WATSON FARLEY
&
WILLIAMS

THE FUTURE OF RENEWABLE ENERGY

RENEWABLE POWER GENERATION, MERCHANT RISK AND THE GROWTH OF CORPORATE PPAS

CONTENTS

FOREWORD

The rise of renewable energy has been a success story over the past decade and, despite a recent fall in investment in European renewables due to subsidy reductions and auction access, all signs point towards further growth.

New investment in renewable energy is, however, fast approaching a key milestone: reliance on subsidy-free power generation. As this milestone is reached, industry incumbents will have no option but to adapt to what a subsidy-free market means for the industry and their business models. This new era will present challenges and opportunities in equal measure. Competitive advantage is likely to be achieved by those that are best able to understand and manage merchant risk, engage with and develop corporate power purchase agreements (CPPAs), and help tackle intermittency through energy storage solutions.

Europe will lead the way in this journey, but the Asian market will follow and face the same challenges. In the meantime, fragmented regulation is the primary hurdle for the growth of renewable energy in Asia.

WFW has been in the renewable energy sector since its inception and, through our sector-focused approach, we have remained at the forefront of the industry and are well placed to observe these trends.

This report, based on interviews with 150 senior level investors, financiers, developers and utilities in Europe, South East Asia and the Middle East, provides insight at this pivotal moment for the renewable energy sector and identifies regional and global trends, as well as key issues that will shape the future of renewable energy.

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EXECUTIVE SUMMARY

Investment in renewable energy is rising

Government targets for a more sustainable energy mix have resulted in more power producers decarbonising their portfolios. This, combined with sector-wide technological improvements, has resulted in an increase in investment in renewable energy. Two-thirds of developers in our survey expect to be involved in seven or more projects in the next two years, up from one-third who were involved in the same number of projects in the previous two years. In terms of direct investment, offshore wind, onshore wind and solar photovoltaic (PV) lead the way with 86%, 83% and 86%, respectively, of respondents directly investing in, developing or financing projects over the past two years.

Regional differences exist in the need for subsidy support

The European market is sufficiently mature that subsidies are no longer required to maintain growth, while these are still needed in Asia. In our survey, 70% of respondents believe that subsidy reductions would have no impact, or in fact have a positive impact on M&A activity in Western Europe, while 82% think it would have no impact on or increase the availability of project finance. This contrasts with 63% of respondents who believe that subsidy reductions in Asia would have a negative impact on M&A activity, and 61% who say it would decrease the availability of project finance in the region.

In a European market without subsidies, being able to deal with the challenges of merchant risk will become increasingly important

Opinions vary among our respondents as to whether the market is adapting quickly enough to accept merchant risk, but what is clear is that, while the availability of project finance will remain strong, changes will be seen in the documentation to manage merchant risk, with cash sweeps and tenor reduction becoming more common features.

Restrictive and unsupportive regulation is the primary hurdle for the Asian market to overcome in order to achieve subsidy-free renewable projects

Just under three-quarters (74%) of South East Asia-based respondents cite this as the main obstacle holding back subsidy-free renewable projects in the region for offshore wind, in contrast to only 43% in Europe.

Interest in CPPAs is booming, especially as subsidy support is being withdrawn

The key to unlocking this potential is through the aggregation of corporate demand. Nearly two-thirds of respondents in Europe and South East Asia consider the lack of generators offering CPPAs that are suitable for SME offtakers, who have a relatively lower power demand, as the main reason for lower uptake. More than half of respondents cite alternative CPPA arrangements, including consortia and joint tenancy, as being one of the single most important factors in unleashing CPPA growth.

With the rise in intermittent energy, energy storage will play an important role in maintaining a resilient energy system

Co-location of batteries with renewable energy projects and increased corporate self-consumption will likely lead the way. Nearly half of respondents based in Europe are already actively investing in, developing or financing energy storage infrastructure, with nearly all respondents viewing this as a strategy with solid potential for managing CPPA balancing risks. The rise of batteries may well be linked to the rise in CPPAs.

The race to invest in renewables is accelerating

83%
of all respondents say they have directly invested in, developed or financed an onshore wind project in the past two years

86%
of all respondents say they have directly invested in, developed or financed an offshore wind project in the past two years, with an equal proportion saying the same about solar PV

69%
of developers expect to be involved in seven or more renewables projects in the next two years

Interest in CPPAs is on the rise

63%
of respondents in Europe and South East Asia agree that the low uptake in CPPAs in some regions is due to a lack of generators offering CPPAs that are suitable for prospective offtakers, e.g. SMEs with lower power demands

53%
of respondents in Europe believe an increase in availability of alternative PPA structures, e.g consortia PPAs and joint tenancy, would be most likely to drive an uptake of CPPAs among smaller offtakers

51%
of respondents overall believe that a net reduction in carbon emissions to meet company goals is one of the most important benefits for offtakers in entering a CPPA

The impact of subsidies for renewables projects

22%
of respondents say that lower subsidies could have a positive effect on the availability of renewables project financing in Western Europe (rising to 30% in the Nordics)

61%
of respondents say that lower subsidies would have a negative impact on the availability of project finance in the renewables sector in Asia in the next two years

52%
of respondents say a reduction in subsidies would have no impact on M&A opportunities in renewables in Western Europe in the next two years – and 18% say it may even have a positive effect

63%
of respondents say a reduction in subsidies in Asia would have a negative impact on M&A opportunities in renewables

CHAPTER ONE

RENEWABLES – THE BEST LAID PLANS

The race to invest in renewables is accelerating and intentions are positive, with developers, financiers, investors and power producers planning to increase the number of renewable energy projects on their books. How are they taking advantage of the opportunities while overcoming obstacles?

The renewables landscape was once a cautious and relatively slow-moving space, but it is now going through a determined transformation. What were once considered untested, unpredictable and unreliable have become proven technologies, from offshore and onshore wind to solar PV power. And governments around the world are taking steps – some faster than others – to build a more sustainable energy mix, combat the growing impact of climate change, cut energy costs and free themselves from their dependency on fossil fuels.

For example, in June 2019, the UK's National Grid announced that "Britain is set to achieve a historic electricity generation milestone this year, with more electricity generated from zero carbon sources than fossil fuels".[1]

That same month, France enshrined in law its intention to achieve carbon neutrality by 2050.[2] In terms of German domestic power consumption, the share of renewable sources had already reached 37.8% by 2018 and the country aims to cut up to 95% of greenhouse gas emissions by 2050, compared to its 1990 levels.[3]

Taiwan has announced plans to phase out nuclear power after the Fukushima Daiichi nuclear disaster and is taking aggressive steps to achieve 5.5GW of installed offshore wind capacity by 2025.[4]

Vietnam has set targets for hydro, wind and solar power generation by 2020, 2025 and 2030, respectively, aiming to increase the proportion of renewable energy in their power generation structure despite their fast-growing power demand.[5]

As a result: power producers are also looking for ways to decarbonise their portfolios while they build their business; investors are looking for new opportunities as returns from fossil fuel sources begin to decline; and businesses of all sizes are looking for safe ways to shift to reliable green energy sources, with many choosing CPPAs as the way forward.

The result is an increasingly attractive and active renewables investment market – although the transition is not without its challenges.

While European investors enjoy a relatively homogeneous marketplace and more renewables-friendly regulations, the Asian market is more fragmented, with inconsistent regulatory environments and economic uncertainty causing some hesitation among potential investors.

Participants in our industry survey understand these regional differences better than anyone. As the director of corporate strategy and development at an independent power producer in Germany points out, "The way renewable energy is looked at in Europe is completely different to the way it is looked at in Asia or the Middle East. Renewable energy is not just another source of energy in Europe – it is seen as the answer to climate change dangers and cutting greenhouse gases at the consumer level. People are willing to support a shift to renewable energy sources."

"In Asia and the Middle East, when it comes to renewables, cost is still the deciding factor rather than climate change concerns and environmental issues," adds the director of investment of a specialist renewables/energy investment fund in Singapore.

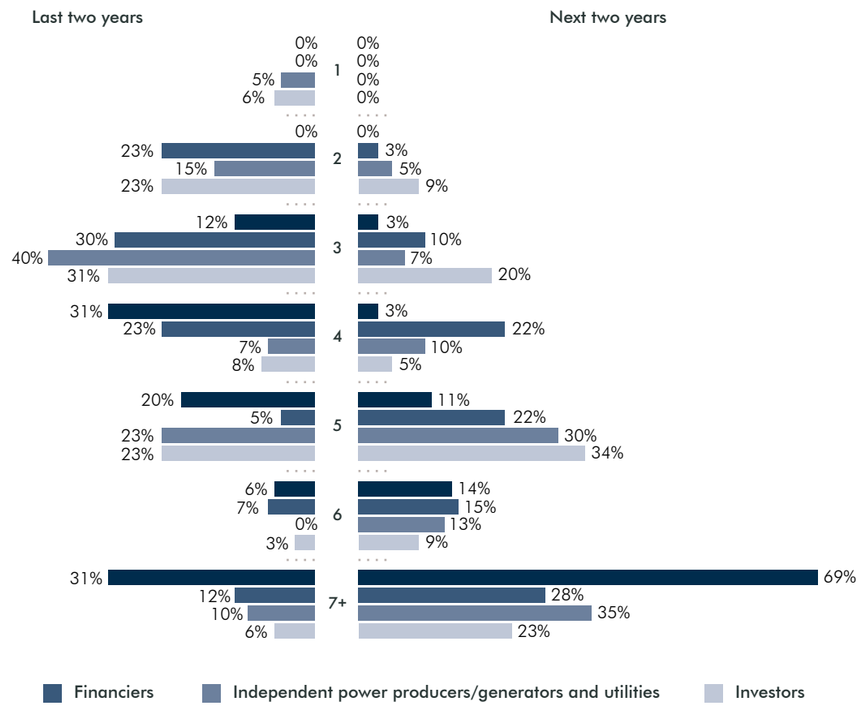
"Renewable energy development still needs significant capital and other support, and it has yet to compete with some other sources of energy when it comes to cost."

The changing pace of development

These differences in the market are having a clear impact on the speed and scale of renewables development and investment.

Developers are natural pathfinders because they understand construction risk and know how to deliver complex projects from scratch. Our survey confirms that they will continue to set the pace: almost a third of developers say they have taken on seven or more renewables projects over the past two years, and two-thirds expect to be involved in seven projects or more in the next two years – far ahead of any other group of respondents.

FIGURE 1: How many renewable energy generation projects have you directly invested in, developed or financed over the past two years? And how many do you anticipate over the next two years?



And where developers lead, others follow as the pipeline grows. Respondents throughout the sector say they expect to increase their engagement in renewables over the coming two years, with the vast majority of independent power producers/generators, utilities and financiers saying they expect to back four or more projects in that time.

Investors are similarly enthusiastic: 21% acknowledge that half or more of their portfolio already includes direct investment in renewable energy generation projects and 71% expect to back four or more projects over the next two years.

It's clear that the renewable energy market will continue to grow significantly and quickly. The only questions are which technologies will take the lead where, when and – perhaps most significantly, given the obstacles many face – how.

Offshore and onshore wind and solar PV projects dominate investments

"The shift in focus to renewable power sources is not surprising, given the steady evolution of the technology at its heart," says Henry Stewart, co-head of the global energy sector at Watson Farley & Williams. "The days when people asked what would happen if the wind didn't blow or clouds blocked the sun are gone. And renewables technologies have become increasingly reliable."

Offshore wind is a prime example: "It has moved from a pioneer's market to mainstream technology and this is likely to have significant consequences," says Stewart. "First, it will produce rapid growth and larger projects. Second, more offshore wind developers are likely to enter the market. Third, it will attract more lenders and increased competition to provide debt, which means offshore pricing may continue to go down."

