CLIFFORD CHANCE

ENERGY TRANSITION TRENDS 2023

– THOUGHT LEADERSHIP

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Energy security and affordability have become major issues for many countries. Rising inflation, increasingly frequent and significant climate events, and an uncertain geopolitical and economic outlook provide a challenging backdrop for governments committed to net zero targets and keen to accelerate the development of low-carbon energy. The trends that we highlight here focus on some of the issues, innovations and legal developments that we are seeing in a number of sectors to meet these challenges.

Growing demand for critical minerals

The energy transition will require massive investment in energy infrastructure and new technologies. The McKinsey Global Institute estimates that an annual average of 7.5% of GDP must be spent on physical assets to achieve net zero by 2050. It is clear that the supply of critical minerals will also be an integral part of the picture across all sectors.

Global demand for lithium-ion batteries is expected to soar over the next decade. Although much of the demand will be driven by electric vehicles, battery energy storage systems will also see a step change. Beyond rare earth minerals such as lithium and cobalt, familiar metals such as aluminium and copper also have strategic importance for the energy transition, from the manufacture of solar panels and wind turbines to the development of electricity networks and battery storage.

The European Commission is working on a Critical Raw Minerals Act, which is expected to be tabled in March 2023. The aim is to curb the EU's reliance on China and Russia for the metals and minerals needed for the energy and digital transitions. The proposal will identify strategic projects all along the supply chain, from extraction and refining through to processing and recycling. This will feed through into the EU's trade arrangements, and ongoing talks with Chile and Australia are likely to include raw materials provisions.

The US Inflation Reduction Act (IRA), of which more below, will spur further investment in the renewables sector and drive the building of critical infrastructure, but it also aims to assist US mining companies with producing the critical minerals necessary for the energy transition.

Floating offshore wind will significantly scale up in capacity

Governments around the world are setting ambitious targets for developing new offshore wind capacity. In the UK, for example, the government has committed to increasing national installed capacity fivefold to 50GW by 2030. Since most new offshore wind potential is found in water depths where traditional, fixed-bottom wind turbines are not viable, floating technology is required to unlock access to these deep-water sites.

According to the Global Wind Energy Council, floating offshore wind currently accounts for only 0.2% of total offshore wind installations worldwide, and a range of floating offshore wind technologies remain under development. Different platform, mooring and integration solutions will be required for different sea and site conditions, so we are likely to see a greater range of developments than in the more mature fixed foundation offshore wind market. Moreover, although the ability to assemble floating turbines at port before towing them to site has cost-saving and programme de-risking benefits, it is clear that major investment in port infrastructure will be required to accommodate the construction and heavy maintenance requirements of floating wind projects before they can be deployed at scale and towed to and from shore.

To address these issues and advance the commercialisation of floating offshore wind, government support in the form of technology-specific subsidies will be critical. We are seeing governments begin to acknowledge this. In the UK, 15-year contracts for difference (CfDs) are available for floating offshore wind projects via a competitive auction process. In last year's allocation round, floating offshore wind projects were able to bid for CfDs for the first time, with a separate technology-specific allocation that did not require them to compete directly with other, more established, lower cost renewables technologies. The UK is also targeting the port and supply chain upgrades required to support the deployment of floating offshore wind at scale, making available £160 million in government funding under a scheme specifically designed to boost investment in this area. This investment will be critical to enable the development of floating offshore wind at a scale that will hopefully promote the same sort of dramatic cost reductions that we have seen with fixed foundation offshore wind.

Notwithstanding the technological, cost and supply chain challenges, there has been considerable floating offshore wind activity across the globe in the past year – ranging from the launch by the French government of the AO6 Mediterranean Sea tender to the wind lease auction on the Outer Continental Shelf offshore of California. France's Provence Grand Large floating wind project also reached financial close on its limited recourse financing, raising confidence in the bankability of floating projects.

With its potential to expand existing offshore wind markets and open up new ones, floating offshore wind will be an important part of the future energy mix. It remains to be seen in many jurisdictions whether adequate regulations and subsidy regimes will be implemented quickly enough to match the ambitious development plans that have been announced.

Dedicated energy transition funds are driving investment into renewable energy generation

The way that capital is sourced to finance investment in renewables and other energy transition assets continues to evolve, as demand to invest in the sector remains resilient. 2022 saw the continued growth of "energy transition" funds, with many new dedicated vehicles either launching or closing under the watch of some of the world's largest investment management firms. Most notably, Brookfield closed its first Global Transition Fund, which, with $15 billion of committed capital, is the largest private fund in its history. Similarly, Blackstone's fourth energy fund has a clear focus on renewable generation assets (with 'Transition', in fact, being added to the fund's name after its initial launch). This trend is likely to continue in 2023, with further dedicated 'green' or 'transition' funds in the pipeline, focused on investing in transforming carbon-intensive industries and climate-related projects in both OECD and non-OECD jurisdictions. These funds address investor appetite for strong ESG credentials, whilst also seeking to capitalise on the anticipated growth in renewable energy generation and the emergence of new, global-scale, low-carbon technologies.

