to anything close to their potential. The comparatively unused interconnection between Singapore and Malaysia is a case in point.[22] Of course, Malaysia is also interconnected with Thailand and so on. Other markets have abundant renewable energy resources far in excess of local demand. Interconnection access is a way to make those resources available to other nearby regions. Electrical interconnection is an important aspect of localisation—it is what allows European Guarantees of Origin (GOs) to work throughout Europe or for companies in Houston to buy RECs from wind farms in the Texas panhandle, which is about the same distance as from Singapore to a wind farm in Phuket, Thailand.

Suppose that there are end users with financial resources and strong renewable energy commitments in Singapore looking for renewable energy that cannot be developed in Singapore—hardly a far-fetched notion. What do you do? To unleash the renewable energy development potential of electrically interconnected regions, there first needs to be a structure to support physical electricity trading as well, complicating and delaying progress in the development of renewable energy and increasing the cost (potentially) to end users in locations with fewer renewable energy options.

The physical transmission system is a key factor in determining how much renewable energy can be developed. As renewable energy targets increase, or as high-profile customers seek to accelerate their own progress towards RE100, the physical electricity system and associated trading arrangements need to evolve much faster. It is time for third-party access of the electricity system—which means it is time to get wholesale markets or equivalent market-like systems back on the table. The future green and digitalised world depends on more accurate information about prices and quantities and the flexibility to optimise these through trading, changes in behaviour, smarter technologies, storage integration, and other smart incentives or pricing signals.[23]

Summary

Credibility and relevance are the key concerns when markets are just getting started and before a clear best standard has emerged. European GOs are an example of an attempt at standardisation that creates flexible benefits as a result.[24] There is no such equivalent regionalised option established yet in Asia. Instead, there are often multiple certificate issuers and registries and types of certificates emerging in Asian markets. Certainly, this is the case in Mainland China, where the lack of a standardised product with exclusive environmental attribution means the certificate market currently sees unstable prices, limited trading volume, and competing products with near-identical functions.

REC pricing and availability are naturally policy sensitive. Consequently, forecasting REC pricing involves a combination of detailed analysis and structured thinking to account for the fact that underlying REC price drivers are linked to policy directions, the availability and cost of conventional generation resources, and technological developments affecting renewable energy performance and cost. Developing and maintaining a transparent and stable policy framework for REC pricing is important and difficult.

Absent a viable REC market, many MNC strategies invariably have shifted towards DPPAs as mechanisms that provide control over project development, timing, and access to the corresponding green attributes.[25] DPPAs can provide MNCs with a clearly traceable renewable energy source but they do not necessarily support the least cost long-term best approach. A circular challenge awaits us. DPPAs will struggle to address the needs of smaller companies without robust mechanisms to facilitate aggregation and trading of the green attributes—precisely what RECs are supposed to be in the first place.

Confronting Structural Design Challenges

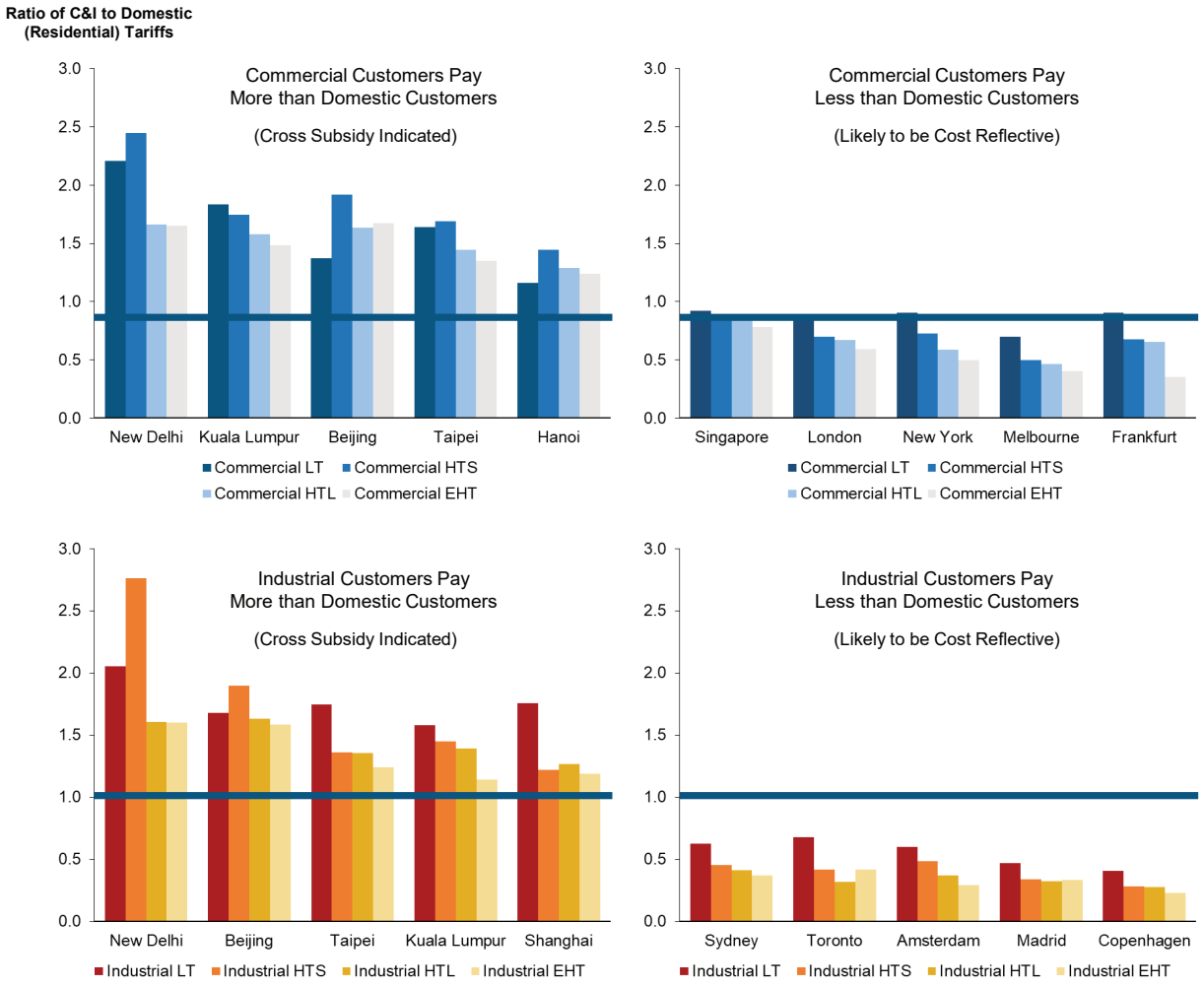
There are many challenges from the MNC perspective. But there are also emerging challenges from the perspective of the designer or sustainability-minded policymaker. At some point these two perspectives must be reconciled. Amongst the most complex and politically sensitive involve the prospect of tariff reform to address (cross-)subsidies.