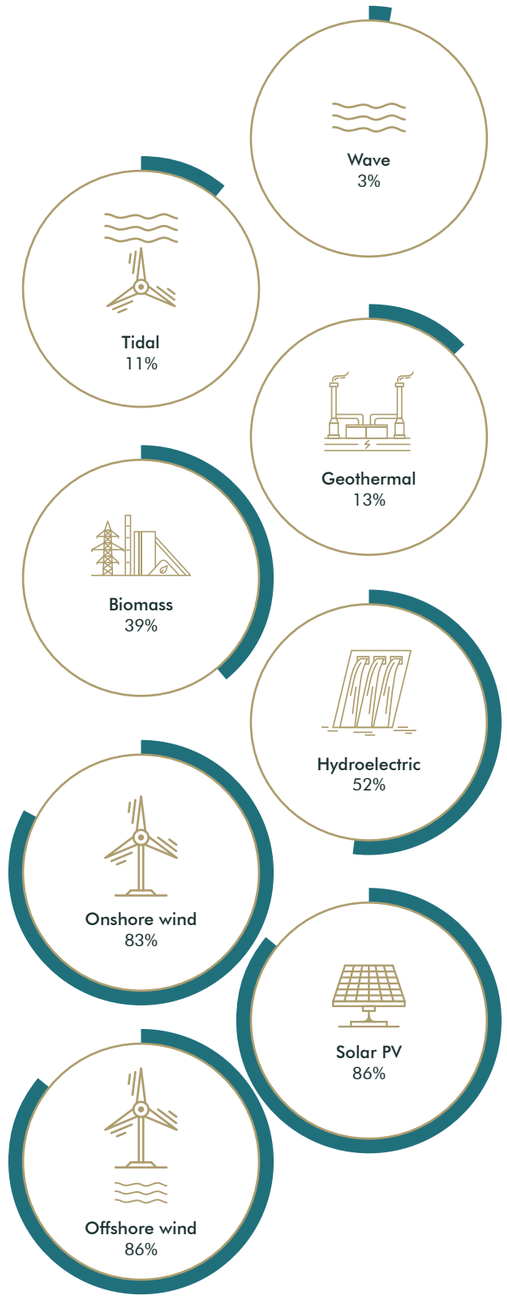
Offshore wind is not the only success story. Onshore wind and solar PV have both become bedrock investments, an idea that Stewart confirms and our survey findings support: offshore wind, onshore wind, as well as solar PV had each been invested in by over 80% of respondents over the past two years.

There are still risks of course, many of them driven by subsidies or a lack thereof. In Europe, there has been limited new solar PV development during the transition from a subsidy-driven market to an increasingly subsidy-free/grid parity market. This may be why only 57% of developers in our survey say they have invested in solar PV over the past two years.

Hydroelectric power has also seen less activity, with around half of respondents saying they have backed hydro schemes in the past two years. This is due in part to a lack of available projects – there are few remaining untapped sources for potential hydropower projects to be developed.

Geothermal, tidal and wave were the least popular with respondents over the past two years. Tidal and wave in particular face significant construction and technology risks. Tidal has the added challenge of relying heavily on political sponsorship. Respondents see biomass as more promising, but air quality concerns mean it remains controversial in some territories.

FIGURE 2: Which of the following renewables subsectors have you directly invested in, developed or financed over the past two years? *(Select all sectors that apply)*



Regional focus: Europe leads in renewables investments

Europe has dominated renewable energy development and investment for more than a decade. What is behind this steady growth?

"Support from the authorities, in terms of permitting, dealing with environmental constraints and eliminating administrative and technical barriers, have all been important drivers," explains David Diez, regulatory and public law partner in the global energy sector at Watson Farley & Williams in Madrid. "For example, Spain has solid wind and solar resources, and land available at a reasonable price. But the main driver has been the government's energy transition strategy. Around 50GW of conventional power is expected to shut down in the next 15 years and this capacity must be replaced by renewables. Replacing 50GW of conventional power capacity will require around 100-120GW of renewables."

This shift in focus can have a clear knock-on effect in renewables investment. Historically, Diez points out that drastic changes in Spain affected asset remuneration and tariffs were cut retroactively. But the government's renewed commitment to renewables (at a national, regional and local level) is attracting developers back to the market.

The benefit of a stable regulatory regime is most evident in the UK and German markets. Malte Jordan, co-head of Watson Farley & Williams' global energy sector, based in Hamburg, notes that "the well managed support shown through subsidies has enabled the growth of infant technologies to a stage where the markets are now, broadly speaking, close to achieving grid parity".

"Across Europe, many new projects are now being developed under CPPA schemes," adds Diez. "We are seeing more and more companies with 100 per cent renewable energy consumption targets that are considering CPPAs rather than using electricity suppliers with guarantees of origin, which are not considered reliable enough from an additionality perspective. These projects do not depend on regulatory remuneration, so the impact of potential regulatory changes on the income of projects like these is much less than a few years ago."

This assessment is notably seen in Italy, where the government has recently launched a 5.5GW series of tenders for renewable energy subsidies.[6] Eugenio Tranchino, partner in Watson Farley & Williams' global energy sector, based in Milan, explains that "despite this new regime, which shows strong government commitment, the PPA market is now where most solar and wind investors and developers are focussing their efforts".

33%

of respondents overall have already directly invested in, developed or financed a renewable generation project in Germany

"Looking forward, the preference is to establish long-term grid-parity projects instead of participating in auctions, in order to avoid future dependency on regulatory regimes and dealing with governmental bodies," says Tranchino.

This combination of regulatory policy, greater liquidity among banks, investors and financial institutions, as well as lower technology costs, has created a positive atmosphere for renewables in Europe.

Regional focus: Asia looms on the horizon

Our survey shows that Germany has dominated renewables investment up to now, followed by the UK, Sweden, France, Norway, Spain and a handful of other European markets. But it also suggests that investors see future opportunities in Asia. Activity in the region reflects a growing interest in renewables and many hope to get in on the ground floor.

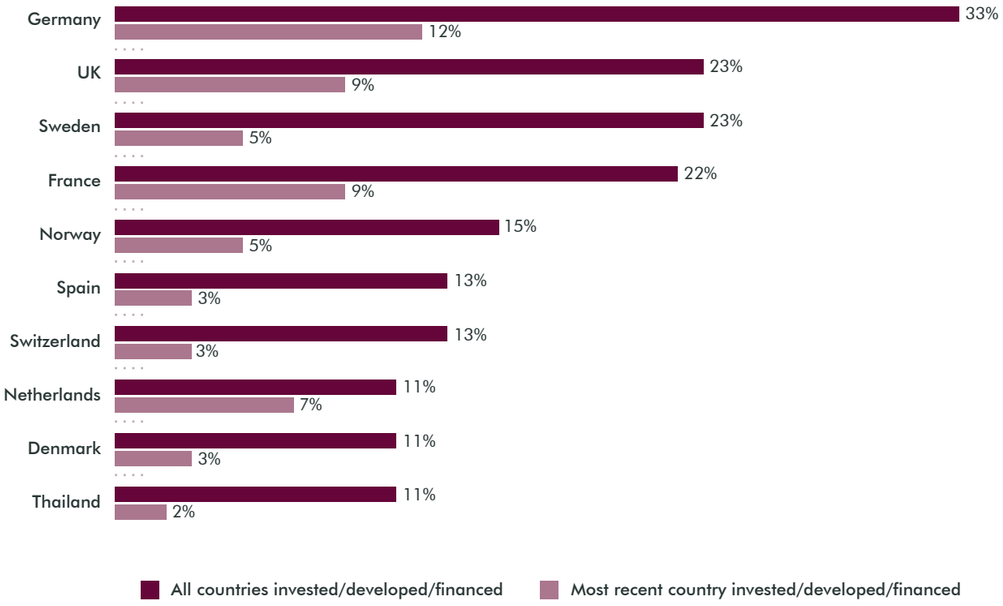
"The renewables market in Asia is being driven in part by structural energy shortages rather than purely environmental factors," says Evan Stergoulis, partner in the global energy sector at Watson Farley & Williams.

"For example, Taiwan is reluctant to rely on nuclear power in the wake of Fukushima and there's limited scope for onshore wind because the country is mountainous. Offshore wind has become a natural choice, notwithstanding typhoon and earthquake risk. The structural need for energy, the declining cost of offshore wind and the ability to build up its own local supply chain have really kicked off the programme."

Japan is following suit, albeit a bit more slowly, says Stergoulis: "The Japanese government acknowledges that reliance on fossil fuels and nuclear is not sustainable. This is partly driven by green concerns, but it's more to do with a structural change in the energy mix."

Similarly, Linh Doan, partner in Watson Farley & Williams' global energy sector in Vietnam explains that, to date, Vietnam has been reliant on conventional and hydropower, but with international

FIGURE 3: In which countries have you directly invested in, developed or financed a renewable generation project? And in which country have you most recently done so? *(Top results shown)*



banks increasingly unwilling to finance coal projects, combined with the demand for power in the country forecast to grow at 10% annually, the development of a renewables market in Vietnam is essential.

Not all change is structural, however, and some shifts to renewables can be attributed to environmental factors. As Christopher Osborne, a corporate partner in Watson Farley & Williams' global energy sector in Bangkok, highlights, the expansion of renewable energy in Thailand reflects aspirations for cleaner energy sources to meet anticipated increases in demand. This is evident in the recent increase of non-hydro renewable targets from 20% to 30% by 2036[7], as well as protests against coal projects that prevented the expansion of two coal fired power plants that would have generated 2,800MW.[8]

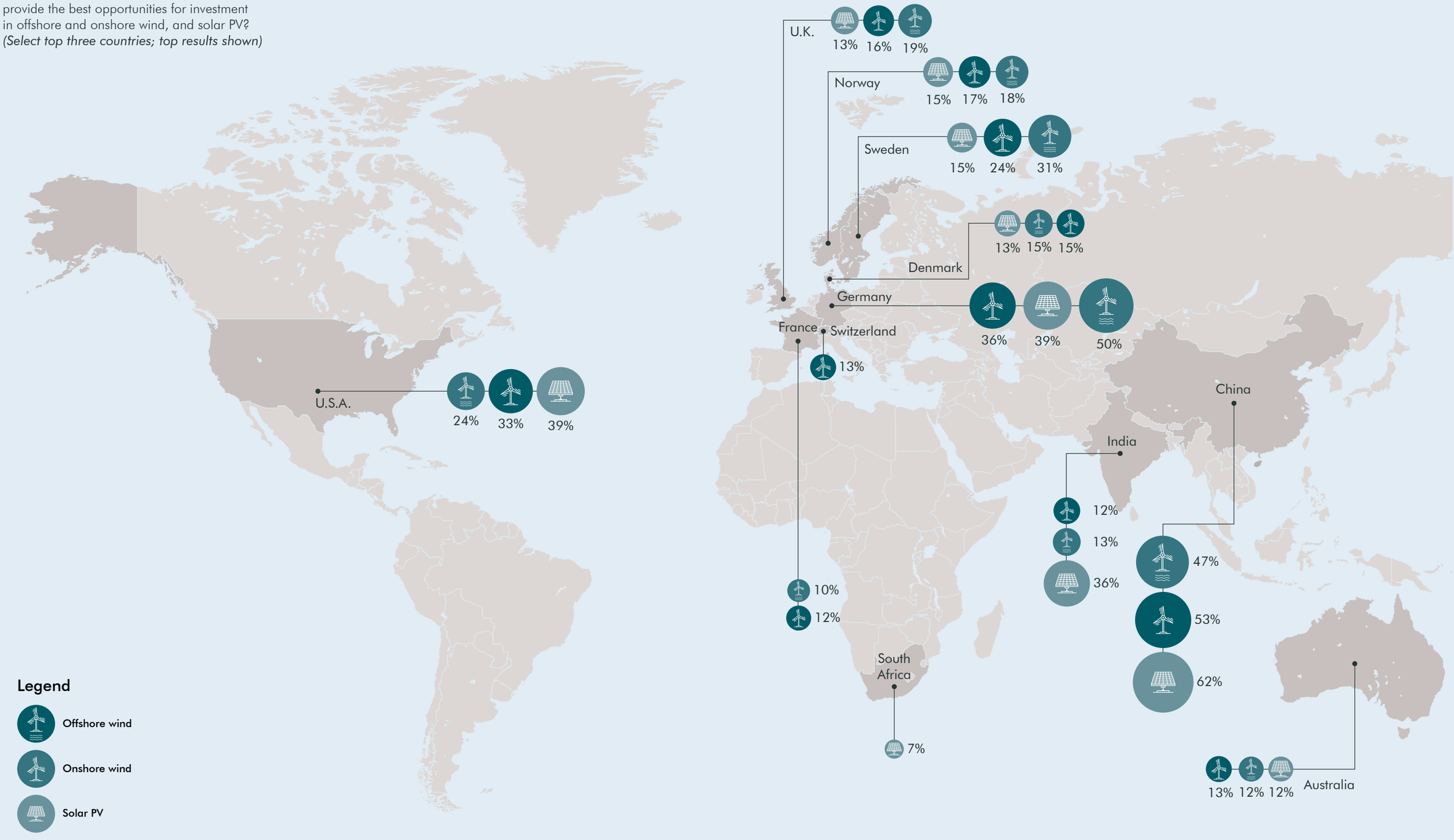
Recent developments – including EDF's landmark agreement with state-owned China Energy Investment Corporation to jointly develop an offshore wind power project[9] – also suggest that China's traditionally closed renewables market is opening up and investors are taking note, although opportunities remain limited.

