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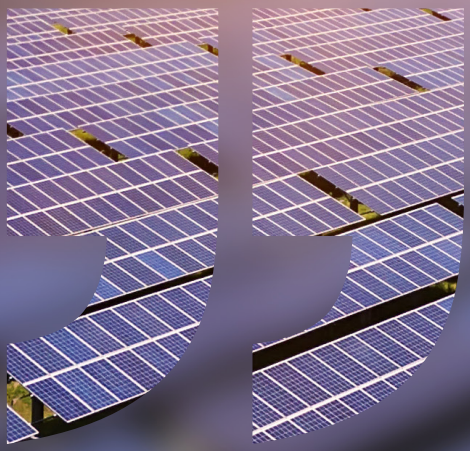
ENERGY TRANSITION PERSPECTIVES: Solar and Wind



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ENERGY TRANSITION PERSPECTIVES: SOLAR AND WIND

In this extract from a recent webinar held in June 2025, we look at how solar and wind projects are being affected by current market trends, including the need for energy storage solutions and grid development, supply chain issues and the potential impact of shifts in global trade and tariffs.

"It is hard to talk about trends in solar and wind projects without first discussing tariffs and their effect on global trade", says Jonathan Bobinger, a partner in Clifford Chance's Houston office. The Trump administration has imposed tariffs on imports of solar panels from certain Southeast Asian countries, namely Cambodia, Thailand, Malaysia and Vietnam. Chinese manufacturers had moved operations to these countries in a bid to avoid tariffs imposed during President Trump's first term, and the new tariffs were largely imposed in response to allegations of subsidies from China and the dumping of unfairly cheap products in the US market.

Following lengthy negotiations, China and the United States have reached a trade agreement, lowering tariffs on Chinese imports to 55%, an overall increase of 30% from the tariffs that Trump put on Chinese imports in his first term. While currently on hold, Trump's proposed 25% duty on imports from Mexico and Canada further threatens components necessary for wind and solar projects.

China's dominance in the production of critical components for solar and wind infrastructure, as well as its stranglehold on vital rare earth minerals, mean that developers need to source at least a portion of their required equipment from China. Shifting production to alternative suppliers in Europe or India is possible, but it comes with its own set of challenges; for example, relocating wind turbine manufacturing from Mexico, where it might be subject to a tariff, to Europe, is likely to extend delivery times by up to 12 weeks and exacerbate supply chain delays already impacted by port congestion and shipping shortages.

Reliance on foreign production has led to substantial development delays for projects across the United States. In particular, shortages of transformers have been an ongoing issue, with average lead times nationally of up to 120 weeks. The price of transformers has risen substantially, and the tariffs on Chinese and other foreign-produced components will continue to cause upward pressure on prices. "For developers, this means thinner profit margins, mid-project repricing or pricing adjustments, tighter project viability and rising PPA costs", says Bobinger.

Procurement strategies

"We've seen offtakers and developers consider a number of mitigants", says Mohamed Hamra-Krouha, a partner in Clifford Chance's UAE offices. "One of these is the implementation of multi-sourcing procurement strategies. That means assessing the developer's supply chain and looking to diversify the supplier base to mitigate risks associated with trade policies and supply chain disruptions, while remaining heavily weighted towards Chinese suppliers."

Another trend is the implementation of technology traceability, to help verify the origin of components and ensure compliance with ethical sourcing standards that lenders are keen to implement as part of their due diligence. This is particularly relevant for anti-forced labour due diligence requirements, which have been spearheaded by some of the multilateral financial institutions which are active in financing solar and wind projects across the MENA region.

Some of these contractual provisions have percolated down into EPC and construction contracts, including the requirement to make supply declarations, to grant audit rights and sometimes to implement the blockchain-based tracking of equipment. In addition, contractual safeguards are being adopted. For example, power purchase agreements

might now include clauses to address tariff risks, force majeure events related to those risks and supply chain disruptions.

