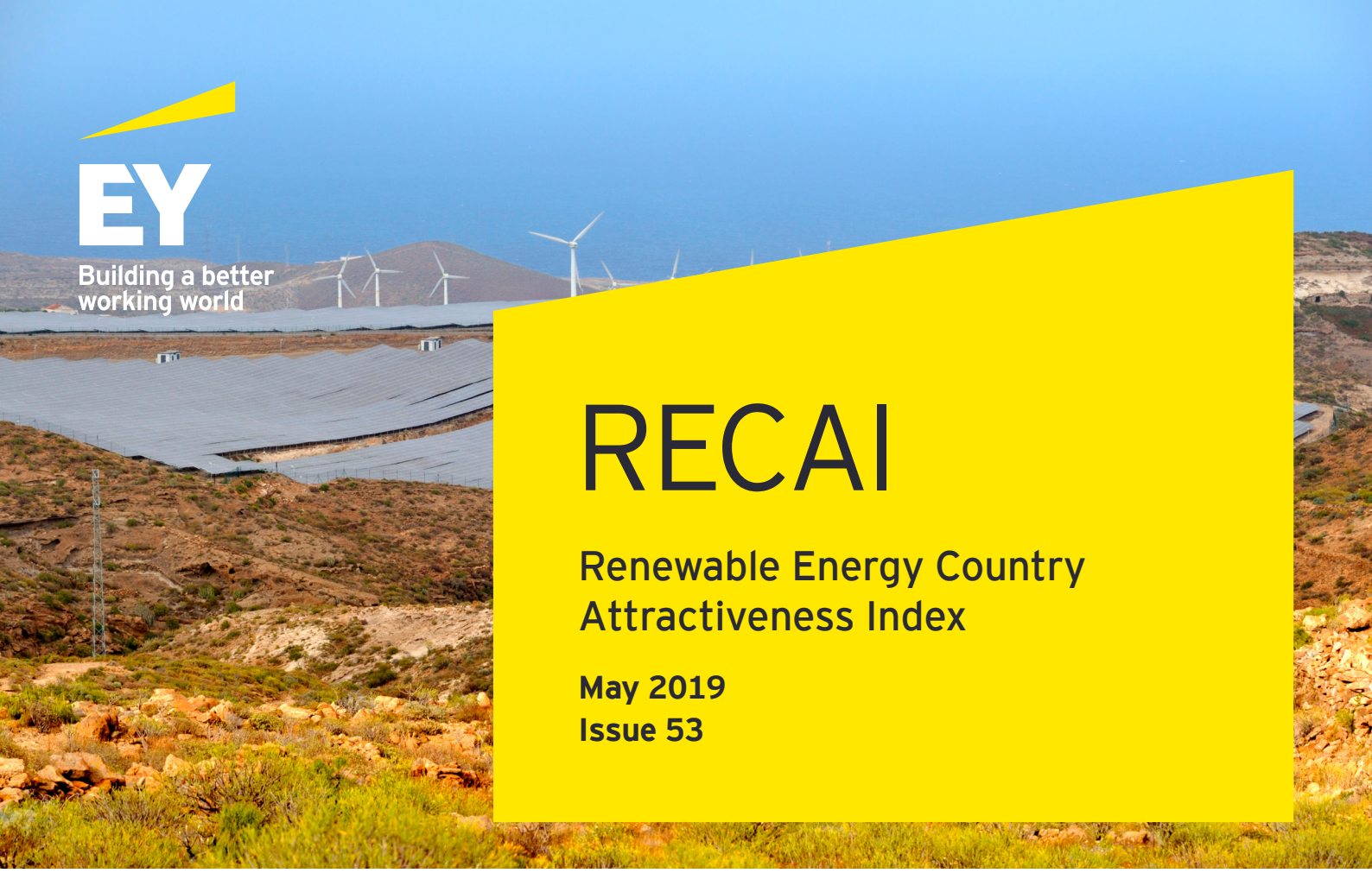

Building a better working world

RECAI

Renewable Energy Country Attractiveness Index

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Success without subsidy: a new renewable energy landscape

Renewable energy developers and investors are stepping into a brave new world – one that is increasingly unsubsidized and where projects compete in the market on their economic and environmental merits.

In this latest edition of RECAI, we examine two related characteristics of this new landscape: how projects are grappling with new-found exposure to wholesale power prices and market imbalance – known as merchant risk – and the growing role of corporate energy buyers in underwriting clean energy projects.

For developers and investors, this is a more complex world to negotiate. Developers must work harder and smarter to find the revenue certainty they need to raise finance or to monetise their efforts. Investors need to understand, price and manage the risks faced by renewable energy projects that can no longer rely on long-term, government-backed revenue streams.

For the renewable energy market overall, however, a future without government subsidy is one that will no longer be vulnerable to sudden shifts in policy, or to retroactive changes to promised tariffs. It will be one where market forces impose discipline, drive efficiencies and accelerate the cost reductions that have allowed the sector to stand on its own two feet.

Not all promising renewables technologies have reached that point yet, though. We examine the rapid growth in offshore wind as it gains footholds in new markets, such as the United States, China (mainland), Taiwan and Japan. For offshore wind to reach its potential in these jurisdictions, government support will be needed to foster local capacity and to build domestic supply chains. But here, too, the direction of travel is clear: it is only a matter of time before offshore wind is viable without government support, as illustrated in recent European tenders.

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Featured articles:

- Index market rankings: China remains top, with United States following in a close second, however France has overtaken India to complete the top three. Norway and Finland have also re-entered the top 40
- The emergence of unsubsidized renewable energy projects and how investors and developers are grappling with the challenges and risks, as well as the opportunities
- The growing role of corporate energy buyers in underwriting clean energy projects with more companies entering into power purchase agreements than ever before
- The rapid growth in offshore wind, as it gains footholds in new markets, such as United States, China (mainland), Taiwan and Japan
- An in-depth look at the latest renewable energy developments in China and Brazil, alongside ten other key country updates

Renewable Energy Country Attractiveness Index

recai

May 2019

Methodology
The index was recalibrated in April 2019, with all underlying datasets fully refreshed. To see a description of our methodology, visit **ey.com/recai**.
A country's chart position in the previous index is shown in brackets.

LEGEND

- Increased attractiveness compared with previous index
- Decreased attractiveness compared with previous index
- No change in attractiveness since previous index

A cancelled renewables auction and revisions to contracts from the state utility's tender for 7GW of wind and solar capacity, because of a change in **Mexico's** energy policy, have injected uncertainty into the market.

Kazakhstan's renewables market is drawing the attention of international investors, with overseas development banks investing in solar PV projects in the country. The Government has also successfully auctioned 250MW of wind capacity.

Plans for a steep cut in **Taiwan's** FiT rates for offshore wind projects raised concerns around future profitability and resulted in PPAs being cancelled before the Government settled on a more modest 6% reduction.

Finland launched a renewable energy tender in November 2018, after the removal of FiTs, awarding seven onshore wind projects with subsidies of just €1-4/MWh, indicating another near-subsidy-free market. Corporate PPAs are also helping to drive investment activity.

1 (1)	2 (2)	3 (5)	4 (3)	5 (6)	6 (4)	7 (7)	8 (8)	9 (10)	10 (9)	11 (11)	12 (14)	13 (12)	14 (15)	15 (16)	16 (17)	17 (20)	18 (19)	19 (13)	20 (26)	21 (21)	22 (18)	23 (23)	24 (31)	25 (25)	26 (-)	27 (24)	28 (35)	29 (-)	30 (28)	31 (29)	32 (32)	33 (27)	34 (22)	35 (34)	36 (-)	37 (40)	38 (33)	39 (-)	40 (36)
China (mainland)	United States	France	India	Australia	Germany	Japan	United Kingdom	Argentina	Netherlands	Chile	Denmark	Morocco	Egypt	Canada	Spain	Brazil	Italy	Mexico	Israel	Belgium	Turkey	Ireland	South Korea	Portugal	Vietnam	Philippines	Kazakhstan	Switzerland	Greece	Jordan	Sweden	Taiwan	Pakistan	Thailand	Norway	Kenya	Peru	Finland	Indonesia

France is leading the way in floating offshore wind, with the European Commission approving four demonstration projects, while six-monthly onshore wind tenders are doubling in size, from 500MW to 1,000MW.