This balance between the enormous potential of the Chinese market and the difficulty for foreign investors is well understood by Stergoulis, who notes: "China is a big market, but it's more of a Chinese-to-Chinese market and it's difficult to access for foreign investment."

This insight is well supported by the survey results. While half of respondents in our survey believe the best offshore wind investment opportunities will be offered by Germany, China comes a close second and it leads the pack in onshore wind with more than half seeing it as providing the most attractive investment opportunities – well ahead of Germany. And with solar PV, China's lead is even more decisive: two-thirds of respondents rank it best for investment opportunities versus just over a third selecting the US and Germany.

These results strongly indicate the market shares our view that while opportunities to invest in China are large, and respondents view China as being one of the most attractive investment opportunities, fundamentally it is still a challenging market to break into for foreign investors and, in the short term, opportunities in Asia may lie elsewhere.

FIGURE 4: Which countries do you think will provide the best opportunities for investment in offshore and onshore wind, and solar PV?
(Select top three countries; top results shown)



CHAPTER TWO

THE IMPACT OF SUBSIDIES

As renewable energy becomes the norm, backed by subsidies and other forms of support, governments are now assessing whether such subsidies are still required. But what does a shift to "subsidy-free" mean for M&A and project financing in the sector?

Governments across Europe are looking to wind down subsidies for renewables projects. The sector's maturity and lower costs are making the political case for subsidies harder to justify. In short, the sector is under pressure to go it alone.

Market participants are somewhat divided on the impact of any subsidy reduction or removal. For example, our survey suggests that 18% of respondents see a move away from subsidies in Western Europe as advantageous for longer-term decision making. While seemingly counterintuitive, this is likely to reflect the fact that, while government support has played a big part in growing renewables, it has also left the sector vulnerable to policy shifts.

However, it would be an oversimplification to see subsidy withdrawals or reductions alone as the primary cause of this shift in sentiment. Instead, the increasing maturity of renewable energy markets – of which subsidy withdrawals and reductions are a symptom – is boosting confidence among lenders and buyers.

Subsidies, support and M&A activity

There is a clear move towards subsidy-free development in both Western Europe and the Nordics, and most respondents in our survey believe this will have no impact on M&A opportunities in those regions. Indeed, a significant proportion see subsidy reductions as having a positive impact both in Western Europe (18%) and the Nordics (20%). This suggests that purchasers are comfortable with the risk and have been able to build a subsidy-free renewables market into their revenue forecast models.

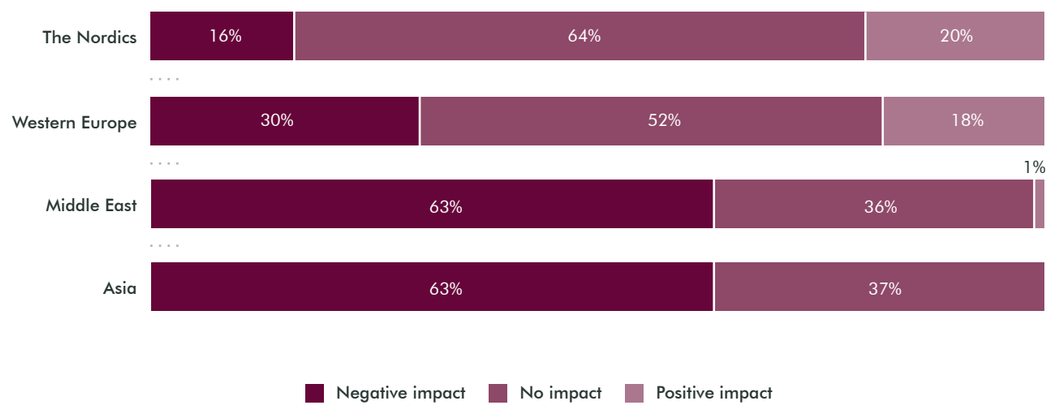
"The renewable energy sector in Europe has already adjusted itself to changing subsidies and is no longer dependent on them for development," says the managing director of a project financier based in Finland. "M&A activity in renewable energy is strong and is a very attractive option for investors, especially institutional investors. Renewable energy is turning out to be a great opportunity for alternative investment that offers long-term, high-value returns for corporates and power companies. It gives them the diversification they need while also promising growth."

The director of corporate strategy and development at an independent generator/power producer in Germany agrees: "Subsidies in Europe now really do not play a big role in renewable energy development. They have become cost competitive through innovation and strict government policies regarding carbon emissions. Companies and investors understand its potential, so they will increase their investments in renewable energy, which will lead to increased M&A activity."

In fact, the outlook for European renewables M&A activity is so promising, according to the managing director of an investment firm based in Switzerland, that there is a call from some companies and investors to cut subsidies entirely "so that renewable energy can be free from government involvement, which will make the industry more robust and open".

The renewables market in Asia and the Middle East, by contrast, is not as mature and almost two-thirds of respondents argue that a reduction in subsidies would have a negative impact on M&A opportunities in both regions in the short term. A reduction in subsidies and support will naturally slow down growth in renewable energy, making it difficult to sustain M&A activity.

FIGURE 5: How do you think a reduction in subsidies or other support might impact M&A opportunities in the renewables sector in the next two years in the following regions?



"In Asia, cost is the primary driver and, in such a young market, any decrease in subsidies will create a slowdown in the market as a whole, and this in turn will impact M&A activity," says Osborne. He further explains that subsidy decreases in one Asian country can result in an internal slowdown but increased activity elsewhere in the region: "A recent absence of subsidised PPAs above 10MW with Thai state offtakers has resulted in an increase in outbound M&A activity as Thai developers look to Myanmar and Vietnam for both greenfield and operational wind and solar projects."

Impact on project finance

As with M&A opportunities, our survey shows that renewables industry players in Europe believe that a reduction in subsidy support would have no short-term impact on the availability of project finance.

This positive perspective is also indicative of a maturing market, in which early adopting banks will remain, but will now also be joined by other lenders that have an increasing desire to bulk up their green and sustainable financing portfolios – renewables projects tick the right boxes.

And as the director of corporate strategy and development at an independent generator/power producer in Germany points out, "regardless of subsidies or government support, project financing in the renewable energy sector in Europe is going to increase".

22%

of respondents believe that a reduction in subsidies or other support could have a positive impact on the availability of project finance in Western Europe in the next two years

A notable proportion of respondents go so far as to argue that a decrease in subsidy support could increase the availability of project finance in Western Europe (22%) and the Nordics (30%), and this mirrors the response seen with regards M&A opportunities.

The message is clear: renewable energy projects are becoming stable enough in Europe to no longer require subsidies to maintain their growth. For a growing number, removing subsidies is seen as a vote of confidence. Given the historic reliance on subsidies, this seems surprising, but it suggests that once grid parity is reached and subsidies are no longer required, more lenders will be willing to lend and there will be one less hurdle (accreditation or equivalent) to overcome. The focus is shifting away from subsidies and on to achieving grid parity, as

well as the use of longer-term CPPAs to manage merchant risk and allow more consumers to take advantage of a renewable energy mix.

In Asia and the Middle East, the outlook for project finance is once again markedly different and again, it is a question of maturity. The adoption of renewables in Asia and the Middle East is still relatively nascent and it is too early for these regions to be weaned off subsidies entirely. Asia's vast renewables market is also much more heterogeneous than in Europe and investors may be wary of entering this relatively new territory.

The fragmented nature of Asia's renewables markets is probably most apparent among the 10 countries of the Association of Southeast Asian Nations (ASEAN).

All 10 ASEAN members have set a target of achieving 23% of their power generation from renewable energy sources by 2025.[10] At present, only five ASEAN members, namely Indonesia, Malaysia, Thailand, Singapore and, most recently, Cambodia, have moved to some sort of competitive bidding process for renewable energy generation projects. Rather than signalling a stable renewables market and a new opportunity for investment, any hint that subsidies may be withdrawn is going to be scrutinised very carefully.

At the same time, project finance is not a new arena for countries in the region. Options have been available to fund infrastructure projects throughout Asia for years.

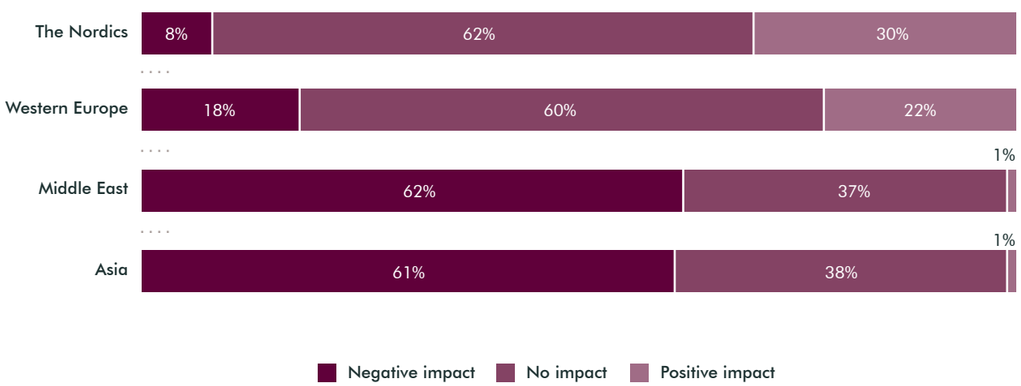
"The project finance market in Asia is generally mature," says Shawn Er, a finance partner in Watson Farley & Williams' global energy sector in Singapore.

"It may not have been significantly used in the past for renewables projects, but the same considerations and principles apply and the same project finance teams involved with the financing of renewable projects have been financing other infrastructure projects, including conventional power generation projects, on an ongoing basis – in some countries, like Indonesia and Vietnam, it's been happening for over a decade."

The difference is that, with the exception of a few outliers, very few renewables deals in the region have been done on a "traditional" non-recourse project finance basis in the manner with which international European banks are familiar. This may be a function of the size of the earlier Asia-based developers and the familiarity of the regional banks with the asset class.

According to Er, banks did not historically view renewables as a separate asset class. Instead, many regional commercial banks and some international ones, treated renewables as a subset of their regular corporate lending business. Developers were often offered corporate lending products rather than project finance, mostly because early renewables projects were not deemed to be sizeable enough or sufficiently bankable. An exception to the above approach would be the renewable projects that were funded by multilateral agencies such as the Asian Development Bank.

FIGURE 6: How do you think a reduction in subsidies or other support might impact the availability of project finance in the renewables sector in the next two years in the following regions?



This may explain why so many respondents in our survey believe that any reduction in subsidy support in Asia (61%) and the Middle East (62%) will have a negative impact on the availability of project finance in those regions.

At the same time, 38% of our respondents believe that a decrease in subsidy support in Asia will have no impact on the availability of project finance.

"While this is significantly lower than Western Europe and the Nordics, it is higher than anticipated," says Er. For example, the initial proposed reduction of Taiwan's offshore wind FIT by 12.71%, announced in 2018, created a significant backlash in the industry and resulted in some developers announcing that they would reconsider their investments. Since then, the government has adjusted its plans and reduced FITs by just 5.71%.[11]

"All of this suggests a market that is largely still not prepared to thrive in a subsidy-free environment," he adds.