In some cases, proponents of green energy transactions seek wheeling charges or transport charges that—depending on how they are structured—bypass these cross subsidies or other charges that must still be recovered from *other* customers. Accordingly, the impact of CSR activity and policy evolution is not strictly limited to those who produce and seek to consume green electricity or secure green energy attributes. There are other often complex impacts with implications for other power system stakeholders and customers. It will be difficult to advance the CSR agenda fully without also recognising the need to resolve electricity pricing, cross-subsidy, and associated energy poverty concerns.

The Bedevilling Issue of Tariff Structures and Cross Subsidies

As shown in Figure 5, commercial and industrial customer tariffs are much higher than those of domestic customers in markets such as India, Malaysia, Mainland China, Taiwan, and Vietnam. This result stands in sharp contrast to what is seen in Singapore, Europe, and the United States. Accordingly, any policy that opens options to large commercial and industrial customers in the cross-subsidised markets has potentially complex and politically awkward implications for tariff rebalancing over time.

Figure 5: Tariff Structures to End Users



What this means is that every opportunity for a larger commercial or industrial customer to secure a DPPA via wheeling charge arrangements needs to be thought through carefully in terms of what costs the green customer should continue to pay. It also affects the opportunities for behind the meter solar development and the implications for net electricity metering programmes. When commercial and industrial tariffs embed cross-subsidies that benefit domestic customers, the loss of electricity sales to commercial and industrial customer revenue can have a disproportionate impact on the utility and subsequent tariff adjustment process.

Tariff design changes may be appropriate, such as removing or retooling cross-subsidies between different end-user categories, as well as the inclusion of fixed charges (demand charge), or other arrangements—and these will necessarily impact the perceived value of renewable energy developments on customer premises. Some degree of tariff reform and cost shifting is likely to be inevitable—the challenge is to navigate the necessary transition while maintaining support and consensus around increasing renewable energy development. A political backlash that chills the pace of green development out of concern over who is really paying for it all is unlikely to be a preferred overall outcome.

The Vexing Issue of Wheeling Charges

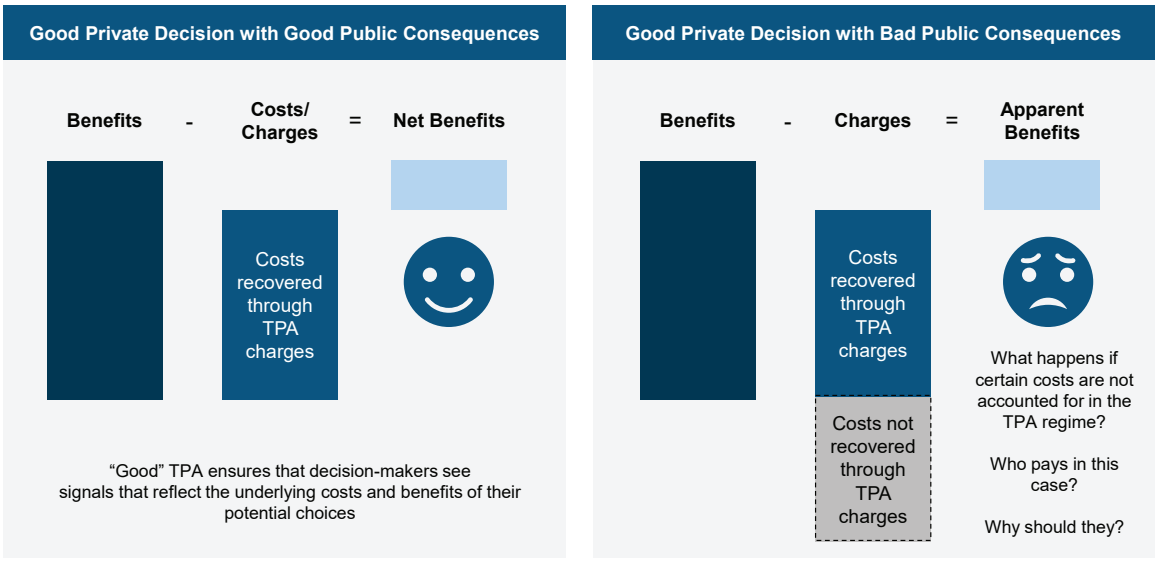
A common issue that emerges time and time again is whether there should be something like a "wheeling charge" or "tolling charge" that must be applied to convey green electricity from a grid-connected solar or wind resource to corporate (commercial and industrial) customers willing to enter into a DPPA. In fully unbundled and restructured electricity markets, the various functional components are typically separated (unbundled); risks are defined and allocated; and in some cases, legacy contracts or other potential stranded costs have been separately managed or accommodated.

A wheeling charge in a *developed* market may indeed be a transport-oriented cost recovery charge. But many other forms will likely already have occurred. When thinking about how to structure a wheeling charge in markets with significant embedded cross-subsidies—or that have not been fully unbundled, or where there may be significant legacy fuel and generation contracts or capacity costs that are still being recovered—sticky political and regulatory problems can quickly emerge. A *transportation-only* wheeling charge accompanied by a DPPA between a green resource and a corporate customer has the potential to bypass a significant portion of the costs that are currently embedded in the tariffs charged to the corporate customer.[26]

Figure 6 strips away all the detail to make a simple but important point. When a decision-maker makes their choices, they only consider the factors that are relevant to the decision-maker. If factors are not relevant to the decision-maker but are relevant to others, these may be overlooked. The left-hand panel depicts a good private decision involves benefits that are greater than the costs. The outcome is good privately and socially. In the right-hand panel, the same decision is good privately, but certain costs are not apparent to the decision-maker and thus have unexpected consequences for society at large. If these consequences are negative and material, then the conditions have been created for a good private decision that still leads to bad public consequences.

To bring this abstraction back to the question of wheeling charges, consider that pursuing the best possible deal commercially has obvious merit but may not align with the best long-term pathway for reaching decarbonisation. Leaving a big part of the problem for others to pay for is unlikely to facilitate the kind of accelerating decarbonisation trend that is needed to meet global science-based targets. A significant part of what is needed going forward is sensible policy advocacy backed by analysis and insights that identify and support options

Figure 6: The Good, Bad, and Ugly of Wheeling Charges and Third-Party Access (TPA)



for MNCs while providing a robust pathway for energy sector development in each country.