A report by a government advisory body has suggested the **Netherlands** is unlikely to meet its 2030 climate goals, with renewables comprising just 6.6% of its energy mix in 2017 and a target of 14% by 2020.

A leading player in the floating energy space, **South Korea** has announced plans to build one of the largest renewable clusters in the world – a 4GW complex off its west coast, comprising 3GW of solar and 1GW of wind power.

With its solar FiT eligibility deadline nearing, plans to develop a 475MW floating solar PV reservoir, and improvements to the wind project approval process, **Vietnam's** renewables market is growing at pace.

Despite some success with projects in Sindh province, **Pakistan** has faced delays in transitioning to auctions. Pipeline projects are yet to materialise because of a reluctance by the previous PML-N Government to increase power tariffs, with only a partial restoration of projects achieved more recently by the country's national power regulatory body, NEPRA.

With plans to build Europe's largest subsidy-free onshore wind farm, at 1.5GW, **Norway** is demonstrating early signs of a comeback in its renewables market, with investors and lenders adapting to new subsidy-free conditions – namely, via PPAs.

Key to abbreviations:
PV – photovoltaic; FiT – Feed-in Tariff; PPA – Power Purchase Agreement

Renewable energy: banking on merchant

The renewable energy sector is moving beyond a reliance on subsidy, but developers, investors and intermediaries are now grappling with the challenges and risks of unsubsidised projects.

The emergence of unsubsidised renewable energy projects represents a tipping point in the low-carbon transition, as a world of choice, innovation and opportunity opens up for investors, developers and consumers, released from the constraints imposed by policymakers and from dependence on public funds. The disappearance of government-guaranteed revenue streams, however, is exposing wind and solar projects to new risks, particularly to volatile wholesale – or 'merchant' – power prices, creating both challenges and opportunities.

Europe has led the way with unsubsidised projects in areas with good renewable resources: solar projects in sunny Spain, Portugal and Italy were some of the first to be developed without government subsidy, and wind projects in Scandinavia are also proving viable. Falling costs have resulted in subsidy-free projects moving forward in the UK and Germany, while – further afield – the disappearance of subsidies in Australia has not deterred developers. Even in China, where government money has created the world's largest installed base of renewables capacity, unsubsidised projects are under development: western turbine makers are battling to supply China's giant 6GW Ulanqab wind complex, which is to be built without subsidy.

"There is increasing demand for renewable energy investments to meet 2030 targets, but we have regulatory support for established, cost-effective technologies to achieve that," says Ricardo Piñeiro, a partner at Foresight Group, a UK-based investment manager. "It's a question of finding new ways of securing contracted revenue streams during the life of the project, recognising that a pure merchant strategy will represent a risk profile not acceptable to most investors considering subsidy-free projects."

An 'education process' is under way to convince institutional investors about the opportunity in unsubsidised renewables, says Alex Brierley, Co-Head of Energy at Octopus Investments, which owns more than £400m (US$524m) of unsubsidised solar assets. He explains that, based on his firm's view of how certain power markets are likely to evolve, "the risk-adjusted returns of some unsubsidised assets in some markets look very attractive – that's why we're investing at scale".

As an example, Brierley says that an operational onshore wind or solar project benefiting from a feed-in tariff – or, in the UK, revenues from renewables obligation certificates (ROCs) – delivers gross unlevered returns of 6%–7%. "You need to dig into the sensitivities around specific power forecasts, but, in unsubsidised markets, you're looking at unlevered returns around the 10% mark," he adds.

Alternatively, by taking construction risk, de-risking assets by entering into fixed-price power purchase agreements (PPAs), or otherwise hedging the expected revenues and then selling them on, mid-teen returns are possible, he says. "Depending on the investor's risk-return preference, there are two or three tunes you can play with these assets," Brierley adds.

Looking for revenue certainty from the corporate market

For many developers, that de-risking will lean heavily on securing a PPA from a corporate offtaker, which can replicate the sort of revenue certainty offered by government-backed feed-in tariffs or contracts for difference (CfDs). According to figures from Bloomberg New Energy Finance, companies globally entered into PPAs totalling 13.4GW of capacity in 2018, up from 6.1GW in 2017.

While corporate demand has been growing, however, it is limited – Bloomberg is forecasting similar volumes in 2019 as in 2018 – and the contracts tend to be bespoke, and so more time-consuming and costly to negotiate. "They are a much more complex proposition" than selling power under a feed-in tariff regime, notes Karin Schramm, a senior director in Project Finance at Germany's BayernLB.

Also, given that PPAs for new projects tend to be at least 10 years, with some running for more than 20 years, they expose both buyer and seller to their counterparty's credit risk. "The credit rating of the off taker is crucial" to the volume and tenor of debt that a project relying on a corporate PPA can support, Schramm adds, as well as to the degree of merchant price risk that lenders are prepared to accept (assuming, as is sometimes the case, that the corporate PPA does not buy all the project's output).

Perhaps counterintuitively, however, Schramm says that the longer the PPA the more sensitive the bank is to merchant risk. "If you have a 15-year PPA, and assuming a project lifetime of 20 years, if things go wrong, you only have 5 years to recover," she says.

A big change for project developers is the need to understand the timing of energy production. In the past, feed-in tariffs tended to be offered on an 'as produced' basis, so projects were paid the tariff regardless of when the power was generated. However, corporate buyers tend to want power supply that matches their demand profile.

"Developers face some new challenges in terms of the analysis needed, including around the seasonal and hourly shape of production in their energy yield analysis," says Tomas Tuominen, European PPA Lead at the Green Investment Group. "We are also seeing corporates conducting this analysis for themselves, as part of their PPA due diligence."

Within European markets, power utilities provide a comparable amount of demand for PPAs as corporates, say analysts. The larger utilities generally benefit from stronger credit ratings, existing generation portfolios that can help to diversify risk, and the ability to trade and hedge in the electricity markets.

"Handling volatile production is not a new topic for us," says Oliver Götz, Head of Origination Renewables in the trading department at EnBW, a German utility that is developing a 175MW unsubsidised solar plant in Germany, and which entered into a 15-year, fixed-price PPA with an 85MW project in February, developed by Energiekontor. "We have many years of experience in hedging and trading such positions. To manage renewable energy assets, you need capabilities in-house."

How new entrants are approaching the market

As well as utilities, other entities with energy-trading capabilities are entering the market, such as oil and gas giants. "Where they are aiming to add value is in their understanding of power markets and trading and pricing 'peripheral' risk," says Louise Shaw, Director, Power & Utilities Corporate Finance, at Ernst & Young LLP in London. Often, they can offer PPAs that are longer term or that offer higher floor prices than those with which traditional utility buyers are comfortable, she adds.

Companies such as French major Total have been investing in a range of power-generating assets, including natural gas plants that offer a market for their hydrocarbons, as well as in renewables projects. In March, Royal Dutch Shell announced its intent to become the world's largest power generator by the 2030s.

"We're seeing oil and gas companies more and more – they are getting significantly involved in green energy," says Schramm, at Bayern LB. "They have considerable demand for PPAs as they seek to build their renewable energy activities, and have large balance sheets; as a bank, you're quite happy to see them in the market."

Other energy firms see opportunities in helping renewable energy projects manage merchant risk. For example, Norwegian energy company Statkraft is in discussions with developers in the UK to offer what John Puddephatt, its Head of Long-term PPA Origination, describes as a "long-term route to market" for renewables projects

Under the UK's former Renewables Obligation subsidy system, "we agreed floor prices for many times this figure, but the floor values for ROC projects were typically much This will involve a two- to four-year fixed price, followed by a five- to seven-year floor price. "This would provide some guaranteed revenues for the project, with the potential for some upside during the floor-price period, depending on long-term power prices," Puddephatt says.