"We've seen project agreements for solar and wind projects that include price adjustment and indexation clauses, with a tariff pass-through mechanism", says Hamra-Krouha. "Flexible provisions that allow the developer to switch suppliers if the original vendors are sanctioned can be helpful, alongside extended long stop dates and milestone flexibility. For example, some wind projects in the region include a six-month extension for customs-related delays. Some developers also look at purchasing insurance with political risk coverage as a protection against trade disruption."

Battery storage projects

"Battery storage projects are becoming increasingly vital as the world shifts towards renewable energy sources", says Delphine Siino Courtin, a partner in Clifford Chance's Paris office. "They are used to deal with intermittency and frequency issues on the grid and can be developed either on a standalone basis or collocated with a solar or wind project."

These projects raise a number of technological challenges, economic considerations, regulatory hurdles and environmental concerns. One of the primary technological challenges is achieving high energy density. The existing technologies are evolving, but there is still a long way to go. Longevity is another concern. Batteries degrade over time, which has been an issue for utilities such as IPPs, where the term of the project is at least 20 or 25 years. Safety is also paramount, with risks of overheating and fire. Rigorous testing and high manufacturing standards are key.

Prices have been falling due to technological advancements and economies of scale, but battery storage systems remain costly. The return on investment is impacted by factors such as the cost of electricity, the value of energy arbitrage and services provided to the grid, meaning that a thorough financial analysis is required. "The concept of using batteries for arbitrage and optimisation is becoming more limited because the more batteries that are on the grid, the less potential gains can be made, as prices are driven down by other battery projects selling energy when the price is high", says Siino Courtin.

The regulatory landscape for battery storage varies across jurisdictions in terms of permitting and approvals and often the classification of the assets, whether they are determined to be generation, transmission or distribution, will have an impact on how they are regulated. Grid integration will require co-ordination with grid operators and compliance with technical standards and grid codes. Finally, battery storage projects are often reliant upon incentives and subsidies, and these need to be carefully managed to avoid market disruption.

There are also environmental concerns which need to be addressed. The extraction of raw minerals for battery production, such as lithium, cobalt and nickel, can have significant ESG impacts. The disposal and recycling of batteries need to be carefully addressed too, since improper disposal can lead to soil and water contamination, while recycling processes can be energy-intensive and costly.

Dominance of Chinese suppliers, and US policy responses

China continues to be the dominant player in the production of renewable energy infrastructure. "The US response to that has been twofold", says Bobinger. "It has placed tariffs on specific Chinese-produced renewable energy products and components, which now seem to have settled at 55% on all goods. Internally, the US passed the Inflation Reduction Act, the CHIPS Act, the Science Act and the Bipartisan Infrastructure Law, all of which have components aimed at incentivising domestic production of solar and wind components."

Legislation has led to a marked increase in domestic clean energy component production and investment. With 160 new manufacturing facilities since 2022 and almost US$500 billion in investment, such increased investment and production have not been at a level to supplant reliance on, or really threaten, Chinese production dominance, however.

The Trump administration has issued Executive Orders to tackle the issue of rare earth mineral sourcing and production. These include measures designed to boost domestic critical mineral production and processing by expediting permitting, prioritising development on federal lands and streamlining regulatory frameworks. The Executive Orders invoke the Defence Production Act to facilitate investment, direct the Department of Commerce to investigate potential national security risks posed by the reliance on imported critical minerals and establish a framework for US companies to identify and retrieve offshore critical minerals, including rare earth elements, from the seabed.

The Trump administration has sought to secure rare earth mineral deals with other countries, most notably a minerals deal with Ukraine. The US has explored sourcing rare earth minerals from Greenland and the Danish Foreign Minister has indicated that the government is open to exploring a minerals deal with the US and the EU. Several minerals deals in various countries in Africa have been floated by the Trump administration, most notably one with the DRC. Despite other steps being taking to avoid Chinese suppliers, the Trump administration has announced a deal with Beijing on rare earth minerals.