Who Gets the Credit?

Renewable energy development clearly has been increasing, but typically the resulting green electricity has been purchased directly by "the grid" or is supported by feed-in-tariffs or other mechanisms. These have been especially successful in Mainland China, Taiwan, and the Philippines. Recently Malaysia's experience has been similar with respect to its Large-Scale Solar programme, in which the Large-Scale Solar (LSS) participants receive a price set by an auction.

For every MWh renewable electricity consumed, the presumption is that there is one less conventional MWh from a CO_2-emitting resource produced. This is how a renewable energy resource can be used to imply an amount of avoided CO_2 emission. When countries support renewable energy via mechanisms such as feed-in tariffs and auctions, the ***green attributes*** are paid for by the system on behalf of all customers. The result is a reduction in ***overall*** system emissions attributable to electricity usage, but this is a passive outcome from the perspective of MNC CSR activity and associated messaging to stakeholders and customers.

Suppose a market pursuing this approach increased its renewable or decarbonised electricity incrementally until finally achieving zero carbon emissions. At that point, all customers using electricity from the grid would enjoy the benefits of being carbon zero with respect to their electricity usage, at least. However, if this point in time is ***after*** the target dates established by a CSR-minded corporate, then it will not help the corporate meet its own private target deadline. For example, if a corporate customer operating in Taiwan seeks to be carbon zero by 2030 but Taiwan itself aims for 2050, then either the corporate must either (1) wait for alignment with Taiwan's goals; (2) undertake potentially much more expensive options to contribute to the acceleration of Taiwan's overall decarbonisation; or (3) find some way to carve out credit for decarbonisation initiatives that would have happened anyway.

To continue with Taiwan as an example, DPPAs are currently available but have been commercially inferior (from the perspective of the renewable energy developer) to the available feed-in tariff arrangements. Accordingly, despite the availability of a renewable energy contracting mechanism for corporate customers, DPPAs have been uncommon. The recent announcement by TSMC concerning an extraordinarily large offshore wind DPPA being a stand-out exception that is so far from recent norms as to almost be the exception that proves the rule.[27]

In some markets, such as Mainland China, there are opportunities to directly invest in projects, but it is still necessary to ensure that you obtain clear access to the associated green attributes and not just the investment returns on the project. Typically, this requires a close alliance with a trusted developer/operator partner. Unlike the conventional utility industry with its relatively few, very large-scale units and traditional ways, the ownership and control structure of the renewable energy sector in Mainland China (as in many countries) is a very diverse mix of small, medium, and large businesses and joint venture partners. These projects often change hands over time, as developers or investors successfully spin off individual projects or meaningful portfolios or, in many cases, run into financial challenges.

Sorting through attribution is complicated by the challenges of avoiding double counting of what one is paying for. We recommend that any project—whether using existing or newly emerging green certificate registries or utilising a bespoke arrangement—be carefully audited and documented.

Summary

Most end users pay attention to the prices they face for the electricity they use but will also pay attention to material savings from any options available to them for managing and sourcing their electricity usage. Even customers thought to be broadly resistant as a class have shown around the world that they will pursue rooftop solar opportunities once the savings become sufficiently clear. A highly compelling combination of increasing technology options, material cost reductions, and growing sustainability preferences has launched an irreversible process.

When customers make choices, they do so with their own costs and benefits in mind. Accordingly, tariffs become one of the more complex issues to resolve, in part because of the linkage to policies of cross-subsidy, and more generally because regulated prices are almost always 'sticky' or very slow to respond to changing market dynamics. Slow moving tariffs pose durable signals to those who have options to reduce their costs by avoiding those tariffs. Eventual tariff adjustments pose an unavoidable risk that decisions taken to avoid tariffs will fail to produce the savings desired (owing to subsequent changes to those tariffs to reduce their fundamental "avoidability"). All stakeholders should know by now that this is the nature of the game. Those who have taken steps to reduce their electricity costs by some combination of self-generation and contracting may well see (certain components of) their tariffs increased in the future to re-align who pays for what.

For MNCs, the additional challenge is how to stay "ahead" of the curve when countries pursue renewable energy policies but do not provide mechanisms for voluntary supplement. Countries will need to devise mechanisms that facilitate a mix of mandatory overall minimum and voluntary incremental renewable energy uptake. In this way, it is possible to ensure that both country-wide targets are met and MNCs and others contribute additionality, whilst still meeting their own more stringent standards.

Case Study: Mainland China

Mainland China's massive economic growth alone accounts for a significant portion of the world's increased CO_2 emissions over the past decade (Figure 7). For example, whereas Mainland China's share of global CO_2 emissions was 11 percent in 1997, it had increased to 40 percent of the world's emissions by 2017.[28] Mainland China's emissions growth dwarfs that of Japan and South Korea put together. Accordingly, some of the more common questions we received for the Asia Pacific region focus on the prospects for development and procurement of renewable energy in Mainland China.

Over the past few years, an increasing number of MNCs have made progress in being able to contract for renewable energy in Mainland China, but most have found it challenging.[29] Some have opted to wait and see what future arrangements emerge while others see options now but are unsure of how to best evaluate them from a cost and effectiveness perspective. There is no single way to advance the objectives of the RE100 and similar decarbonisation initiatives, however, without a significant expansion or simplification of the options available in Mainland China and throughout Asia. The nature of the options emerging in Mainland China and the speed with which they become commercially attractive to MNCs will materially determine the intensity of the impact of MNC activity on global CO_2 emissions.

In this section, we take a more forensic look at Mainland China—an emerging and evolving market for renewable energy procurement. With extensive power sector reform and development of the electricity markets, more renewable procurement options will become available and mature. The clean energy transition in Mainland China and emerging Renewable Portfolio Standard (RPS) policies will broadly increase the options for (and the focus on) renewable energy development.

When More Options is Too Many Options

Table 1 summarises the emerging range of domestic and international instruments that are currently available to support green attribute trading in Mainland China. Over time, greater convergence is needed around a common standard and a more standardised certificate product for which it is easy to verify and validate authenticity.