His firm is in advanced negotiations with some projects on the structure, but – given the challenges in hedging its long-term exposure to such contracts – he says Statkraft's appetite is somewhat limited, illustrating the higher risks involved as markets transition away from subsidies. "The intention is to cap our

exposure for these PPAs at around 200MWs–300MWs per year."

lower than those that may be required to support subsidy-free renewables", Puddephatt says. "We are currently in discussions with various customers to remove these lower floor prices where they are no longer required by generators, in exchange for improved commercial terms. This process could potentially help us widen our subsidy-free offering further."

How hedging can help

Into this new landscape are stepping financial and energy sector intermediaries, with a range of tools to help developers hedge their exposures. For example, Neas Energy, the energy-trading subsidiary of Centrica Group, has entered into balancing and hedging contracts for a number of large-scale wind farms, such as the 650MW Markbygden facility in Sweden.

That contract underpinned a 19-year PPA entered into with Norsk Hydro. By committing to supply power to the aluminium producer during times when the wind farm is not generating, while also absorbing any over-production, the hedge allowed the wind farm to, in effect, sell baseload power.

A similar approach is the proxy revenue swap (PRS), a financial contract for difference that assumes a project's price, volumetric and shape risk, explains Richard Oduntan, CEO of Nephila Capital. The specialist Bermuda-based investment manager has, with its partner Allianz, written more than 2.5GW of PRS contracts, including for Microsoft, Enel and Invenergy.

"From a bankability point of view, the lender cares about the revenue of the project. The PRS proxies that revenue," Oduntan says, transforming variable revenue streams into predictable ones. The product can help projects raise finance by offering them long-term revenue certainty, with Nephila able to write PRS contracts out to 12 years in some markets.

It also allows project operators to enter into corporate PPAs where they guarantee to supply firm power to the offtaker. "The PRS can stand between the project and the offtaker, allowing intermittent-generation technologies to sell baseload power", says Oduntan.

Looking to the future

Growing sensitivity to market prices will accelerate the trend of project operators seeking to squeeze every last cent of cost efficiency from their projects, including from operations and maintenance (O&M). As engineering consultancy Arup notes in a recent report, "new types of O&M contract could emerge where service providers take on performance, revenue and market risk in exchange for a revenue-based service guarantee".

One such operational innovation is the virtual power plant service offered by Statkraft. Without the benefits of subsidies, Puddephatt notes, there will be times when the power price that renewable energy plants can earn from the wholesale market drops below their operational expenditure – especially for projects that face relatively high transmission costs. "If the power price falls below the agreed threshold, we can curtail the project remotely, restarting generation when power prices rise above the threshold," he adds.

"We see fast-growing demand for more active asset management to optimise how renewables projects dispatch into power markets," says Ben Warren, a partner in Ernst & Young LLP's Power & Utilities Team. "Capability and expertise in this area is currently somewhat limited."

Demand-side response techniques – that allow energy users to reduce their power use in response to high prices or during periods of system stress – could give a further boost to the unsubsidised part of the market, says Brierley, at Octopus. "For corporates that can flex the amount of power they're using against the power generated by the renewables asset, that gets really interesting."

Similarly, large-scale battery systems located alongside renewable energy projects can allow operators to extract greater value from electricity markets, by charging up when prices are low and selling when they are high. Operators can also earn revenues by offering grid-balancing services and, potentially, by participating in capacity markets, which reward generators by committing to supply power during periods of high demand.

Certainly, the landscape is changing rapidly. "It's a more diversified market in terms of the nature of counterparties that are investing, and the different risk appetites they have," says Piñeiro, at Foresight. "On the one hand, pension funds are comfortable with a lower rate of return against a high degree of contracted revenues. On the other hand, we are starting to see energy companies looking at subsidy-free projects without requiring PPAs in place – they are happy to take merchant risk."

In a fluid environment, there is considerable opportunity – as well as potential for investors and incumbents to get it wrong, says Warren. "There are all sorts of opportunities for arbitrage exploitation for developers, and there is a whole set of new risks – both market and operational – that need to be considered and priced by investors," he says. "It begs the question as to what risk-adjusted returns will be demanded, and how long it will take for investors to get it right."

"All of this will put further pressure on the incumbents in the marketplace and raises further questions over the longer-term role of conventional, centralised generation. This is a real tipping point for the renewables sector," Warren concludes.

Taking the corporate PPA market to the next level

New companies, new countries and new structures are putting corporate PPAs on course for continued growth.

Corporate purchases of clean energy rocketed last year. According to figures from Bloomberg New Energy Finance (BNEF), companies entered into power purchase agreements (PPAs) that supported 13.4GW of clean energy generation, more than double the 6.1GW of PPAs in 2017.

"PPAs have a reputation as a good way for companies to buy renewable electricity as they allow them to manage energy costs, and there's a tangibility to them – you can see the asset you're buying power from," says Sam Kimmins, The Climate Group's Head of RE100, a collaboration of more than 170 global businesses committed to sourcing 100% of their electricity consumption from renewables.

In 2015, just 3.3% of the contracts entered into by RE100 members to green their power consumption were corporate PPAs; by 2017, that figure had risen to 16%. "We anticipate this number rising exponentially," Kimmins says.

The market was pioneered by some of the world's largest companies and biggest household names – such as Alphabet, Inc. subsidiary Google, Facebook, Microsoft, IKEA and Walmart, and with most activity taking place in North America. Last year, the market expanded into new jurisdictions and new sectors.

Another year of such rapid growth is unlikely, says Kyle Harrison, a corporate sustainability analyst at BNEF, as many of the larger buyers have contracted large volumes of clean power and are unlikely to return to the market in the same volumes. "We won't see the same growth as between 2017 and 2018, but I would expect similar or slightly higher volumes," he says.

Nonetheless, with corporate concern about climate change and clean energy on the rise, new markets opening up to PPAs, and new PPA structures being developed to better meet the needs of consumers and renewable energy generators, providers are confident of strong continuing demand.

New companies are embracing PPAs

For many companies, the motivation to enter into corporate PPAs is economic. Contracts can run for 10 years or more, so can offer a long-term hedge against the risk of rising power prices; they therefore tend to be attractive in countries with high or volatile power prices.

Similarly, the declining cost of power from renewables projects – particularly in areas with good wind or solar resources – is helping to increase the economic attractiveness of PPAs.

RE100 member T-Mobile USA, for instance, has calculated that its investments in renewable energy – including two 160MW PPAs struck with wind farms in the US – will save the company US$100m over 15 years.

Meanwhile, many companies are choosing to procure renewable energy for reputational reasons, or to reduce their exposure to carbon emissions. For these buyers, PPAs can be more attractive than purchasing green tariffs from their utilities because of the direct link that the PPA creates with a particular project, allowing buyers to demonstrate 'additionality' – that is, that their power purchases have led to the creation of additional renewable generating capacity, which supports sustainability ambitions.

Last year, a number of new companies and new sectors came to the market for the first time. ExxonMobil, for example, became the first oil major to enter into a PPA for its own power use, buying 575MW of wind and solar generation in Texas. These firsts are continuing into 2019: in the UK, Northumbrian Water entered into the first corporate PPA with an offshore wind farm, owned by Denmark's Ørsted. Energy-intensive sectors are also entering the market, as illustrated by steel producer Sakthi's 18-year PPA in Portugal with a 25MW wind farm.

New markets are opening up

In a number of jurisdictions, such as Japan and Indonesia, it is impossible – or at least extremely difficult – to enter into PPAs. "For corporate PPAs to take place, electricity markets need to be deregulated and the right policies – enabling corporates to contract directly with developers and allowing renewable energy certificates to flow to the corporates – need to be in place," says Phil Dominy, Director, Corporate Finance – Energy & Infrastructure at Ernst & Young LLP. "We are trying to raise awareness that corporate PPAs can unlock huge amounts of investment in energy infrastructure that doesn't have to come from the taxpayer," says Kimmins, who notes that RE100 members alone account for 190TWh/year of power demand. "That's quite a large opportunity," he adds. The effort is proving successful. In markets such as Taiwan, corporate PPAs are now possible, while in other markets – such as France, Spain and Australia – changing conditions are resulting in PPA volumes taking off.

In **Taiwan**, changes to electricity regulations mean that non-utilities can now purchase electricity directly from generators. Alphabet's subsidiary Google has become the first company to take advantage of this, striking a PPA with a 10MW solar array to be constructed over a commercial fishing pond, using an innovative suspended panel design. Harrison, at BNEF, anticipates strong demand for PPAs from Taiwanese manufacturers, given that many of them serve North American and European companies that are working to decarbonise their supply chains.