Financing trends

"The majority of the life cycle costs of solar and wind projects are incurred as upfront construction costs, and that means that they are particularly vulnerable to increased capital costs during delivery", says Ross Howard, a partner based in Clifford Chance's Singapore office. "In the current environment, the double whammy of higher interest rates, on the one hand, and increased costs (associated with factors such as constrained supply chains, input price escalation and key component backlogs), on the other, has begun to make debt financing more difficult to access in certain markets, particularly when coupled with revenue profiles that in many cases predate the cost inflation. As a result, we're seeing the debt capacity of some renewable energy generation projects reducing and that's being reflected in decreasing debt-to-equity ratios."

The knock-on impact of lower debt capacity is an increased equity requirement and, when the revenue profile is fixed, a decrease in equity returns to investors at a time when return expectations are rising. This means that certain renewable energy developers who are looking to bring in investors are, at best, having to take reduced development premiums or, at worst, simply unable to attract sufficient equity capital. Consequently, we have seen a slowdown of wind and solar projects coming to the financing markets in some regions, with developers seeking to recalibrate their projects to reduce CapEx and, where possible, renegotiate their power prices.

In terms of the debt financing sources available to projects, the outlook depends on geography, scale, and market segment/technology, but multilateral development banks (MDBs) and development finance institutions (DFIs) are providing support to make projects more financeable. MDBs are using concessional finance, blended finance, guarantees and technical assistance upfront to de-risk projects and crowd in private capital. DFIs, including some of the European DFIs, are providing mezzanine and subordinated debt to enhance capital structures. Export credit agencies (ECAs) from Europe, Asia and North America are also able to help unlock liquidity through their support of home-country equipment exports and EPC contractors and, in some cases, untied support with mandates to support investment in particular regions or sectors.

"A particular trend we are seeing as a result of China's ever-increasing supply chain contribution is an increase in co-financing between Chinese ECAs and commercial banks and international agency lenders and commercial banks," says Howard. "This is particularly the case where projects have very significant financing requirements and need to mobilise multiple funding sources. These co-financings will require different lender groups to coalesce around common financing terms and structures in respect of issues where Chinese and international market practice have probably historically taken slightly different positions, for example associated with completion risk."

Regional spotlight – US

The US solar and wind markets are continuing to experience growth, with several projects in development and expected to come online during 2025.

The uncertainty around the future of incentives provided by the IRA may cause developers to adopt a "wait and see" approach. The IRA's introduction of a credit transfer regime has largely been a welcome construct, allowing developers to broaden their pool of investors beyond traditional tax equity groups. However, current legislation being negotiated in Washington could pare back these transfer provisions, which may have a cooling effect on new investment and projects.

Nevertheless, even assuming no substantial changes to the current renewables incentives, most predictions and models do indicate that growth will be slower than in the previous three years. Increased costs, compliance with tariffs and export controls and continued supply chain issues will no doubt take a toll on development efforts in 2025. The Trump administration has ended a Biden-era incentive on new offshore wind farm leases, which will mean a slower year for wind projects.

In many states in the US, waiting times to interconnect a new project to the electric grid can be more than a year. In some states, substantial investment is also required to upgrade grid infrastructure to support new projects. This lack of infrastructure and manpower to provide inspections, permitting and approvals will continue to slow project development.

Regional spotlight – Middle East

"Despite the uncertainties around trade and supply chain, we've actually seen increased appetite for utility-scale projects in the Middle East", says Hamra-Krouha. "In addition to the global power developers who have been very active for many years, we've also seen new players competing for projects. A large number of projects have been announced, linked to the planned retirement of existing oil- and gas-fired base load power plants, as well as large data centre and AI-related investments."