Mainland China Renewable Portfolio Standard (RPS)

In May 2019, Mainland China formally introduced its Renewable Portfolio Standard (RPS) after several rounds of comments by NDRC (National Development and Reform Commission) and NEA (National Energy Administration). Later, in February 2020, the NDRC provided an outline for a provincial-based mandatory renewable consumption plan, further advancing

Figure 7: China's Rapidly Growing Share of Global CO_2 Emissions

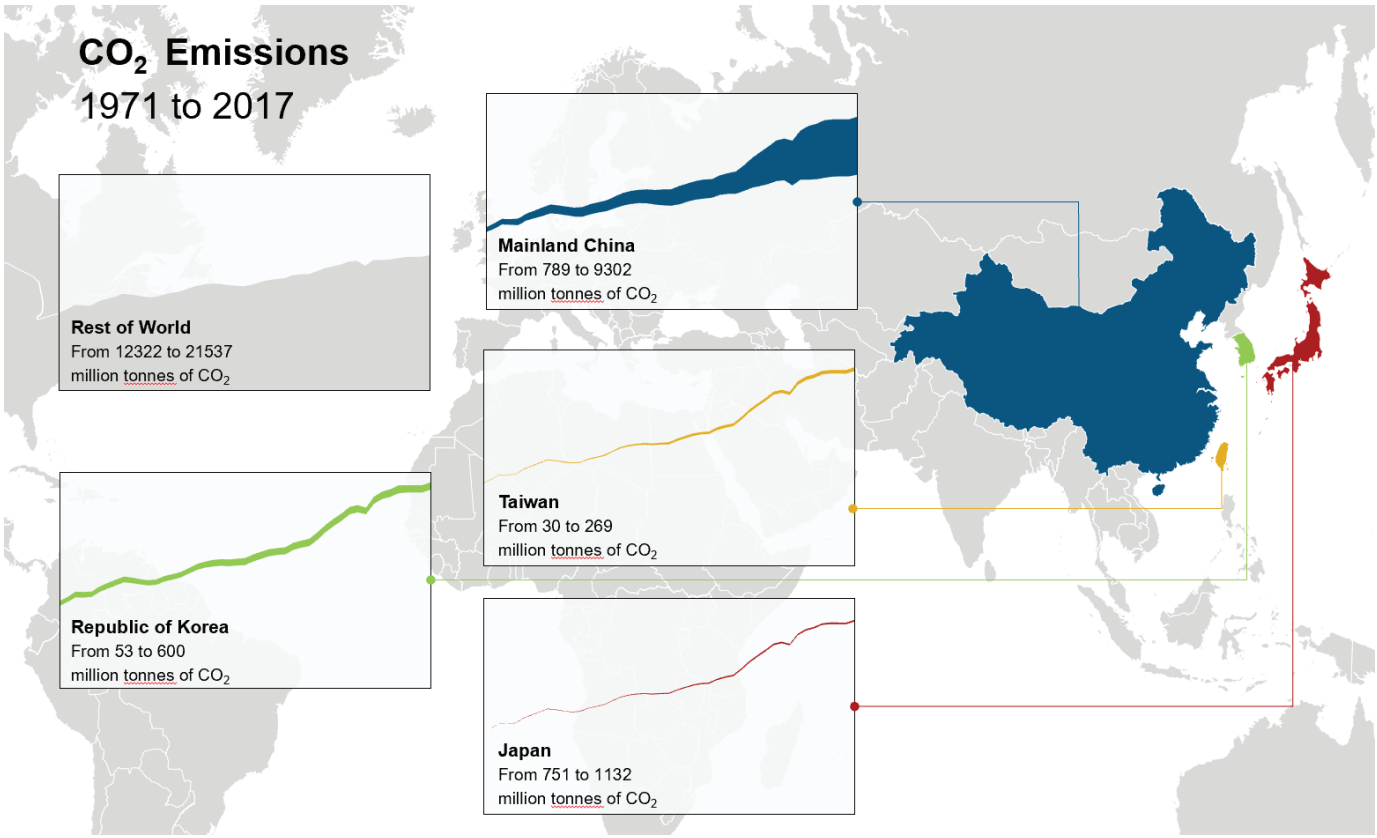


Table 1: Available Green Attributes Certificates in China

Type	Name	Issue Entity	Estimated or Approximate Recent Price Range	Framework Fulfilment	Comments
Renewable Electricity Focus	I-REC (International Renewable Energy Certificate)	I-REC Registry	Solar 0.65 USD/MWh Wind 0.45 USD/MWh	RE100	Prices are bilaterally negotiated between the I-REC Participants and the I-REC buyers.
	C-GEC (China Green Electricity Certificate)	National Renewable Information Centre/ CREEI	National Renewable Information Centre/ CREEI	RPS RE100	Unproven/inactive: Only ~0.15 percent of the approved certificates were traded as of April 2020.
	GoldPower	Climate Friendly/ WWF	N/A	RE100 LEED	Registered with the I-REC standard. Designed to signal additional contributions (in areas such as healthcare, education, employment, gender equality, and biodiversity. Third-party auditors certified. Limited wind, hydro and biomass projects in China.
	TIGRs (Tradable Instruments for Global Renewables)	APX	N/A	RE100	Require third party verification. Strict no double counting requirement. Can convert carbon credits to RECs and vice versa. Nearly no China projects.
Emission Offsets	CCER (China Certified Emission Reductions)	NDRC	N/A	CORSIA	CCER Scheme has been suspended since March 2017.

towards actual implementation. The RPS imposes minimum requirements for renewable energy consumption at the provincial level covering all large electricity consumers, as well as provincial-level grid companies, retailers, consumers with captive power plants, and any end users participating in direct power purchase.

To fulfil the new RPS, obligated market entities are required to consume renewable energy ***directly*** or ***indirectly***. ***Direct options*** include purchasing renewable electricity and/or having their own on-site renewable facilities. Buying equivalent products, which includes purchasing other market-obligated entities' surplus quota through negotiation or purchasing GECs (Green Electricity Certificates), can also fulfil RPS ***indirectly***.

Surplus quota trading will likely become a mainstream forum for green attribute trading in Mainland China. Like all RPS-supported green attribute trading, the price of surplus quota /GEC will depend on the aggressiveness of the RPS, the ability of the generator to find costumers and secure revenues from renewable project electricity generation. The underlying representation of GEC will also be the fundamental element in GEC pricing in the future. With so many GECs linked to projects exposed to FiT subsidy deficit issues, ***initial*** market price dynamics are likely to be complicated and will take some time to work out. Ideally, GEC eventually becomes a standardised certificate with clear representation of green attributes and easier to validate credibility.