In **France**, the reduction in subsidies via increasingly competitive Government auctions is encouraging developers to seek alternative routes to market. In March, Agregio, a subsidiary of utility EDF, announced the country's first PPA, with retailer Metro France, to supply 25GWh of power from a wind farm operated by Eurowatt. Other companies are set to follow: Paris Aéroport and state-owned railway company SNCF have invited bids from developers.

Huge growth is anticipated in **Spain**, says Kimmins at The Climate Group, after the first PPAs were struck in 2018 by banks BBVA and Grupo Kutxabank. Considerable local expertise was created during the boom years of the country's generous feed-in tariff regime. Some of that is being put to work developing subsidy-free capacity that is attractive to buyers. Industrial firms are entering the market: in March, steel maker ArcelorMittal entered into a 10-year fixed-price PPA with two 5MW solar farms developed by the Foresight Group.

While not a new market, **Australia** has seen particularly strong growth during 2017 and 2018, with 1.4GW and 1.9GW contracted respectively – up from less than 200MW in 2016. Corporate PPA growth has been driven by the phasing out of subsidies, falling technology costs, high electricity prices, good solar and wind resources, and a local renewables industry that has proved successful in driving down installation and operational costs, says Jomo Owusu, an associate director in Infrastructure Advisory at Ernst & Young Australia.

New approaches are facilitating corporate PPA structuring

The two standard structures in the market continue to be the sleeved PPA, common in Europe, and the virtual PPA, typically used in the US. Sleeved PPAs – also known as physical or back-to-back PPAs – involve the company entering into a PPA directly with the project, which supplies the generated power to a utility. That utility then supplies power to the corporate.

Virtual PPAs (also known as synthetic or financial PPAs) are simpler structures, where the buyer enters into a contract for difference with a renewable energy project around a fixed price – so, paying the project if the settlement market power prices are below the PPA price and receiving payment if they are above. Meanwhile, the corporate continues its energy supply agreement with its utility, while the project sells its power in the wholesale market.

Both structures act to hedge the buyer against price rises, while enabling the development of additional green power capacity.

In addition to these structures, however, new approaches are being developed to make corporate PPAs attractive to a wider range of buyers and sellers.

A growing number of contracts are structured as 'firmed' PPAs, with a utility or other trader smoothing out the supply of power from the wind or solar farm to ensure that the buyer receives power that meets its demand needs. Sleeved PPAs can thus be 'firmed' into baseload blocks of power. Microsoft has pioneered the use of what it calls volume-firming agreements – otherwise known as proxy revenue swaps – which it has struck with insurance firm Allianz and investment fund Nephila Climate.

Aggregate PPAs allow multiple companies to pool their power demand to reach the scale needed to contract with a larger project. These have proved popular in the Australian market; the Southern Sydney Regional Organisation of Councils (SSROC) entered into a PPA with the Moree Solar Farm last year, on behalf of 18 local authorities in New South Wales, and telecoms firm Telstra led a consortium that bought all the output from the first 226MW stage of the Murra Warra wind farm.

Such deals can allow larger, more experienced 'anchor' buyers to support smaller companies as they take their first steps into renewable energy procurement. In August, online retailer Etsy and software company Atamai joined other companies in a 290MW PPA with two renewables projects in the US.

However, there can be challenges in drafting contracts with more than one offtaker. "You need to ensure that terms are as similar as possible, to minimise the due diligence requirements faced by the banks funding the project," says Owusu, at EY. "The credit quality [of smaller buyers] can also be an issue," given that these tend to be long-term contacts, he adds. "It can be like herding cats," notes one developer.

Most PPAs are struck with new projects, with PPAs enabling 'additional' renewable energy capacity to be created and allowing corporate buyers to claim the credit. However, a new type of PPA, struck with existing projects, is allowing them to extend their useful life. In December, for example, car maker Mercedes announced a PPA with Norwegian energy company Statkraft to enable six wind farms in Germany – the FiT contracts for which were reaching their end – to continue operating.

Dubbed by Dominy as "anti-subtractability" PPAs, these contracts are likely to become popular because they tend to be of shorter duration than the long-term PPAs that financiers usually require before they extend finance to new projects. To prove their environmental credentials, however, such PPAs necessitate due diligence, to ensure operators invest in the refurbishment that is usually needed.

An additional challenge faced by some multinational buyers is that it may not be feasible to enter into PPAs in each country in which they have operations. But, in Europe in particular, growing market harmonisation and the interconnectivity of electricity markets are enabling multi-country PPAs, says Zosia Riesner, Head of Corporate PPA at Lightsource BP, a UK-based solar project developer. Clothing company Nike has pioneered this approach, with a 40MW PPA signed in February to meet the power

demands of its European facilities from Iberdrola's Cavar wind complex in Navarra, northern Spain.

Such transactions "can play to the strengths of the different marketplaces in Europe", says Riesner, which have different renewable resources and power price dynamics. "This might be a good way of striking a balance of efficiency and price certainty, but it's not without risk. Anything that goes from a simple in-country physical PPA to a more complicated multi-country (virtual) approach is always going to be more difficult," she adds. Dominy says that such contracts can introduce 'basis risk' – that is, the danger that a PPA agreed in one electricity market may not provide a sufficiently close hedge for power prices in a different market.

One of the challenges in closing deals is the mismatch between the long-term contracts funders seek to match the tenor of their debt and the shorter-term deals that corporates prefer, says James Armstrong, Managing Partner at developer Bluefield LLP. "Corporates are looking for contracts that don't lock them in," he adds. However, banks and investors are increasingly willing to consider rolling PPAs, given the growing comfort that – when a PPA expires – the project will be able to find a new buyer for its power. Indeed, as Armstrong notes, "we tend to get our highest prices when we sell power through the grid, typically selling our power to wholesalers on one- to three-year contracts, rather than with long-term corporate PPAs.

Coming to market – what companies should do

While a growing number of companies are turning to corporate PPAs to reduce emissions or control costs, the process can be challenging. Kimmins, at The Climate Group, says that – for smaller companies – the transaction costs can offset any potential savings, and even many larger firms do not have energy procurement teams that are able to manage the complex, and sometimes lengthy, contract negotiations.

Riesner, at Lightsource BP, says companies with uncertain future energy demand may find relatively long-term PPAs too restrictive, while it remains difficult for developers such as hers to enter into PPAs with businesses without good credit ratings. "But for buyers who are thinking long term and who are committed to renewables … the market offers opportunities for innovation to meet their needs," she adds.

"The market is complex and it's evolving quickly," says Dominy, at EY. "Even for companies with significant internal resources, contracting in such a specialist field can be daunting – it pays to get expert advice, especially given that corporate PPAs usually require board-level sign-off. And given the length of these contracts, and the significant costs associated with terminating them early, boards tend to look for an impartial, third-party assessment of the business case."

New players, new markets, and new approaches are all now working in harmony – transposing corporate PPAs to a higher pitch of activity. There are exciting times ahead for companies to play a key part in driving new investment in renewables.

Offshore wind sets sail for new waters

Offshore wind in north-west Europe has been one of the renewable energy sector's stand-out successes of recent years. Over the next decade, the technology will spread across the world – but what jurisdictions are likely to be most attractive to developers and investors?

At the end of 2018, 83% of the world's 22GW of offshore wind capacity could be found off the coasts of Europe. Over the next decade, however, Europe will account for just 41% of new offshore wind development, according to figures from Wood Mackenzie, with Asia accounting for 48% and the US making up 11%.

From 2019 to 2028, Wood Mackenzie estimates that 124GW of offshore wind capacity will be added around the world, with the sector delivering compound annual growth rates (CAGR) of 21%, compared with just 8% for the more mature onshore wind market.

"Offshore wind ticks all the boxes" for governments seeking increasingly low-cost, large-scale and reliable clean energy, says Alastair Dutton, who chairs a recently created Offshore Wind Taskforce at the Global Wind Energy Council (GWEC), set up to promote the technology in emerging, non-European markets.