North Sea Energy Islands

The concentration of resources and the level of cooperation between EU countries means that the North Sea is the focus for the development of 'energy islands', which will act as hubs for the generation of clean energy. These pioneering energy islands centralise the generation of renewable energy on an existing or artificial island and use multi-purpose interconnectors to transmit electricity to the grids of connected countries via high voltage direct current (HVDC) subsea cables.

Energy islands will allow for more efficient transmission of electricity generated by offshore wind farms. This will facilitate the rapid expansion of the sector by improving the integration of electricity generation from offshore sources with the power grids of connected countries. Rather than offshore wind farms connecting directly to their home grids in a 'point to point' fashion, with standalone interconnectors to transport electricity to connected countries, multi-purpose interconnectors will combine the transmission of electricity generated by offshore wind farms with cross-border interconnection in a 'hub and spoke' formation. This can reduce the number of landfall points required for grid connection and allow the transmission infrastructure to be used more efficiently, bringing cost and environmental benefits as less cable is required to be manufactured and laid on the seabed. The introduction of such assets could represent the important first step in the development of meshed offshore grid to integrate the rapid build-out of offshore wind in the North Sea and transport clean energy efficiently to the areas where it is most needed.

Energy islands may also host energy storage projects and/or electrolysis plants for green hydrogen production, in order to use additional power generated by offshore wind farms at times of low demand or strong winds. This efficient use of infrastructure can go some way towards mitigating the conversion losses associated with green hydrogen production and provide the flexibility which will be essential for the achievement of net zero objectives.

Developments in Carbon Trading and Offsetting

The voluntary market for carbon credits continues to grow significantly as businesses seek offsets for their carbon emissions and increasing numbers sign up to 'net zero' commitments. Global policies and frameworks around requiring net zero commitments from businesses are developing and evolving. For example, a proposed UK Net Zero Transition Plan Standard will require net zero commitments from listed companies.

Increasingly, businesses are seeking long-term carbon offset supply via investment in the supply chains through being either the primary offtaker for a carbon project or taking equity investment or project ownership in projects. The focus on this method of sourcing through the supply chain (referred to as carbon 'insetting') can help facilitate control over emission reductions and thereby ultimately the credibility of the net zero, or other carbon, commitments of the business. We are also seeing increased M&A activity in this space as private capital providers, such as infrastructure funds and private equity, look to invest in the carbon markets value chain in businesses which derive contracted revenue from performing services (for example consultancy, project development, agency and/or brokerage) and/or selling carbon credits.

Momentum has been building on the formal development of the Voluntary Carbon Market (VCM) structures and, in particular, building on improvements to the quality and integrity of carbon credits and offsetting claims, and this work will continue through the Integrity Council for the Voluntary Carbon Market (on the sell-side) and the Voluntary Carbon Markets Integrity Initiative (on the buy-side).

Meanwhile, pressure is intensifying on businesses making net zero or other carbon claims which rely to any extent on offsets, to clarify and justify that reliance. Indeed, advertising standards, competition bodies and regulators in an increasing number of countries are beginning to scrutinise such statements (either proactively or in response to NGO complaints) for evidence of 'greenwashing'. The need for businesses to demonstrate that any offsetting activity is subsidiary to active carbon reductions / removals in meeting net zero plans, and that high-quality offsets are used, will remain key to navigating these risks.

Development of Paris Agreement carbon trading mechanisms

Since the Paris Agreement was signed in 2015, progress has been slow in determining how the international trading mechanisms under the Agreement would work. Following the completion of the Article 6 Rulebook at COP26, COP27 saw only incremental progress on some of the remaining obstacles to a global carbon market.

In particular, there is still significant uncertainty over the extent to which the Voluntary Carbon Market can operate alongside Article 6 mechanisms. A key question is whether the trading of voluntary credits out of a host country will require 'corresponding adjustments' to the Nationally Determined Contribution (NDC) of the host country and, if so, how host nations can be encouraged to control or limit access to the voluntary market in their country. Further clarity in this area is needed as the issue has contributed to moratoria or limits being imposed on the issuance and/or trading of carbon credits internationally (for example, in Honduras, India, Indonesia and Papua New Guinea).

In December 2022 we published (in co-operation with the City of London Corporation) a report, "**Enabling the Voluntary Carbon Market in the Context of the Paris Agreement**" which considers the state of the Paris mechanisms and the VCM, examines actual and perceived barriers to its scaling and identifies recommendations for the way forward.

More generally, progress has been slow on agreement of the Article 6.4 global trading mechanism, not least because of concern that levies imposed upon Article 6.4 trading might disincentivise the use of this market. More encouragingly, a greater level of agreement was reached at COP27 in relation to Article 6.2 (so-called 'co-operative approaches' between States), and this is likely to lead to increased co-operation and trading activity between individual States hosting and financing carbon reduction projects.