Renewable Energy Procurement Opportunities in Mainland China

The extent of all types of corporate renewable procurement in Mainland China is also still comparatively limited. We summarise the options currently available in Mainland China in Table 2, ranking them qualitatively from most mature to least developed.

As in many markets, the most accessible opportunities often involve what can be done immediately on a customer's premises (e.g. onsite, usually rooftop solar). Grid-connected options involve substantially greater complexity and uncertainty as direct power purchase agreements (DPPAs) are only beginning to emerge in Mainland China, are regionally limited, and are by no means demonstrably robust.

Table 2: Renewable Energy Procurement Opportunities in China

Options	Business model	Capital Investment Required?	Nature of Certification	Availability in China	Comments
Off-site Direct Investment	Direct investment in projects	Yes	Developer is responsible	Yes	Greatest control, but need a partner.
International Renewable Energy Certificates (I-RECs)	Information Disclosure	No	Need to specify criteria to identify acceptable I-RECs	Yes	Not all I-RECs are the same. I-REC is not a single common product but rather a common information reporting platform.
On-site Renewable Generation Development	Self-consumption	Yes	Direct physical delivery	Yes	Details depend on physical site.
	Net-metering	Yes	Direct physical delivery	Yes	Negotiated with RE developer.
Contractual Purchase (Corporate/Direct PPA)	Arrange with Energy Service Company	Not required in most cases (Buyer involvement in investment may be negotiated)	Negotiated	Yes	
	Bilateral negotiation via power exchange centre	No	Parties are responsible	Some provinces	Negotiated with RE developer.
	Centralised bidding via power exchange centre	No	Unclear – not well developed	Some provinces	RE developer submits trading volume and price.
	Distributed energy market trading peer-to-peer trading with wheeling cost)	No	Emerging	Some provinces	Requires proximity/ access to nearby projects.
Standardised China Green Certificates Trading Market	Standardised Green Certificate	No	Emerging	Yes	Currently not actively traded.

That said, the overall renewable energy procurement environment continues to improve and there are policy updates every year. Even so, there are few "quick wins." For example, Jiangsu Province launched a decentralized solar energy market (<20MW if on the 35kV distribution grid or <50MW if on the 110kV transmission grid) in 2019. Solar project developers/owners and the prospective RE customers must register at Jiangsu Power Trading Center (JSPX) as market participants, and provide an 8760 hour load curve at least one month prior to the start of dispatching year. Yet, by July 2020, no distributed solar project has registered on JSPX for trading.[30]

Double Counting

Solar and wind projects in Mainland China developed under a FiT regime sell electricity generation to the Grid. Like the challenges associated with the question 'to whom do the green attributes belong?' addressed in prior sections, FiT pricing creates an issue when considering how those projects should count towards an RPS target.

The FiT price is composed of two parts: (1) the on-grid coal benchmark price; (2) and the FiT subsidy[31]. The FiT subsidy is implicitly the payment for the relevant green attributes of the renewable projects, so these green attributes are logically attributable to those who pay the FiT subsidy (in this case, from all end-users (excluding agriculture) who

Figure 8: Subsidy/REC Double Counting

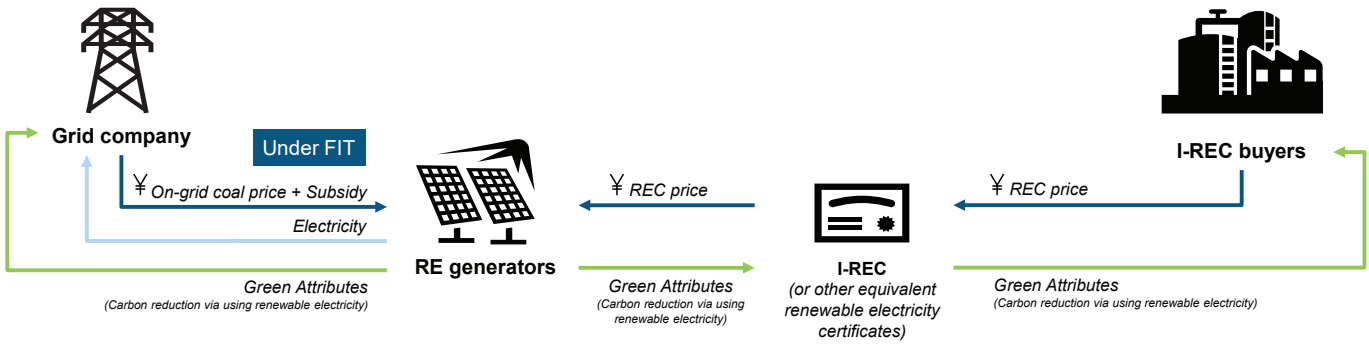
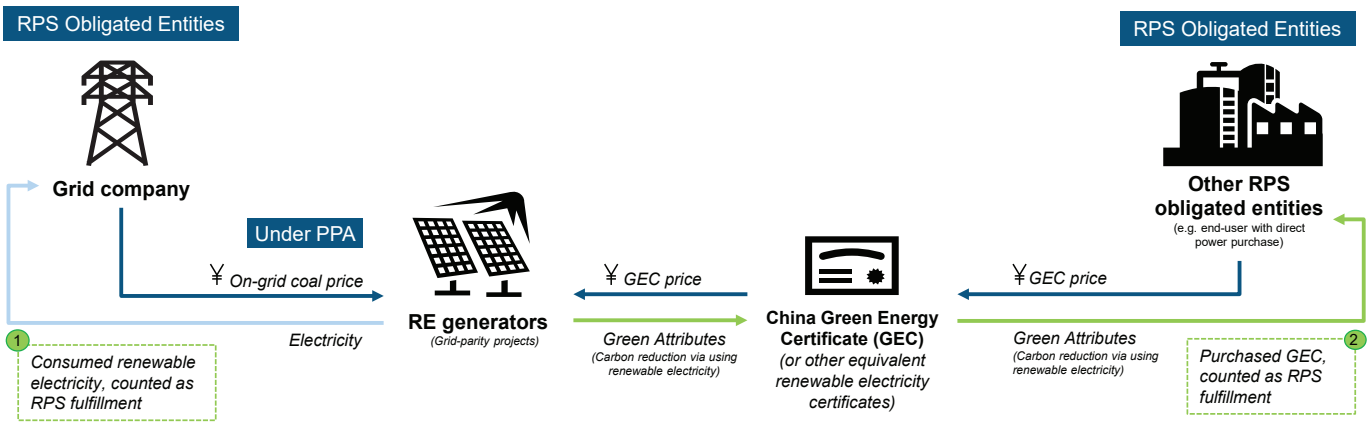


Figure 9: RPS/GEC Double Counting



pay renewable energy surcharge). Projects receiving subsidies are not supposed to issue GECs unless they first surrender their subsidy, as they would otherwise receive the subsidy *and* a GEC as payment for the very same thing. In practice, however, it is still widely believed to be possible to participate in multiple REC registries or continue collecting the FiT subsidy while issuing RECs at the same time, as a result of the complexities of frequently changing or complex ownership structures and the expense and difficulty of auditing and tracking.