He notes that offshore projects are moving ahead without subsidy in jurisdictions such as Germany and the Netherlands, which benefit from considerable experience and mature supply chains. Offshore wind is also attractive to governments for the jobs it creates, Dutton adds.

While Europe will see significant continued growth over the coming decade, much industry attention is turning to emerging markets for offshore wind – namely, the US, mainland China, Japan, Taiwan and South Korea. With very different support programmes, political backing and openness to international participants, however, it remains an open question as to which are likely to prove of most interest to investors.

China takes to the seas

In terms of offshore capacity, mainland China is the big prize. It boasts the world's largest volume of onshore wind capacity – at 178GW at the end of 2018 – but just 4GW is located offshore, according to Wood Mackenzie. The energy consultancy forecasts almost 40GW of new offshore capacity in China by 2028, with China likely to overtake the UK to become the world's largest offshore wind market by 2021.

The Government's 13th Five-year Plan for wind power development anticipates 10GW by 2020, with 5GW connected to the transmission network by that point. While subsidies are being reduced for onshore wind and solar, offshore wind enjoys continued access to feed-in tariffs set at RMB0.85/kWh (US$0.13), twice the rate for onshore projects. From this year, however, the Government is shifting to an auction mechanism to encourage cost reductions in the sector.

Offshore wind also enjoys strong support at the provincial level. For example, in January, Jiangsu province approved 24 offshore projects with a combined capacity of 6.7GW and capital costs of around US$18b, which are expected to be completed by the end of 2020.

Policy support notwithstanding, however, developers face challenges with the profitability of offshore projects, says Alex Lu, an associate partner in the Greater China Power & Utility Market Segment at Ernst & Young Hua Ming LLP in Beijing . "Compared with more mature markets, Chinese developers have a big gap to close to effectively control project lifetime costs," he says, citing high construction and operations and maintenance costs. One route to help them do so is to acquire overseas companies with experience in the sector, and to participate in offshore projects, Lu adds.

As with onshore renewables sectors, China's offshore market is dominated by local players. The major power generators CHN Energy – through its subsidiaries Longyuan Power and Guohua Power – Huaneng, Datang, Three Gorges, State Power Investment Corp (SPIC) and CGN are most likely to become market leaders. Domestic turbine manufacturers are developing larger turbines aimed at the offshore market; Goldwind unveiled an 8MW model last November.

In March, however, French utility EDF announced that it is to help build two offshore farms under development by China Energy Investment Corporation. The Dongtai IV and V wind farms, totalling 500MW, are to be commissioned in 2021. Alongside growing international investment in China's onshore renewables sector, this could mark the opening of Chinese

… with the rest of East Asia in its wake

Meanwhile, opportunities abound in more open markets elsewhere in the region, with Taiwan, Japan and South Korea all looking to develop their offshore sectors.

So far, **Taiwan** is attracting most interest, with a 5.5GW programme under way to 2025 and the Government promising to set out targets beyond that date. Wood Mackenzie estimates that it will develop 9.2GW by the end of 2028.Local developers include Swancor and China Steel Corp, while international firms involved in projects include Singapore-based Yushan Energy, Canadian energy firm Northland Power, Danish energy firm Ørsted, its compatriot investment firm Copenhagen Infrastructure Partners, Japan's Mitsui, and Australian bank Macquarie Capital.

The market was rocked last year when the Government announced, in its annual review of feed-in tariff (FiTs) rates, a 12.7% reduction. After industry lobbying and threats to pull out of the market, this cut was reduced to 5.7%, meaning projects permitted in 2019 will earn 20-year FiTs of TWD5,516/MWh (US$179/MWh), or a higher rate of TWD6,279.5/MWh (US$204/MWh) for the first 10 years, falling to TWD4,142.2/MWh (US$134/MWh) for the subsequent 10.

To earn the FiT, developers must meet relatively high local content requirements, but the rules on this have not been fully elaborated, causing some concern among developers, says Chih Wei Feng, Executive Director, EY Transaction Advisory Services Inc. in Taipei. Another challenge is the immature project finance market in Taiwan, where only a handful of local banks have the capacity to offer non-recourse loans. Given the scale of financing required, more local banks need to get comfortable with lending to the sector, Chih Wei adds.

After Taiwan, **Japan** is the region's next largest market, with Wood Mackenzie forecasting 4.5GW by 2030. New legislation was passed last November, setting the framework for offshore wind and subsidies of Y36/kWh (US$0.32/kWh), double that offered for solar power

Japan's powerful Ministry of Economy, Trade and Industry is soon to publish a plan for zoning, licensing and grid connections.

Currently, only 20MW of offshore capacity is operational, but around 5GW is under environmental assessment, says Naoto Utsumi, Director, Infrastructure Advisory at Ernst & Young Transaction Advisory Services Co, in Tokyo. Challenges involve limited grid-connection capacity, opposition from the fishing industry and local stakeholders, and the costs of building foundations in challenging conditions.

Despite these challenges, local conglomerate Orix Corporation is exploring offshore wind opportunities, as is trading company Marubeni. Foreign companies are putting a toe in Japanese waters: Denmark's Ørsted has signed a memorandum of understanding with utility Tokyo Electric Power to work on offshore projects, while Germany's E.On is reported to be opening a Japanese arm this year.

Finally, **South Korea** plans to generate 20% of its energy from renewables by 2030, up from 6% at present – a target that involves 12GW of offshore wind. Analysts believe that target is unlikely to be met, however, with Wood Mackenzie forecasting 4.5GW of offshore wind by the end of 2028.

Offshore wind benefits from generous support through the country's renewable energy certificate system, strong government support, and attractive topography off Korea's west coast. However, the sector faces headwinds from strong local opposition, an approach focused, to date, on top-down, government-led projects, relatively low wind intensity, and a lack of track record, according to law firm Linklaters.

Nonetheless, some international players are getting involved. Norway's state energy giant Equinor has announced a partnership with the Korean state-owned National Oil Corporation to develop floating offshore wind farms.

The US sets sail

As recently as 2016, the US had no offshore wind capacity. With the first projects coming online, however – led by the 30MW Block Island Wind Farm off Rhode Island – some of the barriers blocking the market's growth have come down.

One of the main impediments was legal, says Leonardo Alavian, in Ernst & Young US LLP's Business Advisory Practice in New York. Vigorous campaigns were waged against early projects, with opposition to the trailblazing – and, ultimately, unsuccessful – Cape Wind project uniting the liberal Kennedy family, concerned about the views from Cape Cod, and the right-wing Kochs, who argued that a privately-owned wind farm should not be built in federal waters.

Newer projects are on firmer legal foundations, Alavian says, and are now backed by a number of state-level targets. These include plans from New York for 2.4GW of capacity by 2030, from New Jersey for 3.5GW by the same date, and for Massachusetts and Rhode Island to commission 1.2GW of offshore wind.

These plans have been backed by public utility solicitations – such as that from the New Jersey Board of Public Utilities for 1.1GW of offshore wind, made last September – and, for the time being, federal incentives, such as the Investment Tax Credit (ITC). Projects entering into construction this year can earn tax credits equivalent to 12% of their value, but the ITC expires next year.

These ambitions are partly spurred by growing concern about climate change, but also by a recognition that offshore wind technology is increasingly economic. The dramatic falls in the levelized cost of energy seen in European offshore markets have persuaded policy-makers, investors and consumers that offshore wind will become a viable part of the generation mix. Bloomberg New Energy Finance has forecast that US offshore wind projects could generate power at US$60–US$70/MWh by the late 2020s, as the market reaches critical mass and a local supply chain brings down costs. This compares with its forecasts of costs of around US$125/MWh in 2022, when the first wave of large-scale US projects come on line.

Cost falls to date are a function of improvements in the technology used and increasing experience and operational history elsewhere. This is helping to persuade US investors to back projects under development.

Nonetheless, hurdles remain. Primary among these are the limited skills base and nascent infrastructure, which are likely to keep costs relatively high for early projects. Another idiosyncratic obstacle is the Jones Act, legislation from the 1920s that requires goods shipped between US ports to be transported on vessels built, owned and operated by US citizens. Preventing foreign-owned offshore wind construction vessels from operating in US waters will slow installation and increase costs.