Merchant risk

Clearly, any reduction in subsidies and other forms of support can have significant implications for project finance and investment, but both are still viable without subsidies, provided merchant risk is properly managed or mitigated.

The financing market is adjusting quickly to the idea of a post-subsidy world.

"Given the more market-driven approach and rapid development happening in the renewable energy sector, the financing market is adapting to the merchant risk involved quite quickly," says the head of finance at a developer in France. "The energy market is transitioning and the financing market has to develop ways to manage that risk effectively to make a competitive offer for investment."

However, some respondents question whether the financing market is moving quickly enough to accept a greater degree of merchant risk.

Opinions on the financing market vary greatly among the different respondent groups: 58% of financiers think it is adapting quickly, but not quickly enough versus just 30% of independent power producers/ generators and utilities respondents.

As for the developer/investor market, 53% of respondents think it is adapting quickly, but not quickly enough to accept more merchant risk. Financiers and investors are the most likely to say this (both 60%), while independent power producers/generators and utilities are the least (45%).

58%

of financiers believe the financing market is adapting to accept a greater degree of merchant risk quickly, but not quickly enough

However, some are circumspect about rushing headlong into uncharted territory: "It takes time for the investor market to understand the application of risks," cautions the head of finance at a utility based in the Middle East.

Projects that rely on exposure to wholesale electricity markets, without the safety net of price guarantees, present a new type of risk for lenders. This is likely to have repercussions throughout the financing ecosystem. Banks, for example, are likely to respond to increased merchant risk by requiring cash sweeps, potentially making renewables a more challenging proposition for equity investors. This, in turn, is likely to stimulate demand for alternative non-bank finance.

While a majority of respondents in Europe believe that project finance will remain available in a subsidy-free market, over half of respondents overall think that cash sweep or other tenor reduction mechanics will become a standard feature of project finance loans for projects that are exposed to merchant risk. This rises to 68% among independent power producers/generators and utilities.

As with the evolution of any new business model, new approaches and protections will need to be tested to determine what works and what does not. The wind subsector underlines this point: 15 years ago, success hinged on predicting wind resources and understanding turbine technology; today, reliable technical modelling is a given. The challenge now is predicting power prices and having the necessary tenor reduction mechanics in place to mitigate risk.

FIGURE 7: How well do you think the financing market is adapting to a greater degree of merchant risk?

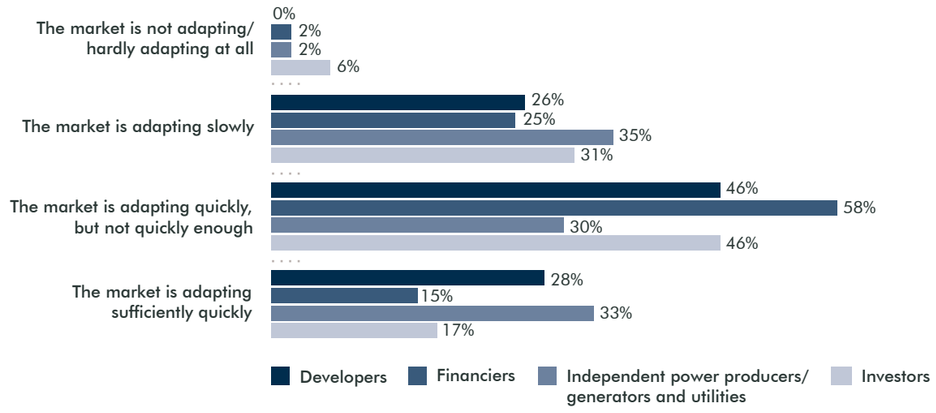


FIGURE 8: How well do you think the developer/investor market is adapting to a greater degree of merchant risk?

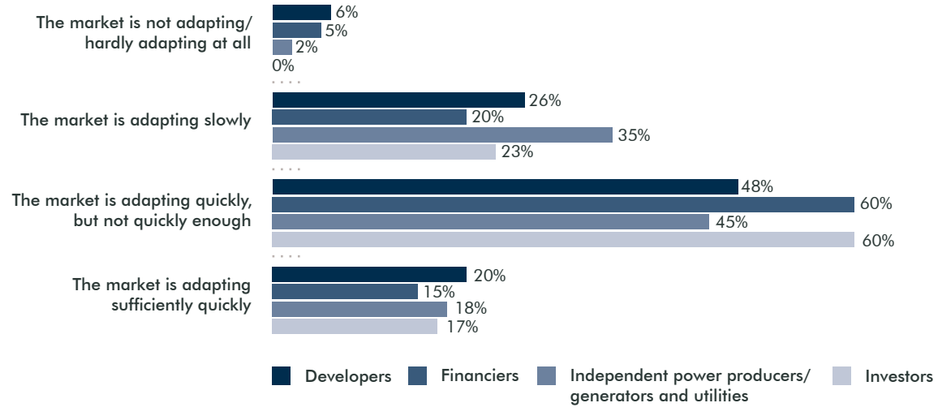
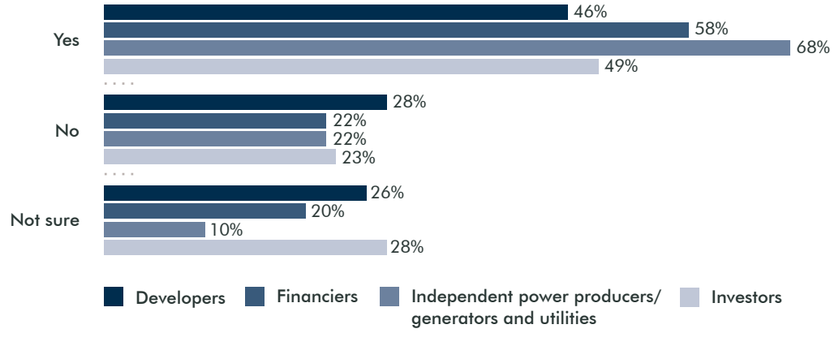


FIGURE 9: Do you think cash sweep or other tenor reduction mechanics will become a standard feature of project finance loans for projects that are exposed to merchant risks?



CHAPTER THREE

OPPORTUNITIES AND RISKS IN SUBSIDY-FREE INVESTMENTS

The outlook for subsidy-free investment opportunities is bright – it's simply a matter of where and when.

Those working on the renewable energy frontlines, particularly in Europe, can already see a future with subsidy and support-free investment opportunities in solar PV and onshore and offshore wind.

"The main driver behind subsidy-free projects is the levelised cost of electricity (LCOE) coming down," says Jordan at Watson Farley & Williams. "Fundamentally, LCOE is driven down by lower capex/opex and greater simplicity in the permitting process."

In Germany, for example, the relatively cumbersome permitting process has contributed to higher LCOE and has slowed the reduction of capex in onshore wind compared to other jurisdictions. But Germany is on the brink of its first subsidy-free projects and, in particular, solar PV projects have already enjoyed a degree of subsidy-free success.

What is particularly interesting is the market's bullish view of offshore technology. Respondents in our survey clearly see offshore wind projects as capable of thriving in a post-subsidy world. This is despite the fact that they are significantly more complex and require much higher capex than either onshore wind or solar. Subsidy-free or zero-bids were pioneered in Germany's 2017/2018 auctions, which produced the world's first subsidy-free bid for offshore wind, and many other jurisdictions have since followed suit.

"Capex levels need to come down to the point where a project can thrive in a subsidy-free environment, based on the prevailing power prices. Those who have made zero-subsidy bids in offshore auctions are, to some extent, speculating on capex coming down by the time they have to deliver the project," adds Jordan. "We have yet to see a fully subsidy-free offshore project that has achieved its commercial operation date, when the system becomes fully operational and can begin selling power under the terms of the PPA."

The right time and place to invest

Future investment opportunities vary significantly by geography. Attractive subsidy-free investment opportunities may be within reach in Europe, but local governments throughout Asia are proceeding at very different rates.

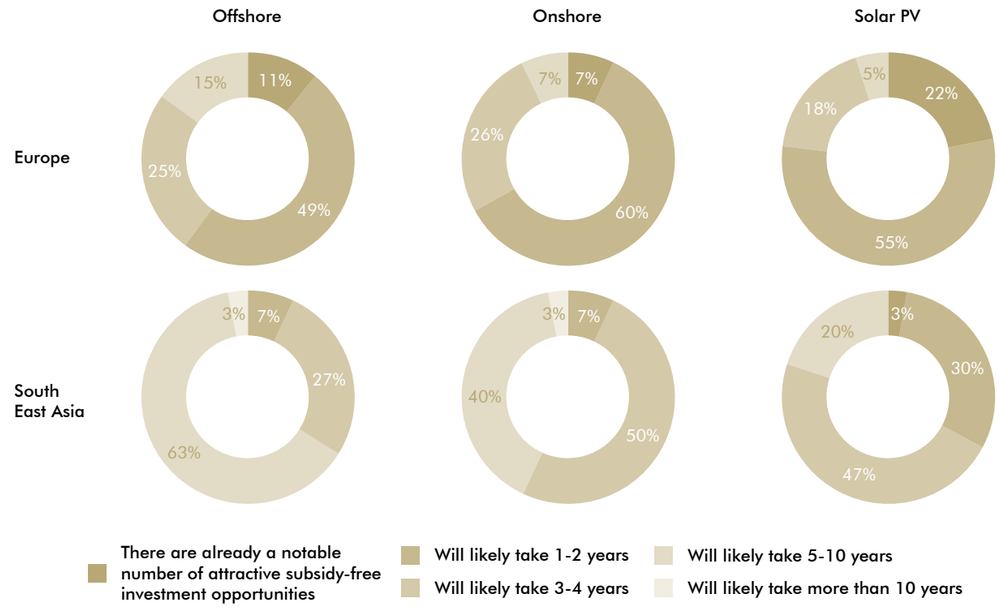
While China has announced it will prioritise subsidy-free wind and solar[12] – and reduce curtailment rates[13] – some governments are proceeding with caution, even where renewables in Europe have reached grid parity. But they are taking steps, and there is clear interest among investors and financiers alike.

"Investors are deploying hundreds of millions in equity in the Asian market," says Stergoulis. "In countries like Taiwan, where you have political risk and less currency liquidity, the export credit agencies are unlocking project finance: without the export credit agencies, you wouldn't have large financings going through. In more established markets like South Korea and Japan, there is plenty of project finance. But all of this investment relies on tariffs – otherwise no one would take the risk."

These different levels of regional optimism are clearly shown in our survey findings: 60% of respondents in Europe say that it will only be a couple of years before a number of subsidy-free investment opportunities emerge for onshore wind, while only 7% of South East Asia-based respondents say the same.

The homogeneity of Europe's technology timeline is also notable. Solar PV, onshore wind and offshore wind are all marching (more or less) in step, with all three expected to offer subsidy-free investment opportunities in the near term among survey respondents.

FIGURE 10: When do you think a notable number of attractive subsidy/support-free investment opportunities are likely to become available for the following renewables? *(Select one for each)*



In South East Asia, by contrast, subsidy-free opportunities are expected to emerge one after the other over a longer period, with solar PV first, followed by onshore wind and finally offshore wind.

Almost two-thirds of respondents say it will take anywhere from five to ten years for subsidy-free offshore wind investment opportunities to reach significant numbers.

Regulation: beating the blockers

What is holding back the development of subsidy-free projects? Overall, it's a mixed picture, which is to be expected given the bullish outlook on subsidy-free opportunities. Lenders are willing to take a degree of risk and allow developers operational flexibility to drive down costs through the lifetime of the project, and this trend is likely to continue.

For example, economies of scale are particularly important in bringing down capex as a percentage of total spend in offshore wind projects. But if developers are going to drive down capex by

FIGURE 11: Which of the following do you see as the biggest obstacles holding back the development of subsidy/support-free projects? *(Select top three)*

scaling up, then a reasonable and stable regulatory environment surrounding onshore grids becomes even more important. This is an area where developers may still be dependent on the local government, even in a subsidy-free environment.

"In Europe, the stable regulatory environment is already allowing for a transition to subsidy-free projects," says Jordan. "These projects are often backed by CPPAs to help stabilise the cash flow – and we're already seeing these in Spain and the Nordics."