Figure 8 illustrates one type of double counting. Whereas I-RECs have been structured in Mainland China to reduce the likelihood of a CSR-minded REC purchaser from inadvertently entering into a double counting situation, the I-REC registry cannot provide assurance. Care (and additional expense) is often required to confirm clear entitlement to the corresponding green attributes.

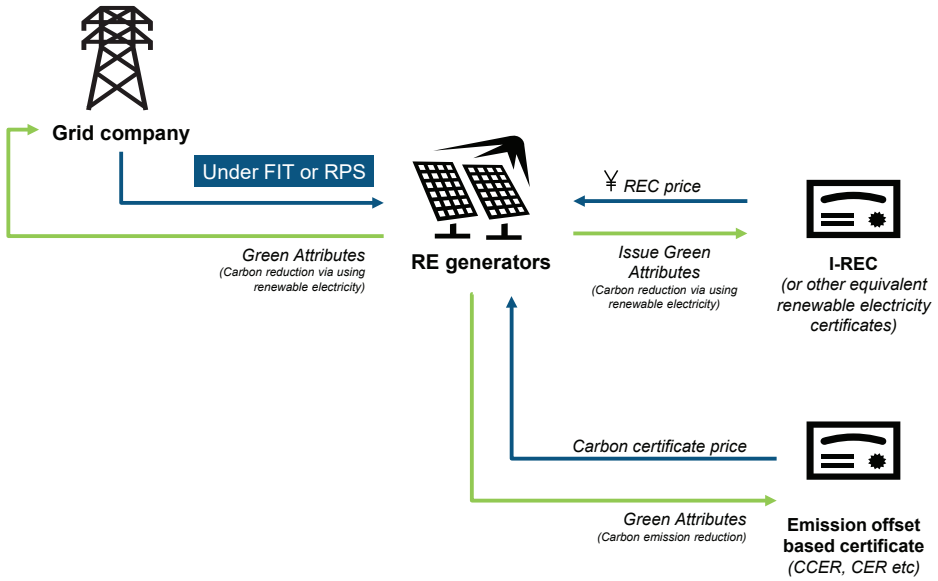
Double Counting Across the RPS/GEC Schemes when Promoting Grid Parity Projects

Figure 8 highlights another form of double counting. With the recent phasing out of Mainland China's FiT scheme and on-going transition to grid-parity pricing, the concerns over double counting have changed in nature, but have not been eliminated. Starting in 2019, grid-parity projects can both issue GECs and sign multi-year PPAs with grid companies. This policy change was intended to promote development of grid-parity projects without a FiT subsidy. However, when grid-parity projects sell electricity to the Grid at coal-benchmark prices, the Grid company can still claim the environmental attributes via consuming renewable electricity to fulfil RPS. Yet the RE generator is also eligible to issue GECs for sale to RPS-obligated entities. The existence of the RPS changes the nature of the associated GECs, but trading behaviour can still result in double counting.

REC/GHG Offsets Certificate Double Counting

A third problematic area of double counting, illustrated in Figure 9, arises because the carbon market and the REC market have been set up as two *separate* markets. A renewable energy

Figure 10: Double Counting of REC/GHG Offsets



project can potentially register for RECs in one market and for GHG offset certificates in the other market because there is currently no system tracking and reconciling both types of green attributes. Although green electricity usually mitigates carbon emissions as well, there has been some concern over double counting if projects issue both certificates at the same time. The I-REC organisation recently amended its code to require all registrants to *include* the potential avoided emission rights within the I-REC.[32] In the future if more interactions take place between the carbon and REC markets, further regulations or guidelines will likely be required in relation to the scope of each certificate type.

Summary

As the 2019 RE100 member survey highlights, Mainland China is still seen as one of the more challenging countries to procure renewable options due to its regulatory complexities—especially because the energy regulatory framework in Mainland China is not mature and is frequently subject to change. It's also impossible for MNCs to ignore, given its size.

Key issues in Mainland China include the fact that:

- Double counting issues require on-going attention and focus to ensure the credibility and acceptability of green attribute certificates in Mainland China;
- Green certificate markets need to evolve to a more consistent and robust standard;
- Underlying pricing of electricity via the so-called coal-on-grid tariff will need to change; and
- DPPA opportunities exist but are currently better suited to very large MNCs with substantial operations in Mainland China that can support bespoke solutions.

More flexible, trading-based arrangements and more structured pricing to support commercial green energy transactions are still yet to evolve. The pace of change, however, is accelerating, with a growing mix of instruments available and a gradual move away from subsidised FiT-based arrangements and perceptible shift towards enabling and supporting a wider variety of renewable energy procurement arrangements.

Concluding Remarks: Supporting Green Energy In Asia

Solutions are emerging for many renewable energy related challenges, which is good, but these solutions still address only part of the overall set of issues that must be resolved over time:

- REC types and markets must mature to a point where fewer different types of RECs are needed to achieve the same overall result through enhancements in transparency, appropriate standardisation of requirements and processes, and effective auditing and compliance checking;
- CSR-minded stakeholders need to recognize the likelihood of higher costs in Asia for green energy, especially as renewable energy uptake and penetration increase to the point of not just catering for demand growth or displacement of the most expensive conventional electricity generated on the system today;
- Policymakers, MNCs, and ESG standard-setting organisations must identify and work to eliminate opportunities for double counting ("greenwashing") without undermining the concept value of RECs themselves. The march towards decarbonisation will need RECs for smaller customers, trading and balancing, and to support the most efficient mix of future large and smaller scale renewable energy projects and storage resources;
- Governments and regulators need to ensure that any new arrangements made available for green energy contracting (DDPA) or green tariffs or on-site development as well as REC trading are consistent with recovering the costs of the systems that are providing electricity supply and backup to all customers. *Green third-party access or wheeling arrangements should not unintentionally or inadvertently shift cost recovery to unsuspecting customers or other stakeholders at some later point in time.*
- Related to the above, unbundled RECs must also be recognised as a complement to bundled sales under DPPA structures. DPPAs are good, but not everyone will be able to utilise DPPA options efficiently given the typical minimum size of such projects and the fact that syndicating interest in a DPPA project is analogous to issuing and trading the corresponding RECs;
- Sector regulators much also establish physical and financial trading and access arrangements for electricity across jurisdictional borders so that regions that have fewer or more expensive renewable energy options available can access regions with more and lower cost renewable energy options – recognise that this is one of the key success enablers of REC and DPPA markets in Europe and the United States which benefit from large and highly diverse electrical grids and renewable resource distributions;
- Regional (multi-country) hybrid markets should be considered to facilitate common standards, more flexible project development, and a faster pathway towards greater regional renewable energy adoption;
- More careful consideration should be given to the potential role of technology in eventual matching of the *time profile* of renewable energy generation and renewable energy consumption. While such matching is neither practical nor necessary at this time, it is technically achievable and likely to become more important as the amount of renewable energy increases and the amount of storage required on any given system also increases. At the end of the day, power systems must always balance supply and demand.

Ultimately CSR activity and green energy investment must increase severalfold over the next decade. This will require strong corporate participation, not only by a relatively few, high profile leaders, but by many more, including the collective supply chain partners. It will be very difficult to achieve such growth without a more robust green attribute marketplace. Decarbonisation and the transition to a new energy paradigm will most likely accelerate, not so much because of specific policies or prohibitions or even specific technologies or fuels, but because of the cumulative impact of many factors, any one of which makes for a good starting point.

To the above we should draw out one further observation and corresponding challenge. Ultimately, RECs and even most DPPA arrangements involve separating certain green attributes from the many other underlying attributes that remain bound with electricity itself. Where was the electricity generated relative to where it is consumed? What was the condition of the transmission system between the point of renewable energy generation and the presumed point of its consumption? What were the losses along the way? What time of day was the renewable electricity generated compared to when electricity was consumed by the end user who purchased the REC?

To state the challenge more plainly: as the amount of renewable energy increases in a system, the system itself must become more sophisticated in order to accommodate that electricity in ways that always allow supply and demand to be matched. It is not enough that the wind blows when it blows and the sun shines when it shines and everyone who uses electricity uses it whenever they want. To balance supply and demand, there must be something more than a simple REC price signal or DPPA contract. That something more is a sophisticated underlying electricity wholesale and retail pricing model the likes of which is not (yet) found in many Asian countries.

If electricity markets do not become correspondingly more sophisticated, then simple REC markets or DPPA arrangements will eventually fail to support sustainable renewable energy development in a cost-effective manner. And if REC markets must become more complex – perhaps to ensure that renewable energy is produced and consumed with a much more accurate degree of locational, vintage, and time-of-use based matching—REC markets are more likely to fail.

For now, most renewable energy consumers are enjoying a period in which the challenges of balancing the system are often left to (and paid for by) others. As the renewable energy proportions increase, the underlying system details and associated challenges will matter much more.

Welcome to a greening Asia.

Endnotes

1 See: "A Fundamental Reshaping of Finance", Larry Fink, BlackRock CEO letter, 2020, available at: https://www.blackrock.com/us/individual/larry-fink-ceo-letter (downloaded 22 June 2020)

2 Scope 1 emissions are all direct emissions from the activities of the reporting company or under their control. These include fuel combustion on site such as self-equipped electricity generation units, fleet vehicles, air-conditioning leaks and so forth.

Scope 2 emissions are other, indirect emissions from electricity and heating/cooling purchased and used by the reporting company. Scope 2 emissions are created from the electricity generation used by the organisation. Accordingly, by sourcing renewable energy, a company can reduce their attributed Scope 2 emissions.

Scope 3 emissions are all other indirect emissions including upstream and downstream emissions that occur in the value chain of the reporting company. Scope 3 emissions usually accounts for the greatest share of the carbon footprint of the reporting company, covering emissions associated with purchased goods and services, transportation and distribution, investments, leased assets and franchises, business travel, employee commuting, contracted waste and water, and use of sold products.

3 See: https://www.theclimategroup.org/news/going-100-renewable-2019-re100-progress-and-insights-annual-report (downloaded 22 June 2020).

4 See: https://www.there100.org/re100

5 See RE100 2019 Annual Report, p.16. In 2019, China was voted by RE100 members as the most challenging country for renewable electricity sourcing. Few countries or regions in North and Southeast Asia have developed retail electricity markets – only Japan, Singapore, Philippines. Some, like China and Vietnam, have emerging market mechanisms options but without the developed commercial or regulatory structures that make them robust. MNCs in most Asian countries are still served by entities that are state-owned or vertically integrated (or both).

6 https://sciencebasedtargets.org

7 In 2019, the RE100 companies claim to consume renewable energy on par with the "21st largest electricity consuming country in the world", but this suggests a total of only around 5 percent of the world's electricity.

8 In a game of musical chairs, there is always at least one fewer chair than players. The music starts and everyone walks around all the chairs. When the music stops, everyone tries to sit down. The ones who sit down get to keep playing. The ones who have no place to sit, lose.

9 By "in an economic sense" we mean that they reduce the costs of the system overall – not just to a particular stakeholder. Of course, it is also possible that existing regulatory or market arrangements are such that renewable energy opportunities appear cost reducing to a given stakeholder or from a particular perspective because of costs shifted to others to pay or bear a loss on.

10 DPPA is short for "Direct Power Purchase Agreement". Sometimes these are also called "Corporate PPAs" as they typically involve a corporate buyer procuring energy (usually renewable) directly from a generating resource.

11 The US sulphur dioxide allowance market followed a similar pathway, in which stage 1 involved a combination of regulations that forced the creation of emission allowances. Their price was modest for some time even as the reduction target got more stringent. The prices spiked over a quite short period as a result of a confluence of factors before collapsing because so many coal plants were shut down in the wake of the natural gas boom (analogous to coal ceasing to be a viable alternative). See: Burtraw and Szambelan, "U.S. Emission Trading Markets for SO_2 and NOx", Resource for the Future, RFF DP 09-40, p. 10. Downloaded 7 July 2020 at https://media.rff.org/documents/RFF-DP-09-40.pdf.

12 Of course, wholesale markets do need to be both (1) sufficiently robust in their design and participation to be able to integrate high levels of renewables reliably and securely; and (2) equitable enough in their policy settings to recognise the role of compensatory arrangements when introducing fundamental changes. These are indeed challenges, but they have reasonable solutions.