Preconditions for success

As new jurisdictions look to develop an offshore wind sector, certain preconditions are required to attract international developers and investors. "We always talk about the need for a stable regulatory environment," says Mark Giulianotti, Managing Director at Green Investment Group (GIG), "but, even before that, you need to have the ambition of the government and the energy sector within that country to replace fossil-generating stock with low-carbon generation. That's fundamental."

Long-term commitment is important, given the complexity and time involved in developing offshore projects, says Dutton, at GWEC: "It takes around seven years from granting sea-bed rights through to construction. It's not like building a solar plant."

Governments also need to recognise that, necessarily, early projects will be relatively expensive before local supply chains and expertise are developed. While there is a variety of ways to support early projects, the calculation of developers and investors is straightforward: "It needs to be attractive enough in terms of the risk and return," says Giulianotti.

For local supply chains to emerge, there needs to be "several gigawatts of visibility", he adds – but once local capability emerges, it can support large numbers of jobs and, potentially, a lucrative export business. Chih Wei, at EY, says that the Taiwanese Government and industry are hoping to use their first-mover advantage to carve out a position as a regional hub.

GWEC has developed a 12-point, market-readiness assessment tool that can be used by governments and industry to evaluate the steps they need to take to support offshore wind development. It covers elements from initial policy design through to operations, including legal issues, grid readiness, off taking, finance, and health and safety.

This last element is critical, says Dutton, at GWEC. "It's not only about looking after people, although that's very important. By doing things right first time, projects complete on time and on budget."

Investment in US offshore wind will still depend upon "some sort of regulatory support", says Andrew Perkins, a partner in Ernst & Young LLP's Offshore Wind team, once the ITC subsidy falls away. The levelised cost of energy for offshore wind will still be greater than that for onshore wind or solar. But he is excited at the opportunity presented by direct power purchase agreements (PPAs) with utilities driven by state-level obligations. "In select locations, offshore wind makes commercial sense against the alternatives as the contractual support from PPAs provides the certainty that developers and financiers need."

The scale offered by mainland China "looks very attractive" and may tempt international players to overcome their historical reluctance to grapple with regulatory barriers and the challenges of competing with domestic enterprises. "The move by EDF into mainland China's offshore market is extremely interesting in this regard," Perkins adds.

Certainly, Taiwan illustrates the degree of international interest in offshore wind, he says, "if you are open to investment, and if you get the permitting and tariffs right. There is no lack of ambition among international investors regarding offshore wind."

From fixed to floating India's solar push falters

The offshore wind industry has, to date, relied on fixed foundations for its turbines, restricting development to seas no deeper than 40 metres. Advances in floating turbine technology, however, promise to allow wind farms to be anchored further offshore – where winds are often stronger and more consistent – and off coastlines that don't benefit from gently sloping seafloors, such as the US west coast, Japan, or Europe's Atlantic shoreline.

The technology is some way behind its bottom-fixed equivalent. The first floating offshore wind pilot, the Hywind 1 project – developed by Equinor (then Statoil) off Norway and using a single 2.3MW Siemens turbine – began generating power in 2009. The first multi-turbine project, Equinor's 30MW Hywind Pilot Park off the coast of Scotland, became operational in 2017.

It is developing fast, however. A report last year from the UK-based Floating Wind Joint Industry Project, led by the Carbon Trust, said capacity is forecast to reach up to 260MW by 2021, with five or six concept designs de-risked sufficiently to allow deployment at commercial scale. By 2030, the Carbon Trust estimates 12GW of capacity will be deployed globally.

Policy support will be vital, however, if the technology is to achieve its potential, the Carbon Trust notes. As well as direct financial support for early floating wind projects, the report calls for government action to ease site leasing and to put regulatory and legal frameworks in place, and for investment in technology providers and the supply chain.

Business as usual promises growth for Brazilian renewables

The future for Brazil's renewable energy sector following the presidential election last October is now becoming clearer. Although Jair Bolsonaro made almost no mention of clean energy in his manifesto and had pledged to withdraw Brazil from the Paris Agreement on Climate Change, it appears – so far – to be business as usual for the sector.

The large-scale auctions that have underpinned substantial growth in Brazil's wind and solar capacity are set to continue, lower interest rates are tempting private sector investors back to the market, and unsubsidised distributed generation is growing rapidly. Historically, hydroelectric plants have supplied the bulk of Brazil's power, meeting 73% of its consumption in 2018. However, from almost zero in 2009, wind has grown to represent 8% of the total, with almost 15GW of capacity installed. An additional 4GW is contracted and due to start generating by 2024. Solar, meanwhile, generated less than 1% of Brazil's power in 2018, from around 2GW of capacity.

Large-scale renewables have been supported predominantly through public auctions, which tend to be open to a range of technologies, including thermal plants, and where developers bid for power purchase agreements with distribution companies. In March, Brazil's Ministry of Mines and Energy announced that six 'new energy' auctions, which are typically open to renewables projects, are to be held over 2019–21, with the amount of power required yet to be announced.

Despite the uncertainty created by last year's presidential election, significant renewable energy investments continue to go ahead. In October, for example, Italian utility Enel began construction of a 475MW solar farm in north-eastern Brazil, believed to be the largest to date in Latin America, and backed by 20-year contracts with distribution companies. In the same month, Brazilian development bank BNDES provided US$158m of funding to cover 30% of the investment needed for the Cutia and Bento Miguel wind complexes, totalling 313MW of capacity, in the same part of the country.

At the end of last year, EDF Renewables and Canadian Solar reached financial close on the 399MW Pirapora solar project. This scheme illustrates a new development in the Brazilian market: the involvement of capital market investors in funding renewables projects. As part of the total US$373m financing, the two project sponsors raised US$59m through the private placement of 16-year bonds, rated AAA by Fitch.

This reflects renewed appetite for Brazilian clean energy assets. During the country's recent economic slowdown, when interest rates rose above 14%, funding renewables became more challenging for investors. However, now interest rates have returned to more normal levels – they are currently at 6.5% – funders are increasingly turning their attention to opening alternative sources of capital, with the support of BNDES, to renewable energy developers. Private banks are becoming more important sources of long-term debt to the sector, which is also increasingly able to raise funds from the capital markets directly, through bond issues.

In addition, the Brazilian market is seeing dramatic growth in distributed renewable energy systems, as smaller commercial and industrial buyers recognise the opportunity to cut energy costs by contracting directly with smaller developers. Most of these projects – which are below 5MW in size – use solar photovoltaics and are being developed by companies using new business models to challenge the incumbent developers.

Regulatory changes are in the pipeline that are likely to benefit renewables. For example, co-located wind and solar projects currently have to pay twice to be connected to the grid, even if they are using the same connection. Given that the wind can blow through the night, such co-location makes economic sense, and the Government is understood to be planning to reduce these connection costs.

Renewables advocates are also hopeful that the planned part-privatisation of Eletrobras, Brazil's largest power generator and transmission operator – expected this year – could invigorate the local market, allowing its renewable energy division to invest in new areas under new management.

Investors shouldn't expect to snap up the company's renewable energy assets on the cheap, however. Some previous privatisations have attracted strong demand from investors, leading to sales at market-level, risk-adjusted returns.

China looks to a subsidy-free future

The Chinese renewable energy sector is hoping that 2019 will be better than 2018, when subsidy cuts slowed growth in solar installations dramatically. While policymakers have reversed course on some of their harshest moves to slow the sector, they are also moving forward with measures to encourage subsidy-free development, demonstrating the growing viability of clean energy technologies.

Last year, solar photovoltaic (PV) additions fell to 44.3GW, from a record 53GW in 2017. The fall was triggered by a reduction in the subsidies paid. The country added 20.6GW of new wind power, compared with 15GW in the previous year.

By the end of 2018, China accounted for 35% of global solar capacity – with 172GW – and 32% of total wind capacity, with 181GW.However, as the country moves away from its expensive feed-in tariff (FiT) regime towards unsubsidised energy, the rate of solar additions is likely to moderate, according to analysis from Fitch Solutions, while those from wind are likely to increase. The firm estimates that solar capacity will grow at an annual average of 36GW between 2019 and 2028, while that of wind will grow at an average of 23GW/year.