There is also the question of regulation as it relates to capacity: is the existing grid capable of consuming the electricity that will be generated by a hypothetical offshore wind project? If not, there is significant curtailment risk and this is even more acute in offshore wind projects, which have a single point of access to the grid.

As Jordan notes: "If the grid has not been sufficiently upgraded, it may not be possible to feed in that electricity on a technical level. Therefore, understanding the regulatory answers to curtailment risk is becoming increasingly important, as well as helping evaluate the consequences of the offshore project being compensated for electricity it is not able to feed in because the grid has not been sufficiently upgraded."

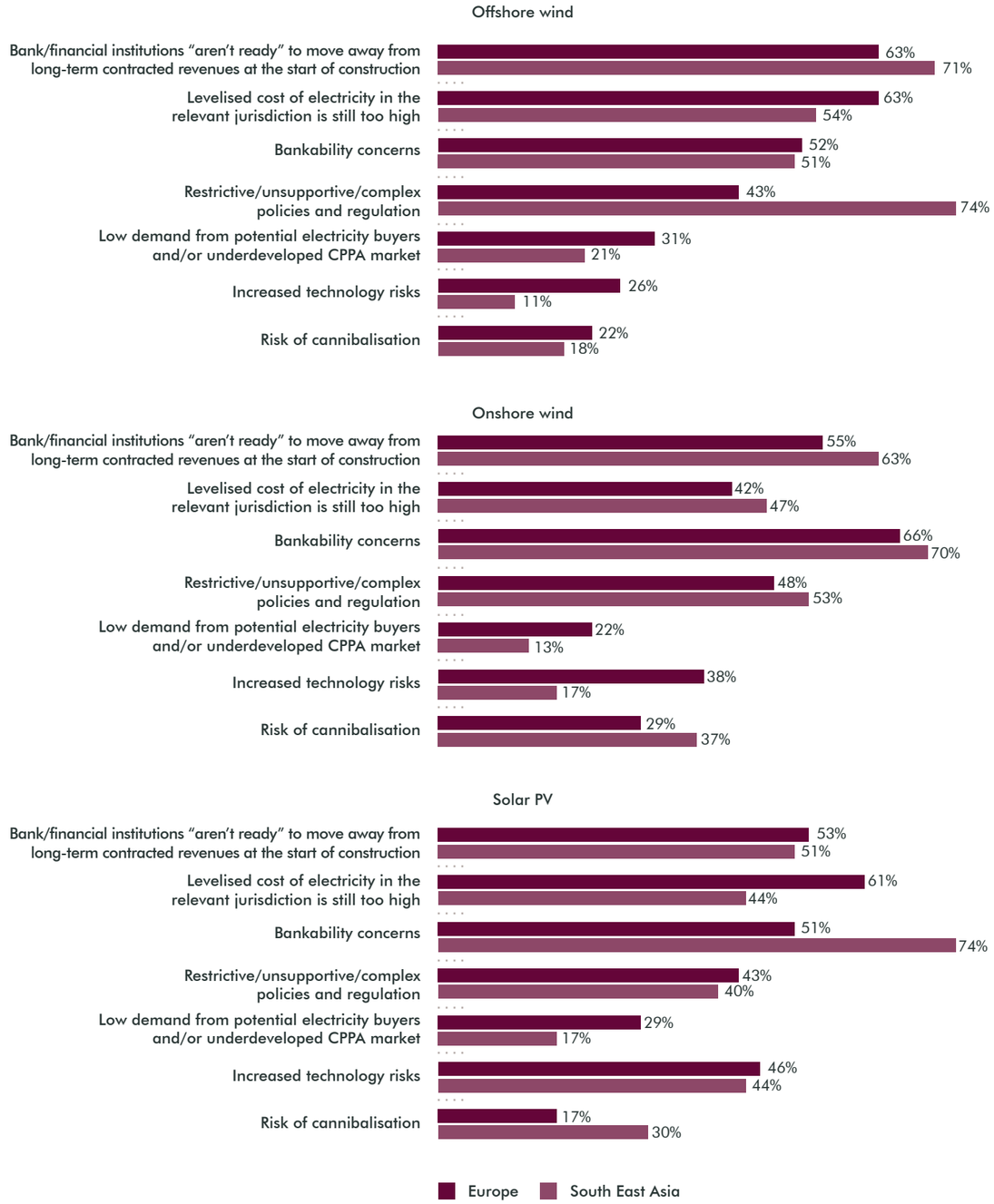
A different story emerges in Asia, where restrictive, unsupportive and complex policies and regulations are clear obstacles, particularly for offshore wind projects.

"EU regulations have an impact on all countries within the EU, but there are currently no equivalent supranational regulations in Asia," says Jon Thursby, a projects partner in Watson Farley & Williams' global energy sector in Singapore. "The regulatory regimes of the countries hosting renewables projects can vary dramatically. Further, although the regulatory regimes in some countries in Asia, such as Taiwan, are well established, regimes elsewhere in the region were only introduced very recently or are still being developed."

Policy and regulation to support offshore wind are still works in progress in the region. Thursby highlights that "Japan has only recently passed legislation on setting up a national framework for offshore wind that, among other things, addresses fishing rights, which are particularly contentious in Japan".

Meanwhile Doan adds that, in Vietnam, there is currently uncertainty over which government entity is ultimately responsible for granting offshore sea rights, as well restrictions on mortgaging assets and sea sites to lenders.

FIGURE 12: Which of the following do you see as the biggest obstacles holding back the development of subsidy/support-free projects for the following renewables? *(Select top three, regional splits)*



Supportive and unambiguous policies and regulations are vital for the development of offshore wind, which is complex and risky. While the market is demonstrably comfortable dealing with technology risk (in Asia, adaptations include dealing with deep water installations and managing typhoon resistance), it is much less sanguine about the potential impact of regulation. Three-quarters (74%) of respondents in the region cite this as a blocker.

The sense that Asian countries need to up their regulatory game is not restricted to offshore wind, as the Mumbai-based managing director of a project financier points out: "Because of poor policy implementation by regulators and complex policies, renewable energy investments continue to remain in the nascent stage in most of Asia. New investment and progress in development will remain slow until more effective policies are implemented. We need regulations and policies that reduce the risks, and those policies should be flexible to adapt to new technologies and changing markets quickly."

A clear example of a successful flexible approach, and one that highlights how specific sectors in certain countries can flourish, is the deployment of solar rooftops in Thailand, which has resulted in subsidy-free projects.

As Osborne notes, "solar rooftop developers are in fact selling electricity to commercial users at a discount to the prevailing government tariffs".

Of the obstacles identified, it is encouraging to see the relatively low rank given to technology risk and low power demand among survey respondents in both Europe and Asia. As renewable projects and the underlying technology are better understood by lenders, covenant packages in respect of the operation of projects are likely to be loosened, allowing developers to improve their projects.

As Stewart points out, "this has already been seen in covenant packages, which potentially allow UK solar projects to include a battery storage component retrospectively".

74%

of respondents in South East Asia believe that bankability is one of the biggest obstacles holding back the development of subsidy-free solar PV projects

Bankability concerns are holding back subsidy-free renewables projects

The transition to subsidy-free renewables is one of the biggest systemic changes the industry has faced to date. The situation is complicated by the speed with which some renewables are approaching grid parity. In the case of utility-scale solar PV, for example, the price has declined so fast that it is already cheaper than coal in some geographies.

The shifting interplay of costs, revenue and subsidy for each renewable technology makes weighing up the bankability of projects increasingly complex.

"The key issue in Asian renewable project finance is the bankability of any given project in the particular jurisdiction and the credibility of the developers involved," says Er.

"Government subsidies, such as feed-in tariffs, increase the bankability of those projects for international banks, providing certainty of revenue. And while the fact that many banks have a mandate to increase their participation in green financing is helpful to the growth of the industry, it will not be enough to enable governments in Asia to withdraw subsidies for renewables projects entirely."

Looking at onshore wind, two-thirds of respondents overall agree that bankability concerns are the biggest obstacle holding back the development of subsidy/support-free projects.

A similar percentage of respondents say that subsidy/support-free offshore wind projects are being held back by banks and other financial institutions that aren't ready to move away from long-term contracted revenues at the start of construction.

Just over half of European respondents also believe that bankability concerns are an obstacle for solar PV – rising to 74% among respondents in South East Asia. Meanwhile, 61% of respondents in Europe say the high LCOE in the jurisdiction is an obstacle to subsidy-free solar PV projects.

Lack of subsidies: the impact on returns

The renewables market is somewhat divided over the impact that a lack of subsidies might have on the anticipated internal rate of return (IRR) in investments, but the overall trend is positive.

"We understand the true potential of renewable energy and believe that it will not depend on subsidies or government support in the future," says the managing director of a project financier in Finland. "We are among those investors who believe that subsidies restrict the potential of renewable energy, so we are open to taking risks when investing in projects."

A healthy proportion of survey respondents seem to agree: nearly a third say it would not tighten the assumed IRR. And even those respondents who predict that subsidy-free projects will temper IRR expectations cannot be assumed to be ruling out investment.

As has already been pointed out, a majority of respondents believe there will be attractive subsidy-free investment opportunities for onshore, offshore and solar in the very near future, although it is open to debate whether these respondents have assumed they will be able to mitigate increased levels of merchant risk through alternative instruments, such as CPPAs.

Investors in our survey are the ones most likely to believe a lack of subsidies will tighten the anticipated IRR, with 89% saying this is the case versus 58% among financiers at the other end of the scale. Investors are also most likely to point to subsidy-free projects tightening the assumed tenor of available financing (71%).

In terms of the impact of subsidy removals on technological innovation, the regional differences highlighted in our survey findings are stark: 84% of respondents in South East Asia believe that a lack of subsidies/support/benefits would slow the pace of technological advances in the sector versus just 16% in Europe. In fact, 42% of respondents in Europe argue it would speed up technological advances.

As the subsidy-free era draws closer, especially in Europe, attention is rapidly turning to what replacement long-term, sustainable and guaranteed sources of revenue will be available to renewable energy projects.

More detailed questions on the role of PPAs and new trends in the market, particularly CPPAs, are becoming increasingly important.

FIGURE 13: Do you think that if a renewable project were subsidy/support-free, it would result in a tightening of the assumed IRR?

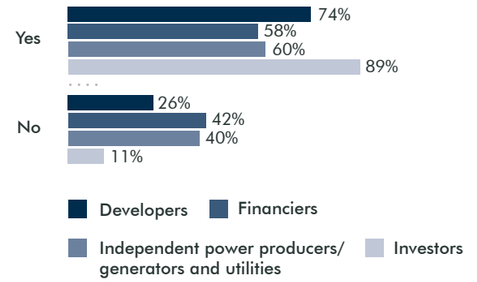


FIGURE 14: Do you think that if a renewable project were subsidy/support-free, it would result in a tightening of the assumed tenor of any available financing?

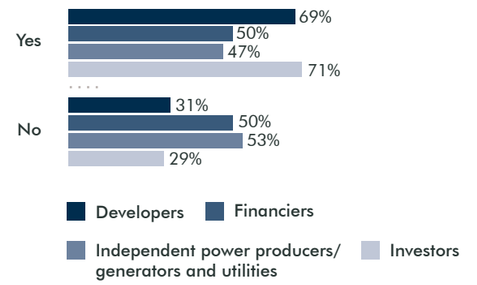
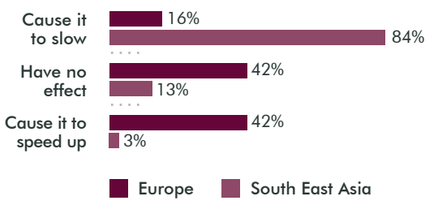


FIGURE 15: How do you think a future reduction in subsidies/support and benefits for renewable generation projects would affect the pace of technological advances in the sector?



CHAPTER FOUR

CORPORATE POWER PURCHASE AGREEMENTS

CPPAs are on the rise as more businesses strive to improve their green credentials while also controlling their energy costs. But there are still obstacles to be overcome.