There is less reliance on MDBs and DFIs in the Middle East and, in key markets such as the UAE, Saudi Arabia and Oman, local banks have continued to provide much of the funding for solar and wind projects. The competition has allowed developers to drive more aggressive structures, with increased numbers of projects looking to adopt soft mini-perm financings to source financing from lenders who would not be able to commit to traditional long-term project financing tenors. Korean and Japanese ECAs are also active in these markets.

Regional spotlight – Africa

"The lack of transmission assets on the African continent and delays in implementing new connections and some large power projects have resulted in several countries in Africa focusing more on commercial and industrial (C&I) energy projects", says Siino Courtin. These are energy projects aimed at providing electricity to companies or industrials with either no, or very limited, use of the grid.

For example, the REEP programme in South Africa has resulted in over 120 new renewable energy projects. Morocco was one of the first promoters of these projects through the 13/09 regulations which were introduced more than 15 years ago. However, many African countries have not yet implemented the reforms to their electricity code that are needed to permit such projects, with private PPAs and national utilities maintaining a monopoly in relation to transmission assets.

Regional power pools and grids initiatives, such as the West African Power Pool (WAPP) and the South African Power Pool (SAPP), allow generators in one country to sell electricity in another country of the power pool. The regulatory frameworks are still being developed, but these are viewed as essential in the electrification of Africa and useful structures to deal with intermittency and frequency issues.

Regional spotlight – Asia Pacific

By 2030, renewables are set to make up between 30 and 50% of the power generation mix in most Asia Pacific

markets, and in both 2023 and 2024, the region led the globe in new clean energy installations, with over 400 gigawatts added in 2024 alone. This means that the region now accounts for more than half of the world's installed clean energy capacity.

China remains the primary contributor to this growth, but significant momentum is building across India, Southeast Asia and the Northeast Asian markets.

Vietnam has been very successful in building out its onshore solar and, to a lesser extent, onshore wind capacity over the last decade, driven in large part by favourable feed-in tariffs. However, these projects have faced some challenges. Weaknesses in the transmission grid have led to significant curtailment of operating solar assets, causing financial pain for investors. These issues have led to a temporary suspension of major new solar developments.

Singapore's renewable energy import projects represent one of the largest development opportunities in the Asia Pacific region, being an ambitious process organised by Singapore's Electricity Market Authority to import up to 6 gigawatts of stable renewable power into Singapore from neighbouring countries by 2035. These projects are seen as a first step towards the long-held regional ambition of an interconnected ASEAN grid to improve energy security across the region. We expect these projects to help accelerate the development of solar and BESS projects in countries such as Indonesia and Malaysia, to provide the renewable power for import. Meanwhile the Philippines continues to attract increasing attention from international investors with the continued roll out of its Green Energy Auction Program which is seen as one of the most progressive and effective renewable energy auction policies in the region.

Regional spotlight – Latin America

Latin America is experiencing substantial growth in wind and solar power, spurred by increasing investment and ambitious renewable energy targets. The region is set to add over 25 gigawatts of solar and wind energy capacity in 2025, with significant investments in Brazil, Chile, Mexico and Colombia. Funding for sustainable projects has surged, with green bonds issued by companies and governments directing resources into renewable energy initiatives.

Corporate PPAs and hybrid structures are on the rise. Chile and Brazil continue to lead with corporate offtakers driving demand. Sponsors are structuring merchant-plus-PPA deals, which often have storage-ready components. Sophisticated hybrid structures are gaining traction, particularly those blending wind, solar and storage with flexible offtake profiles.

Looking ahead, digital infrastructure, energy demand and nearshoring are likely to create challenges, and not just in the semiconductor industry – automotive, EV supply chain and pharmaceuticals are expanding their manufacturing footprints. Transmission bottlenecks remain an issue, particularly in Brazil and Colombia, and sponsors and funds are increasingly eyeing private transmission lines and merchant interconnection hubs to unlock renewables. Finally, a new generation of green instruments is on its way, such as carbon-linked debt, renewable-linked derivatives and sleeved PPAs, driven by corporates with net zero mandates.