Chinese developers are not being cut off from subsidies entirely yet. In solar, regulators are once more approving ground-mounted projects, after halting approvals in June 2018 in a bid to reduce subsidy bills – at which point there was a backlog of at least RNB120b (US$18b) in unpaid subsidy payments – and to achieve lower curtailment levels.

According to Citigroup, China is expected to allocate around RNB3b (US$0.4b) of subsidies to solar projects in 2019, and it forecasts 42GW of new capacity under its base case, with the potential to rise to 50GW.Meanwhile, the Government is continuing to support wind energy through its FiT regime, but with the rates paid continuing to decline. Since 2017, the tariffs have decreased by 5%–15%, depending on the area's wind resource. The Government is also actively supporting its offshore wind sector, which continues to qualify for attractive subsidies.

In addition to continuing subsidies, however, the Government is promoting subsidy-free renewables projects as technology costs fall. The National Energy Administration is proposing to set up an auction system, backed by 20-year offtake contracts, guaranteed grid connections, lower transmission fees, protection against curtailment, and eligibility for an expanded green certificate programme, among other things. Qualifying projects would be expected to sell power at the same price as non-subsidised coal-fired plants.

One landmark planned project is the giant 6GW Ulanqab Wind Power Base, a series of wind farms in Inner Mongolia under development by the State Power Investment Corporation at a cost of RNB42.5b (US$6.3b). The scheme will supply power to the 2022 Winter Olympics, to be held in Beijing and neighbouring Hebei province. Another landmark development is the country's first large, concentrated solar power and energy storage project, at 100MW and 390GWh, using a 260m-tall tower on the fringes of the Gobi Desert.

Crucial to the success of unsubsidised projects, says Fitch Solutions, will be their ability to reduce wastage where transmission constraints have prevented renewable energy projects dispatching power and, so, reducing the revenue they can earn. Provincial grid operators have tended to favour coal over renewables, as the former is cheaper than subsidised renewable energy. Curtailment rates have been falling in solar – from 6% in 2017 to 3% in 2018 – which, if it continues, will make unsubsidised projects increasingly economically viable.

To date, foreign investors have had little role in China's renewables sector, with overseas investment accounting for less than 1% of the total. International funders have steered clear of the market after bruising experiences around the turn of the century, when the national power company gave preferential treatment to domestically owned generating assets during a period of oversupply. This resulted in foreign investors – mostly in coal-fired plants – divesting from China.

However, improved market practices and transparency are tempting investors back, this time into renewables. In 2017, for example, French utility ENGIE took a 30% stake in Unisun, a Chinese PV firm, while Total, the French oil major, last year helped seed, with two local partners, a China-focused clean energy fund. French power giant EDF, meanwhile, has more than 400MW of clean energy capacity under construction or in operation in China. It also announced its first investment in the country's offshore wind sector in March, with stakes in two projects with a combined capacity of 500MW. In the solar rooftop space, Canada-based Brookfield Asset Management and Japanese logistics provider GLP formed a joint venture last year, to install 300MW in three years using a third-party ownership model.

China's renewable energy market is, without doubt, undergoing a transition as the Government seeks to rein in the costs of the subsidies paid to the sector. With continuing concerns about pollution, falling technology costs, and revived interest from international players, however, growth in the world's largest clean energy market is set to continue

Key Developments

Green New Deal invigorates US policy debate

Democratic US presidential candidates are lining up to endorse the goals of the Green New Deal, promising to put renewable energy at the heart of next year's election. Unveiled in February, the package aims, among other things, to make the US power sector zero carbon within 10 years.

While the Green New Deal does not offer policy specifics – and is strongly opposed by much of the Republican party – it has been credited with raising the profile of climate change, and with prompting some Republican politicians to acknowledge the growing importance of the issue to voters.

It comes as renewables in the US are becoming a more mainstream part of the generating mix, even in the absence of strong support at the federal level. US solar photovoltaic capacity is forecast to rise 14% in 2019, with more than 12GW of additions expected by the Solar Energy Industries Association after 10.6GW of new capacity in 2018 – 2% less than in 2017, in part because of the introduction of tariffs on imported solar cells and modules.

Utilities are increasingly taking advantage of record low power costs from renewables. At the end of last year, Texas-based New Braunfels Utilities bought part of the output from a 255MW solar plant for less than US$0.025/kWh in a 15-year contract. Around one-third of the state's energy mix is now low carbon.

However, the bankruptcy of California's PG&E, the largest utility in the country, has cast a shadow over the financing of renewable energy projects. The San Francisco-based company has more than 250 contracts for renewable energy, representing investments of US$51.7b. Generators who have entered into long-term contracts with the utility are concerned that these could be renegotiated or cancelled. The bankruptcy has also raised questions about the credit risk posed by large utility off takers, which is likely to make it harder for new projects to raise financing on the back of such contracts.

India unveils massive renewables tender plan, but delivery doubts persist

The Indian Government is to auction 40GW of solar and wind capacity each year to 2028, with the goal of generating 40% of its power from around 500GW of renewables by that date. The new target, announced in January, extends the existing goal of installing 100GW of solar and 75GW of wind by 2022.

Despite a flurry of recent tenders, however, doubts are growing about whether the near-term targets can be met. Solar Energy Corporation of India (SECI), the government agency charged with implementing the country's renewable energy build-out, has conducted six rounds of wind auctions since 2017, attracting rock-bottom bids for 8.4GW of capacity. Of the 1GW auctioned in the first round in 2017, however, less than half was commissioned before the mid-2018 deadline.

Meanwhile, solar tenders have been scaled back or cancelled as developers have bid higher prices than anticipated, in response to higher costs from tax changes and the imposition of import tariffs on solar cells and modules. Developers have also struggled to secure land for projects, while grid-connection issues have slowed other projects.

Of 58GW of renewable energy capacity tendered in 2018, only 20GW was awarded, according to Bridge to India, a consultancy. Renewable energy developers say that more consistent policy and regulatory support for the sector is needed if the Government is to meet its ambitious targets.

Meanwhile, all three major parties have expressed broad support for clean energy in their manifestos for the ongoing parliamentary elections, results of which are due to be announced on 23 May. The BJP and the Indian National Congress party have both reiterated support for the National Solar Mission, while the minority Aam Aadmi Party has promised to promote decentralised renewables infrastructure.

UK seeks third of power from offshore as it unveils sector strategy

The UK has unveiled plans for offshore wind to supply 30% of its electricity by 2030, up from just 6.2% in 2017. The Offshore Wind Sector Deal, unveiled in March, also aims to treble the number of people employed in the sector, to 27,000, by 2030.

By that date, the Government is targeting 30GW of offshore wind, compared with 8.2GW by the end of last year. The sector deal involves participants in the industry investing £250m (US$330m) over the next 11 years, in exchange for the £557m (US$730m) in subsidies for renewables already announced.

However, the announcement follows the withdrawal of support for onshore renewables in 2016 that has slowed growth in the sector in the UK. Last year, just 598MW of onshore wind was installed in the UK, according to trade body RenewableUK, down from 2.7GW in 2017. The Government also disappointed industry advocates with a refusal to support the Swansea Tidal Lagoon, while changes to network charges – which have been favouring decentralised renewables, energy storage and demand-side response – will further hit the sector.

Climate and energy looms over Australian election strategy

Climate change and clean energy are likely to feature prominently in Australia's national elections, due in May, with the opposition Labor Party accusing the National-Liberal coalition Government of lacking a coherent policy on the issue. Labor, which is ahead in the polls, has pledged AU$10b (US$7.1) for large-scale renewables and energy storage, as part of a plan for a 45% cut in carbon emissions by 2030.

In February, the Government announced AU$2b in funding over 10 years to underwrite small and medium-sized emission-reduction projects, noting that the country is on course to meet its commitment under the Paris Agreement to reduce emissions by 26%–28% by 2030. However, its energy policy has focused on reducing customer bills and improving reliability – including, potentially, by subsidising new coal-fired generation.

That approach has come under attack from within the governing party, with New South Wales Energy Minister Don Harwin calling on the Government to do more to tackle climate change and address policy uncertainty that has contributed to higher wholesale prices and delayed clean energy investment.