13 Mainland China has developed several regional pilot wholesale markets in which some larger customers can participate, though none of these have the commercial contracting and trading flexibility or robustness seen in more developed markets. Many ASEAN countries have undergone various waves of energy sector reforms with varying degrees of impact, though most, including Malaysia, Thailand, Indonesia, and Vietnam remain largely regulated markets. As part of on-going sector reform discussions and policy development initiatives, DPPAs are likely to emerge in Malaysia and Vietnam soon, but details remain to be worked out. In addition, unlike North America and Europe, electricity prices throughout most of Asia comprise a mix of subsidies and cross-subsidies which complicates the process of exposing commercial and industrial customers to any form of "choice."

14 Odoroaga Monica/123rf.com.

15 See: Beckett, Samuel. Waiting for Godot. New York: Grove Press, 1954. In Beckett's play, two men meet, talk, and experience a number of mysterious interactions and events, whilst waiting for a man named Godot who never shows up.

16 A company with significant operations in Asia could theoretically procure all its green attributes from, say, Europe in the form of GO certificates. However, if all companies operating in China were to only purchase European GO certificates to cover their green energy requirements in China, then European companies would eventually run out of available GO certificates in Europe and would have to look elsewhere. Mathematically, a corresponding number of equivalently credible certificates would eventually need to be procured from Chinese green resources in order to restore balance. Conceptually, such a global market could work. Practically speaking, however, it is not the way things have developed. In any event, it is just a matter of time before the problem of option availability in Asia must be resolved.

17 In some cases, voluntary RECS can be issued even if a project is receiving a subsidy, which undermines the validity of the REC from a CSR perspective. It is crucial to validate the basis for the REC standard being reported.

18 The Renewable Subsidy (RE-Subsidy) payable to eligible renewable projects is sourced from Renewable Energy Development Fund (REDF) set up by the Ministry of Finance in2011. REDF is funded from a surcharge added to all consumer's electricity bill (excl. agriculture) . Since its introduction, the surcharge has been increased four times, and it is now RMB 0.019/kWh Over time, the RE-industry has greatly outgrown the government plan, and the resulting deficit in the RDF is unexpectedly high, reaching 216 billion RMB by the end of 2019.

19 GO prices are from Greenfact.com.

20 See: https://www.nrel.gov/docs/fy19osti/72204.pdf, page 19, which refers to Barbose, G. 2017. U.S. Renewable Portfolio Standards 2017 Annual Status Report. Berkeley, CA: Lawrence Berkeley National Laboratory.

21 Wholesale market prices could even be negative if there are resources generating on the system that cannot be shut down (curtailed) such that some resources are willing to pay to keep running through a period of system imbalance while other resources must be curtailed or shut down. In such cases a battery storage resource could even be paid to use available electricity from the system to charge up. Electricity systems are complex and must be operated within tight constraints. When the task of operating within those constraints becomes more difficult for any reason, the value of whatever it takes to keep the system in balance can temporarily become very high indeed. This is one reason why complex power systems are increasingly about processing massive amounts of information to find better ways for supply and demand side resources to respond to frequently changing system conditions rather than just planning out the development of new power stations to meet predicted growth.

22 The interconnection provides both countries with emergency backup, but the interconnection is not generally scheduled for electricity supply into either country for any reason, including for the purpose of exporting or importing renewable energy.

23 Smart systems are about the capability to be smart, not about actually being smart. Smart systems respond to signals. The outcome of a smart system is only as smart as the signal to which the system responds is appropriate. There is far too much focus right now on systems that are capable of being smart and not nearly enough on what it takes for those systems to actually *be smart*. Smart pricing and smart regulation and smart policy frameworks are crucially required to raise the effective "IQ" of a power system that seeks to go green.

24 GOs are administered at the European level but may still be subject to localisation preferences. For example, one might prefer GOs from certain locations for certain compliance reporting purposes, and this could necessitate paying a premium if GOs from that location cost more than those from another location. Such localisation preferences undermine the idea of getting the most RE for the least amount of money, but it may it easier to think about certificates as something other than traded pieces of paper. Inherent in any multi-regional certificate-based regime are usually political concerns about who

wins and who loses when money flows from one region (buyers) to another (sellers).

25 With energy project developers and project owners in Asia constantly being acquired, sold, or restructured, it is essential to assure a clear line of sight between the resource that "creates" the renewable energy attributes and the end user. Accordingly, some green energy development partners (particularly larger high-profile international players) offer guarantees of authenticity, at a higher cost. Typically, they will source the green attributes from their own projects, as there is no better way to maintain and assure control.

26 The ability to avoid these embedded costs would immediately make green energy appear less expensive than the conventional or mixed supply sourced from the grid overall. However, the costs avoided by the overall electricity system when a corporate customer adopts DPPA plus a transport-only wheeling charge are much smaller than the revenue lost when the corporate customer ceases to pay the standard tariff for its electricity use. This bypass issue bedevils tariff option development, especially given the rapid speed with which corporate customers can take decisions on options that appear to immediately reduce their electricity costs. Regulated tariff structures, cross subsidies, and the absence of functionally unbundled and restructured electricity sector arrangements have been significant obstacles to DPPA adoption. The collective result of all these aspects is that DPPA options involve renewable energy and that do not involve avoidance or bypass of existing embedded costs could involve a ***premium*** to the existing tariff rather than a ***discount***.

27 https://www.greentechmedia.com/articles/read/orsted-signs-worlds-largest-corporate-ppa

28 IEA (2019), CO2 Emissions from Fuel Combustion

29 See RE100 2019 Annual Report, p.16. In 2019, China was voted by RE100 members as the most challenging country for renewable electricity sourcing.

30 In view of the limited availability to date of corporate renewable purchase agreement in most provinces, some industrial and commercial customers have considered sourcing nuclear power which brings 40% energy-related emission reduction at a net cost saving of RMB 20~30/MWh.

31 The on-grid coal price is also known as the coal-fired power plant (CFPP) benchmark on-grid price.

32 See "Change to ability to disaggregated potential avoided emission rights", I-REC standard, 14 April 2020.

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About The Lantau Group

The Lantau Group is a specialist economic and strategy consultancy focussed on the energy sector in the Asia Pacific and Middle East regions. With offices in Hong Kong, Shanghai, Singapore, Korea and Australia, we also have senior advisors based in Abu Dhabi, Indonesia, New Zealand, Thailand, UK, USA, and Vietnam.

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