The growth in the use of renewable CPPAs is continuing to make waves in the market. The likes of Google, Mercedes-Benz, Unilever and Amazon have been grabbing headlines over the past few years with their entry into renewable CPPAs – Amazon alone has now entered into CPPAs for a reported 1.3GW of green generation capacity globally.[14] The influence of these pacesetters should not be underestimated.

"Clients are increasingly interested in the potential for corporate offtake. This is no longer a niche position, and even relatively traditional players are now looking at this for a number of their projects," says Diez.

Interest in CPPAs is not limited to European or US markets either, and there is an expectation that they will also develop a substantial role in Asian markets in the near future.

"There has been an increase in CPPAs over the past couple of years and this will prompt better acceptance rates in the coming years as well," says the CEO of an independent generator/power producer in Singapore.

CPPAs: what are they?

A renewable CPPA is an agreement for the sale and purchase of electricity between a renewable generator (such as a windfarm operator) and a company that needs to buy electricity for its own use (as opposed to a supplier or reseller that intends to on-sell the electricity).

CPPAs are usually entered into on the basis of an electricity price that is fixed or otherwise limits the parties' exposure to movements in the market price, e.g. via a cap and collar arrangement.

Drivers of growth in CPPAs

CPPAs are attractive to both offtakers and generators alike because they meet multiple goals, including access to finance, carbon reduction, price and revenue certainty, security of supply and risk control.

For renewable generators and their financiers, a key attraction of a CPPA is predictable long-term revenue. This helps to secure funding for new projects, which is increasingly important as government subsidies for renewables in Europe and elsewhere are slowly withdrawn.

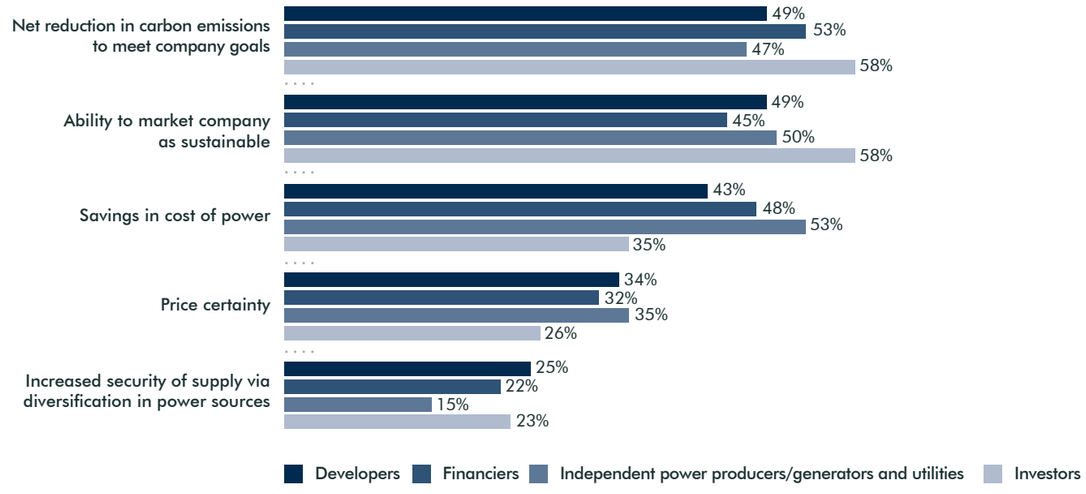
Long-term revenue certainty can also be obtained by generators entering into long-term PPAs with traditional utility offtakers on the basis of fixed or floored prices. While this is a stable, growing market, the scope for significant increases for such contracts is viewed as relatively limited compared to that for the young CPPA market.

CPPAs can also provide generators with access to higher electricity prices: while utility counterparties come to PPA negotiations benchmarking against wholesale prices, corporate counterparties, particularly smaller ones, are often benchmarking against retail.

Some financiers also look to CPPAs to provide risk diversification within their portfolios.

"With the utility-offtake model, the ultimate credit for lenders ends up being a relatively limited list of utilities with similar exposures and more or less correlated financial health. Injecting corporate offtakers into lenders' portfolios broadens their exposures to a wider and less correlated group of credits," explains James Harrison, senior associate in Watson Farley & Williams' global energy sector in London.

FIGURE 16: Which of the following do you believe are seen by offtakers to be the most important benefits to committing to a CPPA? *(Select top two)*

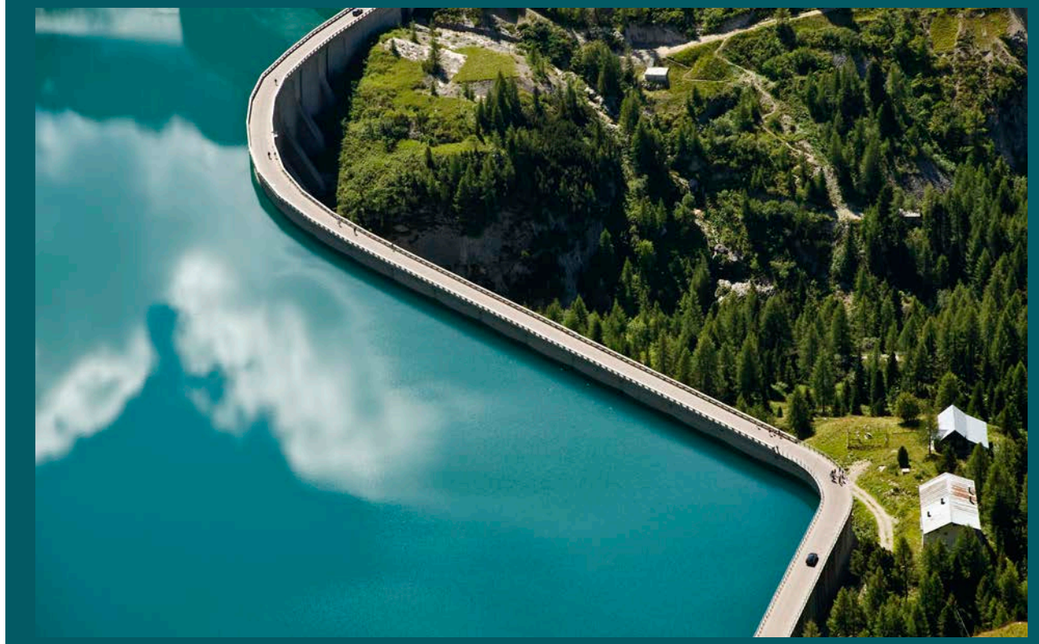


For offtakers, CPPAs offer a similar list of potential benefits. CPPAs can provide offtakers with access to cheaper power (as compared to retail pricing), and greater certainty of cost and security of supply over long-term horizons than would be available under conventional electricity sourcing arrangements. This is particularly attractive to energy-intensive businesses.

But it is the need to both be green and to be seen to be green that is also a key draw of CPPAs for offtakers, driven in large part by shifts in consumer expectations around climate change and corporate responsibility. Half of all respondents back up this idea, agreeing that a net reduction in carbon emissions to meet company goals and the ability to market the company as sustainable are two of the most important benefits to offtakers committing to a CPPA.

While we expect that, over time, these would give way to other considerations, these are currently the primary drivers for offtakers.

"The sustainability provisions that are now available have been one of the main reasons for the surge in CPPA uptake and changes in pricing structures aimed to be beneficial to the corporate setting would be one of the key drivers," says the director of M&A at a utility based in Spain.



A focus on synthetic PPAs

Synthetic PPAs are already used in the US and are now being adopted in Europe, especially by the power-trading arms of utilities. A synthetic PPA is a derivative instrument, in some cases governed by an ISDA (International Swaps and Derivatives Association) Master Agreement.

Under a synthetic PPA, the offtaker hedges the generator's exposure to fluctuating electricity prices.

Currently, the most prevalent synthetic PPA model comprises two separate hedges for two consecutive periods.

In the first period, price certainty for the generator is provided by a fixed-for-floating swap (similar to a contract for difference) achieved by fixing a strike price. If the spot price is less than the strike price, the offtaker pays the difference to the generator and vice versa.

In the second period, price protection for the generator is provided by a put spread or collar transaction. This is defined between specified upper and lower strike prices.

A number of issues can arise, in particular where the generator and offtaker enter into a route-to-market (RTM) agreement alongside the synthetic PPA.

A common issue is the potential requirement for both generator and offtaker to make payments to each other, at different times, under both the RTM agreement and the hedges. This results in a more complex credit analysis for both parties, as well as for project finance providers. It is therefore important to ensure the effective rights of set-off between the two contracts to minimise credit risk and to ensure netting of payments can always be achieved.

Other points require consideration. First, the synthetic PPA and the RTM agreement should be regarded as separate contracts capable of existing independently, unless specific cross defaults are included. The relationship between the contracts – and their ability to survive the termination of the other – is always subject to negotiation.

Second, since RTM agreements are generally in the nature of "take-and-pay" contracts, whereas virtual PPAs are frequently entered into on the basis of a fixed notional generation profile (agreed prior to construction), particular attention needs to be given to the generator's ability to continue to make full payment under the virtual PPA, even where those payments are not supported by RTM revenues from actual generation.

Third, thought is needed about how any renewable certificates will be transferred to the offtaker, if required. Where the offtaker also provides RTM services, they could be transferred through the RTM agreement.

Finally, the derivative nature of the PPA means the generator and offtaker will have reporting obligations under EMIR and REMIT in some jurisdictions.

"Synthetic PPAs offer a mixture of flexibility and practicality to the market that is now becoming more widely recognised and we expect to see their growth accelerate in the near to medium term outside the US," says Rob McBride, a partner in Watson Farley & Williams' global energy sector based in London and specialist in energy-related derivatives.

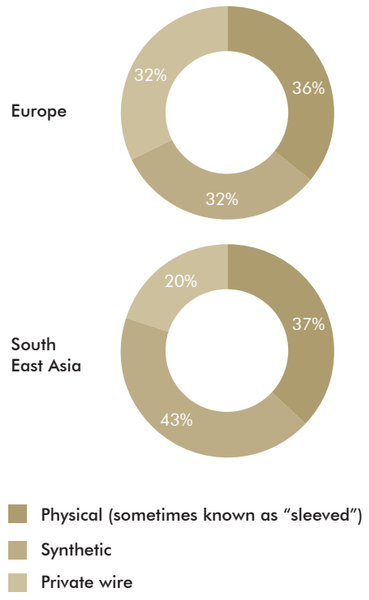
Varieties of CPPAs

CPPAs can be structured in three ways. Private wire (or behind-the-meter) CPPAs are the simplest physical CPPA structure: the generator and offtaker use a private connection, so the grid itself is not used. This is however only feasible where the generator and the offtaker are in relatively close proximity and as such the structure is of relatively limited application.

Sleeved CPPAs are more complex. Electricity is exported from the generator to the offtaker by a licensed electricity supplier via the grid. The supplier is paid a sleeving fee for its involvement. It is the most flexible of the two physical CPPA structures, but it is only feasible where the generator and offtaker are connected to the same grid.

Synthetic (or virtual) CPPAs do not involve a physical connection and as such are more flexible. The generator sells electricity to a supplier at a spot price, while the offtaker buys electricity from a supplier at a spot price. (Sometimes, the generator and the offtaker sell and purchase power to and from each other at a spot price under a route to market (RTM) power purchase agreement rather than using a separate supplier.) Separately, the generator and the offtaker agree, under the virtual PPA, to hedge each other against the fluctuating spot price.

FIGURE 17: Either in practice or in theory, which type of PPA contract do you/would you prefer? *(Select one)*



79%
of respondents have already considered developing, investing or financing a project that is party to a physical CPPA

Our survey does not point to a clear preference in the renewables market when it comes to CPPA structure. Respondents in Europe prefer a sleeved CPPA contract only slightly more than a synthetic one or a private wire. In South East Asia, respondents favour synthetic CPPAs slightly more than sleeved CPPAs, with private wires a relatively distant third. This reflects the fact that the choice between CPPA structures is in practice restricted by the specific attributes of the relevant projects, e.g. whether or not the generator and offtaker are physically proximate or connected to a single continuous grid.

Meanwhile, the survey shows that developers, financiers, independent power producers and investors are open minded about CPPA structures. Over three-quarters (79%) of respondents have already considered developing, investing in or financing a project that is party to a physical CPPA, while 73% say the same about synthetic virtual PPAs.