Despite uncertainty at the federal level, state policies are helping to bring renewables projects forward. In Victoria, the 425MW Coopers Gap Wind Farm, under development by AGL, is set to become Australia's largest wind farm when it is completed in early 2020. The Victoria Government approved a larger wind farm – the 800MW-plus Golden Plains Wind Farm – earlier this year, to be developed by WestWind Energy.

In New South Wales, approval was granted in January for the country's largest solar farm, the AU$1b, 900MW Yarrabee project, developed by Reach Solar Energy and due for completion next year. That developer recently completed the 375MW Bungala solar plant, in Port Augusta, South Australia.

Uncertainty clouds South Africa's power markets strategy

The continuing electricity crisis in South Africa and mixed signals from the Government are weighing on existing and prospective clean energy investments in the country. An announcement, in mid-February, that contracts under the Renewable Energy Independent Power Producer Programme (REIPPP) could be renegotiated spooked investors, but it was speedily reversed by the Government. Meanwhile, development banks and investors are continuing to back renewables in the country, while its coal-fired sector is struggling to find funding.

South Africa is currently suffering from blackouts and load shedding as the state-owned generator, Eskom, struggles under US$30b of debt and an antiquated generating fleet. Some argue that tariffs negotiated under early rounds of the REIPPP are part of the problem; others point out that renewables capacity is proving vital in meeting power demand.

The Government certainly sees a greater role for renewables. Its draft Integrated Resource Plan published last year, foresees an additional 8.1GW of wind and 5.67GW of solar by 2030, making up 25% of total capacity by that point. However, it has given mixed signals on whether and when that capacity will be commissioned: the Department of Energy signalled a hiatus in renewables procurement, while Energy Minister Jeff Radebe has suggested another REIPPP round could take place in 2019.

Investors are voting with their wallets. New coal-fired projects in the country are struggling to find investment, whereas renewables are benefiting from backing from – among others – the Development Bank of Southern Africa. This has announced US$200m to help fund 330MW of embedded renewable energy generating capacity and US$209m for the 100MW Redstone concentrated solar power project, with 12 hours of thermal storage to generate baseload energy

Solar farms take to the water

As of September 2018, 1.1GW of floating solar farms had been installed globally, according to a new World Bank report, which calculates that the technology has potential to deliver at least 400GW of capacity.

Floating solar is growing exponentially, with just 10MW installed as of 2014, the World Bank says. It is proving attractive because it avoids land acquisition and site-preparation challenges, and can often be sited close to where electricity demand is high. The report also notes that, while upfront costs are slightly higher than for conventional solar, costs over time are equivalent, as the cooling effect of water boosts the energy yield of floating solar panels.

In March, Chinese state-owned developer CECEP completed the world's largest floating solar project, at 70MW, built in collaboration with French floating solar specialist Ciel & Terre in a former coal-mining area of Anhui province, China. Last year, Kyocera Corporation switched on Japan's largest such plant, with 13.7MW of capacity.

Thailand, meanwhile, plans to commission 2.7GW of floating solar capacity across nine hydroelectric dams. State-run utility Electricity Generating Authority of Thailand is to open a tender in May for a pilot 45MW floating solar farm at the Sirindhorn Dam, in the north-east of the country. Some countries are also eyeing offshore installations. At the end of last year, South Korean President Moon Jae-in announced plans for 3GW of offshore floating solar, alongside 1GW of floating wind, in the Yellow Sea off Korea's west coast.

Ethiopia launches 800MW solar tender

The Ethiopian Government is seeking bids for six solar farms, with a combined capacity of 798MW. At an expected total cost of US$750m, the projects are to be partially funded by the Government under its public-private partnership framework.

The tender is being run through the World Bank's Scaling Solar Programme, which combines a number of World Bank services with the goal of creating viable markets for solar power within a particular client country. This latest tender is Ethiopia's third within the programme; Enel won the first, in October 2017, to build a 100MW solar plant, and local utility EPP won the second, to build 250MW of solar.

Ethiopia has a target of universal power access by 2025, up from around 30% currently, with renewables accounting for the majority of new supply. It aims to increase generating capacity to 17.3GW by that date, from 4.3GW at present. The largest generating project is the 6.5GW Grand Ethiopian Renaissance Dam hydropower scheme, while two geothermal projects are also under development.

The Government's National Electrification Program, launched in 2017, anticipates connecting around two-thirds of the population to the grid. The remaining third will get power through mini-grids or distributed solar technologies.

Netherlands risks missing 2030 climate goals

Despite recent progress in developing clean energy, the Netherlands is unlikely to meet its 2030 climate goals, according to a government advisory body. In March, the Netherlands Environmental Assessment Agency PBL analysed government proposals and found that they would reduce emissions by between 31 and 53 million tonnes of carbon dioxide equivalent by 2030.

However, the Dutch target of reducing emissions by 49% below 1990 levels by that date implies necessary reductions of almost 49 million tonnes, the agency said, meaning the target will probably be missed.

Hitting the top end of the Government's range would require investment of €75b (US$85b), mostly in electricity production and transportation. Proposals, which include a carbon levy on businesses, were due to be published in April.

This is despite considerable recent progress in bringing clean energy forward. Last year, the Netherlands joined the 'solar gigawatt club' of countries installing more than 1GW of solar in a single year, according to Solar Power Europe. It installed 1.4GW of solar photovoltaics, almost twice the 0.77GW that came online in 2017.

Over the coming months, the Dutch Government will also tender the next round of subsidy-free offshore wind farms, the 700MW Hollandse Kust Zuid 3 & 4 projects. In addition to 4.5GW set out in its current offshore road map, the Netherlands plans to add a further 7GW of offshore capacity by 2030.

Colombian renewables tender fails

The Colombian Government has declined to accept any bids for the country's first long-term renewables tender, citing competition concerns. UPME, Colombia's mining and energy planning agency, sought bids for 12-year power purchase agreements for a total of 500MW, with projects to come online in 2021.

While 27 local and international companies expressed interest in participating in the tender, only eight projects were bid by seven companies, including Italy's Enel Green Power, Canadian Solar, Solarpack of Spain and China's Trina Solar.

The low number of bidders meant the auction did not meet rules set by Colombia's energy market regulator to ensure it complied with the country's competition and anti-trust laws.

A new auction is now to take place before the end of June.

The tender was the first in a series designed to commission 1.5GW of renewables by 2022, by which point the Government aims to increase the share of renewables in Colombia's generation mix to almost 10%, up from around 2% at present. Currently, Colombia sources around 70% of its power from hydro.

Turkey cancels solar tender, but bioenergy booms

The Turkish Government has cancelled a tender for 1GW of solar capacity that was due to be auctioned at the end of January. It gave no explanation for the decision, but industry speculation suggested the tender may not have generated sufficient bids – which were capped at US$65/MWh – to go ahead.

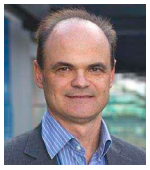
The move follows a 1.2GW offshore tender, with a ceiling of US$80/MWh, announced in June 2018, with an October deadline for bids, which has passed without official acknowledgement.

Turkey carried out successful onshore wind and solar tenders in 2017, both for 1GW of capacity, but the country's economic outlook since then has deteriorated sharply, making financing new projects challenging.

While large-scale solar and wind are struggling, the number of bioenergy projects is growing rapidly. Turkey's energy regulator, EDPK, lists 101 biogas and biomass plants, totalling 526MW of capacity, while the grid operator lists a further 94 unlicensed plants, making up 264MW of capacity, according to Renewable Energy Monthly. EDPK lists another 21 biogas plants and 64 biomass plants, totalling 480MW, under development.

Such projects benefit from feed-in tariffs worth US$0.133/kWh, considerable locally available feedstock, and top-up tariffs for those using locally produced equipment, as well as the liberalisation of the country's energy sector.

Contact the RECAI team



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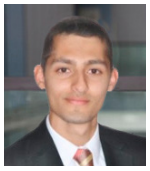

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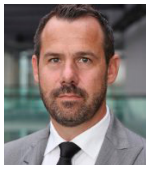

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