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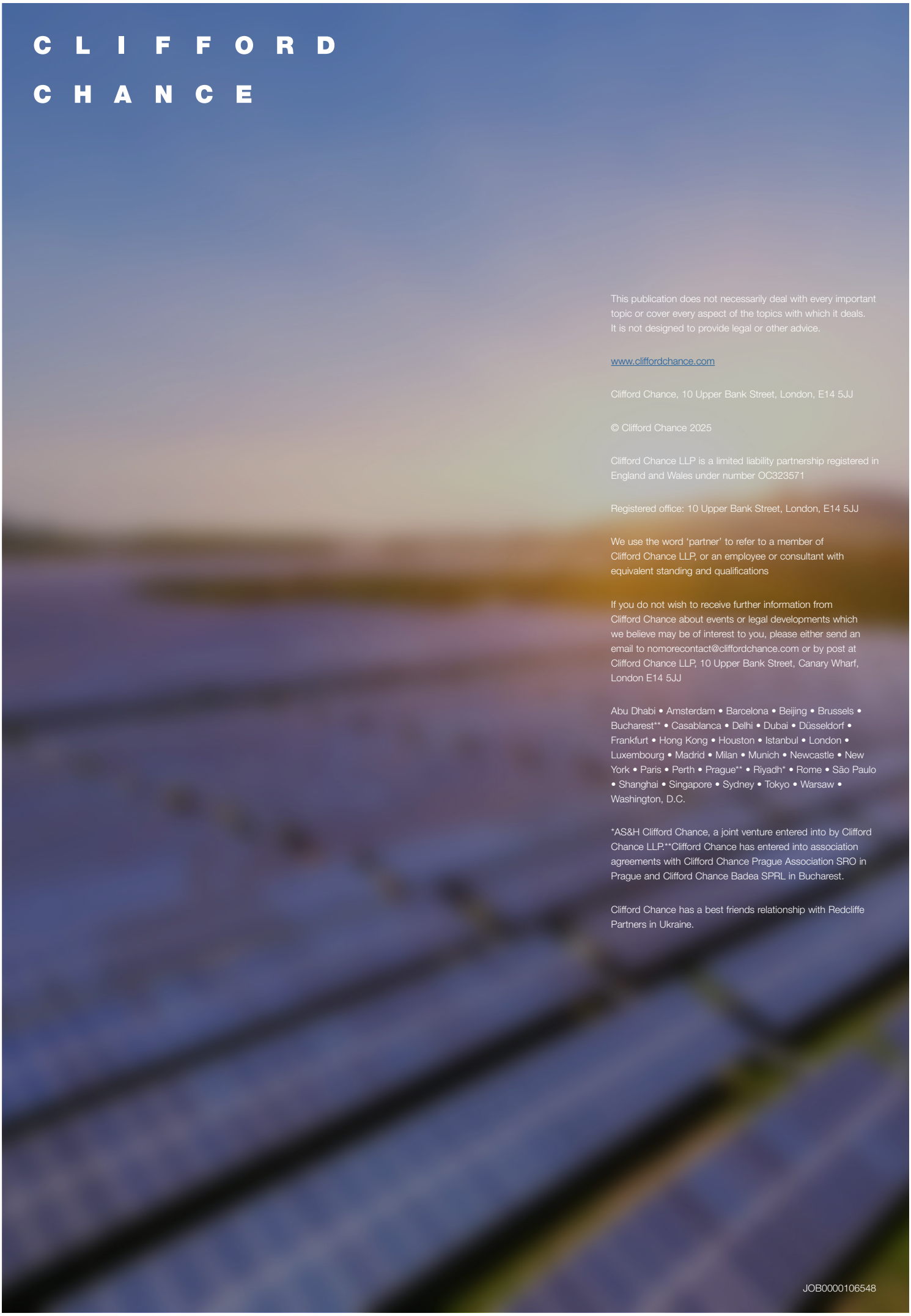

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