Challenges facing the broader use of CPPAs

Broadening the use of CPPAs is not without its challenges. One challenge reflects the relative novelty of CPPAs: the limited internal expertise that most corporates have at their disposal to seek out, negotiate and subsequently manage wholesale electricity purchase arrangements. This factor is pointed to by some 27% of respondents in Europe in our survey, and 32% in South East Asia.

"For an option like this to be exercised, you require technical back-up and utmost precision, and the infrastructure required and line patterns not aligning well would result in sufficient doubt to forgo the idea of the PPA and remain within secure utility ranges," says the director of M&A at a utility based in Spain.

Respondents also point to the low visibility of CPPA opportunities as putting the brakes on uptake (36% in South East Asia and 43% in Europe), while similar

proportions point to the lack of flexibility in the CPPAs available, in terms of pricing and hedging structures (36% in South East Asia and 41% in Europe). Respondents also indicate some concern about the competitiveness of CPPAs versus traditional supply contracts.

Rather than suggesting any systemic weaknesses in the CPPA market, however, the challenges outlined above – visibility, flexibility, competitiveness and technical familiarity – are more likely to be symptoms of a market that remains in its infancy. A degree of self-correction can therefore be anticipated as the market matures.

The most fundamental challenge to the wider adoption of CPPAs, however, is that of matching the volume of electrical output from renewable projects with corporate demand. Current renewable projects, particularly offshore wind projects, often have generation capacities far exceeding the demand of all but a very small number of individual corporates.

Our survey highlights the extent of the problem: almost two-thirds of respondents in Europe and South East Asia agree that a lack of generators offering CPPAs that are suitable for prospective offtakers – for example, SMEs with a relatively lower power demand – is the main reason for lower uptake in some jurisdictions.

Aggregation of offtake – potential solutions

The simplest solution, from a generator's perspective, is to sell all of the project's power to a single creditworthy buyer and for that buyer to on-sell the power to a number of corporate offtakers.

However, from the perspective of the corporate offtaker, that approach can fall foul of internal requirements around demonstrating "additionality", i.e. how readily it can be demonstrated that the relevant project would not have been constructed without the involvement of the corporate.

From a corporate's "additionality" perspective, it would ideally offtake directly from the project. However, projects have rarely offered the opportunity to do so to more than a couple of potential offtakers at a time. This reflects in large part the potential cost and complication for any generator in entering into any meaningful number of separate PPA negotiations. Within such constraints, two main structures have emerged, namely anchor-driven structures, and offtaker-consortium structures.

With an anchor-driven structure, a generator will enter into offtake arrangements with a creditworthy and sizeable buyer for a sufficient enough portion of the project's output to render the project investible. The project then sells its additional "spare" output to a smaller corporate offtaker (or potentially multiple corporates). Such structures are however not ubiquitous and, even if they were, by their nature limit the access that they provide to small-scale offtake.

With an offtaker-consortium structure, a group of offtakers join forces to aggregate their offtake requirements and act as one in negotiating their offtake arrangements with the generator. This simplifies the negotiation process for the project, while enabling consortium members to pool costs and expertise, and potentially benefit from economies of scale as regards the terms of offtake. Crucially, it allows corporate offtakers to access smaller-scale offtake.

This structure has recently generated considerable interest in Europe, where the prime example is the Dutch Wind Consortium of AkzoNobel, DSM, Google and Philips and their offtake arrangements for the Krammer and Bouwdokken wind farms.

Consortia structures, however, have their challenges. In particular, to function effectively they require the formation of a stable and equitable partnership between sufficiently like-minded members, and to be backed-up by an effective governance structure. It remains to be seen whether consortia can function effectively with significant numbers of members.

The market is ripe, then, for the deployment of innovative solutions and the involvement of new market players. On that theme, the growth of energy aggregator LevelTen Energy in the USA suggests that a model of syndicated offtake may be feasible not only in theory but also in practice. The model would see a single aggregator negotiate a PPA structure with a generator for all or part of its project's output, take the PPA structure to market and fill it with a syndicate of offtakers and also, potentially, then manage the syndicate (and transfers in and out of it) over the life of the project.

"Syndicated offtake is an enticing possibility," says Stewart. "In theory, the aggregator in that model need not be an existing participant in the electricity markets, although it will be interesting to see whether, if the model becomes more widely used, existing players in the markets move into the role. On sleeved PPA projects, for example, there may be synergies from using the same utility that provides sleeving services as the project's aggregator."

There is therefore a swathe of potential corporate demand which, until in some way aggregated, cannot be accessed directly by renewable generators.

Innovation in the market is needed to address this gap: more than half of respondents in Europe and South East Asia cite alternative CPPA arrangements, including consortia and joint tenancy, as being one of the single most important factors in unleashing CPPA growth.

Meanwhile, "aggregation as an issue is only going to get more acute as the pathfinder corporate offtakers like Google and Facebook satisfy their immediate demands for power and take a step back from the market," says Harrison. "An effective and broadly applicable aggregation model is urgently needed if CPPAs are truly to fulfil their potential."

"Most companies will be willing to try a CPPA only if all the boxes on their strategic list are ticked off," says the CEO of an independent generator/power producer based in Singapore. "I'm sure a lack of economic competitive benefit is halting their interest to a certain extent. Moreover, investment in supporting infrastructure equipment cannot be justified on such a large scale."

FIGURE 18: What do you think are the main reasons that CPPA uptake has not been as high in some jurisdictions as it has been in others (such as in the U.S.A. and the Nordics)? *(Select top two)*

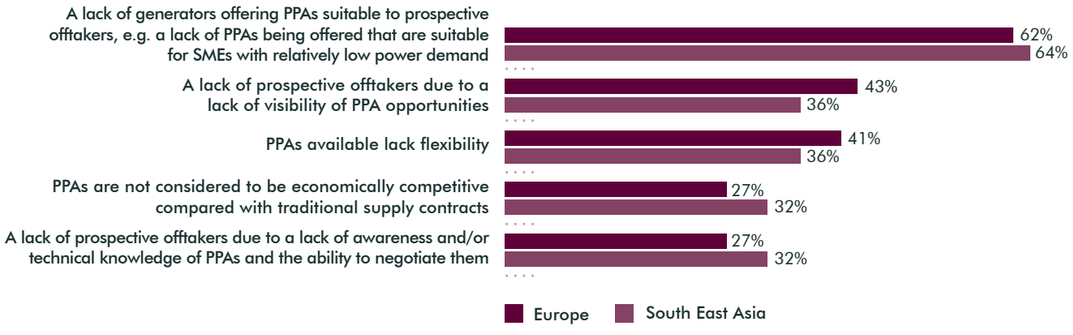
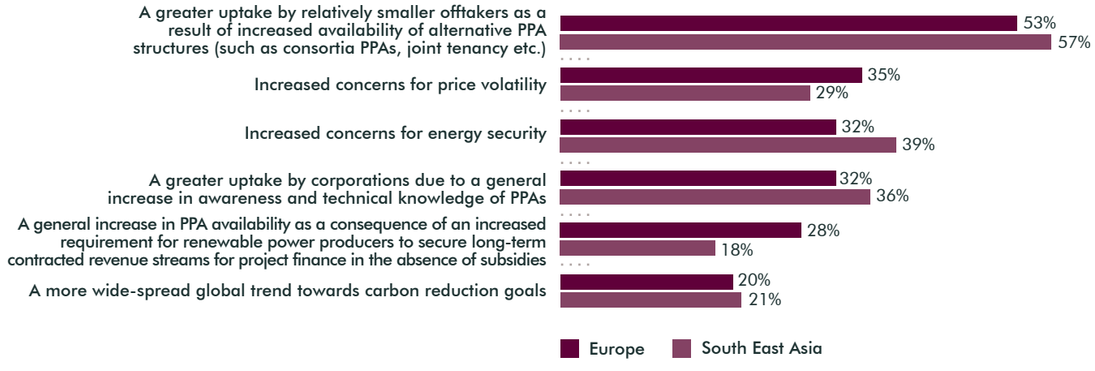


FIGURE 19: Which of the following do you think is most likely to drive a surge in the uptake of CPPAs in the next two years? *(Select top two)*



CHAPTER FIVE

ENERGY STORAGE INFRASTRUCTURE

The 2015 Paris Agreement seeks to limit the global temperature rise to "well below" 2°C compared to pre-industrial levels. Achieving this will mean increasing the proportion of renewables in the primary energy supply from 15% (in 2015) to about 65% by 2050. Most of the gap will be filled by wind and solar, but storage systems will be the key to achieving this target.

Renewable energy is intermittent by nature. Combined with nuclear (the output of which cannot easily be flexed), the challenge of balancing supply and demand will increase significantly. Energy storage – which makes it possible to balance supply and demand – holds the key to creating a resilient energy system.

Indeed, while not attributable to renewable energy, the power cuts that affected the UK in August 2019 highlight the growing need for large scale deployment of energy storage infrastructure.

Pumped hydro is currently the dominant storage technology and constitutes 96% of the total installed storage power capacity. However, scope for hydro expansion is limited by a lack of suitable sites, high costs and environmental concerns. As a result, the predicted share of pumped hydro is expected to fall from 96% to between 45% and 51% by 2030.[15]

Batteries are the most promising solution. The cost of lithium-ion ("Li-ion") batteries has decreased from more than US$3,000/kWh in 1990 to under US$200/kWh in 2016.[16] These cost reductions have arisen due to manufacturing learning rates, cell chemistry improvements and economies of scale. They are expected to continue, with costs forecast to fall by 54-61% for Li-ion batteries by 2030.[17]

In addition to lower costs, advances in technology continue to improve performance, with estimates of the life of a Li-ion battery increasing by 50% and the number of full cycles possible increasing by 90% by 2030. As a result, total battery capacity is predicted to grow to between 100GWh and 167GWh by 2030[18] – up from just 11GWh in 2017.

"The classic model of the grid sourcing all energy is eroding," says Mike Folsom, senior associate in Watson Farley & Williams' global energy sector based in Hong Kong. "There's likely to be significantly more CPPA activity in the next decade, either private wire, sleeved or synthetic CPPAs. In the case of private wire, the ongoing development of batteries will encourage a rise in renewable energy self-consumption. Large and medium-size companies will strive to become more energy self-sufficient, with greater attention paid to their own energy consumption. This is likely to drive behind-the-meter self-consumption via batteries."

Deployed at scale, batteries have the potential to turn the vision of renewable baseload into a reality. Indeed, renewable baseload shows all the signs of becoming a new asset class. This is one of the reasons why storage is now so attractive to investors. Delivering baseload (or some of it) via batteries hinges on extending the length of time over which electricity can be discharged: "flow" batteries, which use a liquid electrolyte, are a candidate.

The challenge of intermittency and surpluses could also be managed outside conventional power markets.

"If the renewables industry itself wants to create solutions that achieve more than simply overcoming regulatory shortcomings or grid-based obstacles, they may want to consider more sector-connectivity-based options," says Malte Jordan. Solutions based on sector connectivity, for example, could see renewable electricity being used to produce hydrogen directly for transport and industrial customers – completely bypassing the grid.

Jordan explains that "a group of blue-chip energy players in Germany have put together a consortium that is trying to install a network of hydrogen stations. The industry itself may need to come up with the infrastructure necessary for an end-consumer to seriously consider buying a car powered by a fuel cell."

New ways of thinking about power consumption may also play a part in managing intermittency. Smart grids and smart cities, for example, envisage steering demand to match supply – the opposite of today's energy model.

The development of storage facilities is also linked to the development of e-mobility: "In Europe, car manufacturers have started developing stationary energy storage systems notably to support a public charging infrastructure for electric vehicles. In this context, storage capacity is sold to support both network services and industrial storage needs (for example, load management or backup)," says Laurent Battoue, partner in Watson Farley & Williams' global energy sector based in Paris.

Legislation has been another big hurdle for the deployment of batteries – in most cases it has not kept up with the technology.

"During the relatively recent boom in UK solar construction, questions were raised around whether subsidies would be lost for already-built solar projects if a battery was retrospectively added to that project," explained Folsom. "And while that issue has been resolved, legislation still has not defined what a battery is, so it is treated as a generating asset, which means that it has payment liabilities when it consumes and generates electricity, i.e., in its charge and discharge mode. This creates licensing uncertainties as well as cost drawbacks. The legislation does not reflect the value that batteries can add to the grid and address imbalance issues through their ability to move electricity in time, and not just in space."

Storage as an investment driver

Given the fundamentals, it is not surprising to see that industry players are actively investing or seeking to invest in energy storage and this is indicative of a market in transition.

"Investment in energy storage can play out in different ways," says Folsom. "For example, developers are interested in battery infrastructure that can be co-located with existing projects. They want generation capabilities or timed power deployment, so they can charge and discharge during periods of low and peak demands. They can also enjoy cost sharing or cost savings through shared infrastructure when co-locating."

47%

of European respondents say they are already actively investing in, developing or financing energy storage infrastructure

Those considering standalone battery systems, on the other hand, want to discharge energy quickly to address inevitable balancing difficulties in the grid with an increased mix of renewable sources.

"The revenue models for these involve charging at a period of low demand and discharging at a period of peak demand for arbitrage pricing or providing frequency response services," says Folsom.

The third option is behind-the-meter batteries, which may appeal more to large corporates than developers.

"These are private wire arrangements where corporates charge at a period where the price is low and discharge when it would be high," explains Folsom. "This approach is a bit different because they are not looking at batteries for revenue generation, they want cost savings to help increase potential profits. It offers certainty, from a corporate perspective, with all of the opportunities and far fewer drawbacks."

At a regional level, almost half of European respondents say they are already actively investing in, developing or financing energy storage infrastructure, while a further third are actively seeking to do so.

The picture in South East Asia is slightly more subdued: 44% say they are actively seeking to invest in, develop or finance energy storage infrastructure, with just 3% saying they have already done so. Half say they are "open to opportunities" to do so.

"One of the main obstacles in battery adoption, in both Europe and Asia, will be the rigid mindset of a market that is accustomed to a single revenue source," says Folsom. "In the same way that lenders will need to become increasingly comfortable with merchant risk in subsidy-free renewable projects, they will need to become equally comfortable with revenue stacking, i.e., multiple sources of revenue, which battery-based energy storage systems typically require, as opposed to the single source of revenue that you usually see with power projects."

This may be easier in some jurisdictions than others. For example, in 2016, the battery market in the UK looked good as a potential revenue source, especially with the rise in frequency response mechanisms. But since 2016, there has been a fall in the two main frequency response markets (firm frequency response and enhanced frequency response) as well as de-rating being applied to the capacity market (another main market for batteries), which has significantly impacted the revenues available for Li-ion and other short power discharge battery types.

These changes have made the creation of a viable revenue stack for project financing a standalone battery energy storage system more difficult. This is because of the lower revenue stack levels that are now achievable and the increased variable-to-fixed revenue ratio.

Batteries included?

There is clearly a good case for building battery systems alongside renewables projects from the outset, rather than seeking to fit them retrospectively. This is especially the case in regions where the grid infrastructure is already under pressure. With the transition to intermittent power sources, strain on the grid will grow and the ability to balance supply and demand will get harder.

When considering the use of batteries in Asia, countries such as Vietnam (which has aggressive renewables targets, but already suffers from grid curtailment issues) will feel the benefit of implementing battery systems with renewable projects.

However, as Doan points out, for this to happen on a national scale, frameworks need to be developed and put in place: "Achieving this will take time. The Vietnamese government and Vietnam Electricity (EVN) previously considered encouraging battery development but have been hesitant to do so until battery technology is more developed."

As a consequence, the market in Vietnam is likely to evolve in a similar way to that in Europe, i.e. with renewable projects leading the way and battery systems trailing behind them.

By contrast, Thailand has been a successful early adopter in encouraging battery storage through the introduction of "semi-firm" renewable PPAs which require a minimum output of 63.3% installed capacity at all times. This, combined with the recognition of renewable energy as a potential baseload capacity, has grown Thailand's appetite for battery storage infrastructure.

Nearly all respondents agree that investing in, developing or financing energy storage infrastructure is a strategy with solid potential for managing CPPA balancing risks; batteries add a further layer of risk management for CPPA participants. This response is in line with expectations for the battery subsector – particularly with the growth of the behind-the-meter private wire CPPA market.

However, regional differences are as clear here as with renewables as a whole: 56% of European respondents say investing in energy storage infrastructure is "definitely" a viable strategy to help them reduce or manage balancing risk in the context of CPPAs. Only 23% of respondents in South East Asia say the same (though 67% agree that it is "potentially" a viable strategy).

What does all of this mean for the future of renewables and energy storage?

"I believe there are two routes forward," says Folsom. "First, through a combination of battery prices dropping, technical quality increasing and renewable projects growing in scale, this will result in co-location becoming more appealing. Projects will not be fitting battery storage systems retrospectively, they will be creating sites with co-location in mind.

"The second is a growth in renewable energy self-consumption, with corporates striving to increase their self-sufficiency, and using behind-the-meter batteries to manage the demand side of the energy equation as much as the supply side."

FIGURE 20: Is energy storage infrastructure an area of technology which you are…? *(Select one)*

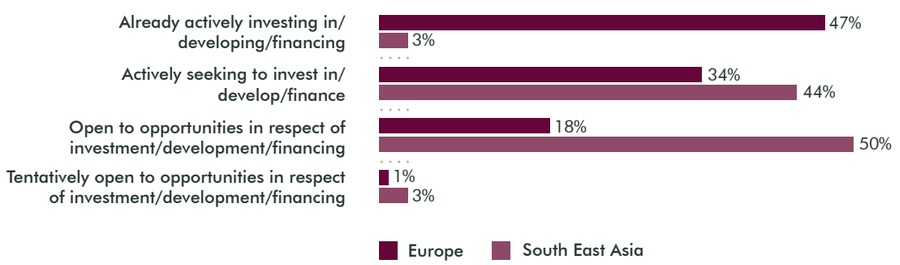
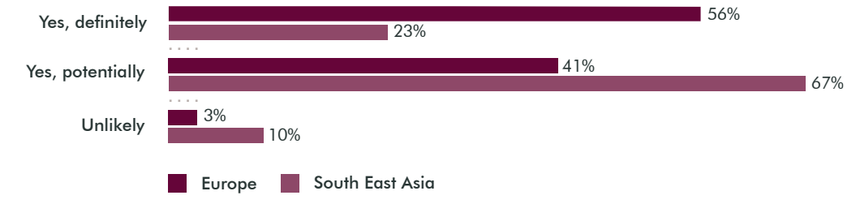


FIGURE 21: Do you view energy storage infrastructure as a viable strategy for the reduction or management of balancing risk in the context of CPPAs?



CONCLUSION

WHERE NEXT FOR RENEWABLE ENERGY?

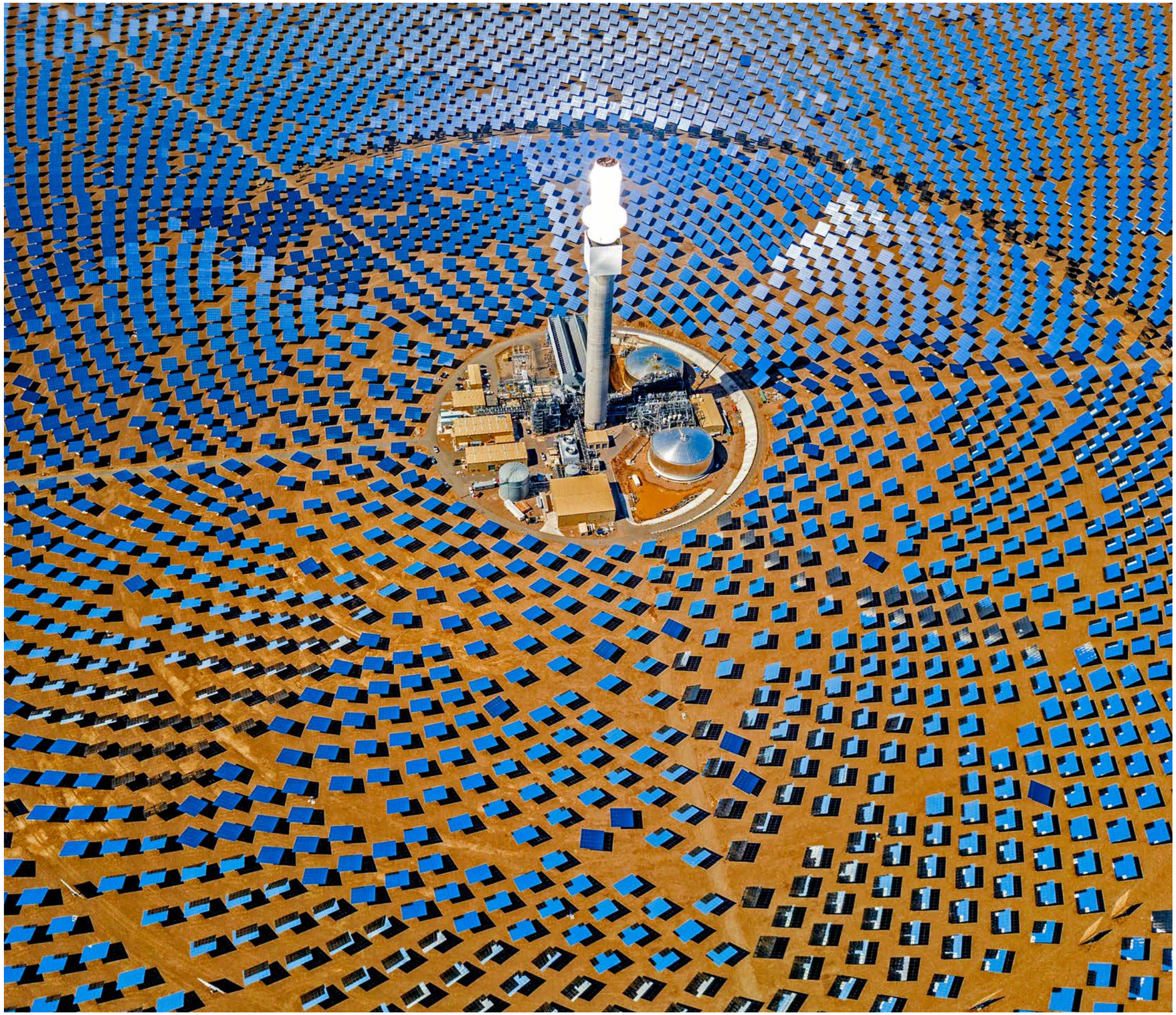
Our survey of investors, financiers, developers and independent power producers and utilities confirms what most people in the industry already knew: investment in renewable energy is on the rise, driven by regulatory and reputational pressures as well as improvements in renewables technology.

Despite this enthusiasm, the survey also makes it clear that the industry is very much in transition. While almost two-thirds of developers expect to be involved in more renewable energy projects in the future, subsidies can still make or break a project in many markets.

For European participants, a reduction in subsidies is seen by many as a positive thing for M&A and project financing, but Asian respondents see any loss of support as having a largely negative impact.

What does this mean for the industry in the years ahead? It suggests that investors are looking for ways to bridge the gap between large-scale, high-risk, long-term renewables opportunities and lower-risk investments that could provide returns in a shorter timeframe. CPPAs – especially ones that are suitable for SME offtakers – are attracting the attention of many in our survey, as is energy storage infrastructure, given its potential to manage CPPA balancing risks.

Investors do need to remain vigilant though, whether entering a developing market struggling with uncertain and inconsistent renewables policies or buying in to an untested technology that risks becoming redundant before the returns are in. But the long-term prospects for renewables look promising and there are plenty of opportunities on the horizon, for those who can see which way the wind is blowing.



METHODOLOGY

In Q1 2019, Acuris surveyed 150 senior level investors, financiers, developers and independent power producers and utilities based across Europe, South East Asia and the Middle East. All responses are anonymous, and results are presented in aggregate. The survey included a combination of qualitative and quantitative questions, and all interviews were conducted over the telephone by appointment. Results were analysed and collated by Acuris.

Endnotes

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