Despite some of the recent criticisms of the VCM, carbon offsetting still has an important role to play as the most recent report of the IPCC has acknowledged. Focus, however, needs to be on ensuring that offset projects are of high quality leading to enhanced market confidence.

US Inflation Reduction Act's hydrogen incentives are impacting trade

A key hydrogen trend to focus on for 2023 is "trade". The industry has moved from concentrating on the "colour" (i.e. grey, blue and green) of hydrogen in the energy transition to where it is made and whether it is improperly subsidised.

The Inflation Reduction Act of 2022 (IRA) provided a variety of incentives for clean energy projects in the United States, including the introduction of a clean hydrogen tax credit that could provide credits of up to US$3 per kilogramme of the clean hydrogen produced by a qualified green hydrogen facility. The IRA has drawn the ire of the EU, which views the tax incentives as protectionist and market-distorting. These incentives are designed to attract hydrogen producers to the United States, and the EU sees this as a potential significant disadvantage in the race to produce green hydrogen at scale. The cumulative effect of these US government programmes will be to reduce the delivered cost of hydrogen and its derivative products, such as green ammonia.

The EU submitted comments to the Internal Revenue Service (IRS) stating that the clean hydrogen tax credit "contains a problematic domestic production requirement that puts EU-based producers at a disadvantage as they must compete on a distorted market with subsidised US-based producers". It also expressed concern that there is no spending or production cap for this subsidy.

The EU has threatened to challenge the hydrogen subsidies at the World Trade Organization (WTO). Bernd Lange, the Chair of the EU Parliament Committee on International Trade, has raised this possibility if the US does not address the EU's concerns. However, the US has paralysed the WTO's Appellate Body, rendering any decision made through the Dispute Settlement Body essentially unenforceable.

Instead, the EU may need to resort to creating subsidies of its own in order to compete with cheap hydrogen being produced in the US, though these subsidies will be subject to the EU State aid rules, which themselves may then need adjustment. Currently, Germany is pushing for a temporary State aid frameworks, as adopted during the 2008 financial crisis and the COVID-19 pandemic.

Meanwhile, France and Spain signed a friendship and cooperation treaty on 19 January 2023 aimed at loosening rules on state subsidies and creating an EU sovereign fund to boost green industries across the EU.

To find out more, see our recent briefing: Focus on hydrogen: **The impact of the US Inflation Reduction Act's hydrogen incentives on trade**.

The path is clearer for carbon capture and storage technologies

The role of carbon capture and storage (CCS) technologies in the effort to achieve climate targets is increasingly important. The International Energy Agency (IEA) Net Zero by 2050 scenario relies upon a significant scale-up in CCS, including the reduction of emissions from existing energy assets, providing solutions in sectors where emissions are hardest to reduce, such as cement production, supporting the growth of clean hydrogen production and enabling the direct capture of CO2 from the air. More commercial projects are under development and attracting investment – over 200 new capture facilities are expected to be operating by 2030, capturing more than 220 million tons of CO2 per year (Source: IEA). Geographic distribution of projects in development is diversifying, but there is a long way to go.

In the EU, there has been an increase in activity to develop the regional infrastructure required to drive the market forward. For example, various announcements of CO2 pipelines between Germany and Norway, a memorandum of understanding between France and Norway and the agreement on CO2 transport and storage signed between Denmark and Belgium. However, acceleration is needed in some key areas, including common quality requirements for CO2 and visibility on viable structures for the whole value chain. The European Commission plans to table a communication on the strategic vision for CCS in 2023.

In the United States, the IRA has provided a significant boost for CCS (US$369 billion for clean energy, which includes substantially increasing the availability of tax credits for CCS, increasing the 45Q tax credit from $50 to $85 per metric ton, simplifying the process to receive those credits, investing in CCS infrastructure, and opening up the tax credits to smaller CCS projects). Additionally, the Infrastructure Investment and Jobs Act of the 2021, will provide approximately US$12 billion across the CCS value chain over the next five years (Source: IEA).

In Southeast Asia, there are several projects in the early stages of development, including in Indonesia, Malaysia and Thailand. Malaysia arguably has the edge over the region, with Petronas recently taking final investment decision to develop the Kasawari CCS project off the coast of Sarawak, which, once complete, will represent one of the largest CCS offshore projects in the world by volume of CO2 captured. However, efforts around regulation and incentivisation in the region need to be accelerated to unlock and drive forward CCS in a meaningful way.

Direct Air Capture (DAC) projects are currently small in number and are mostly developmental. However, larger scale projects are planned, and it is becoming clearer how DAC projects can fit into the broader decarbonisation picture.

The evolving future of nuclear power

The **International Energy Agency's World Energy Outlook (WEO)**, issued in late 2022 projected more than a doubling of global nuclear power generation by 2050 to 871GW, compared with the current 393GW of operable nuclear capacity worldwide. This also includes the (in many cases, urgent) need to replace existing generation assets due to be decommissioned in this period (or to extend their operational lives).

However, beneath this global projection, there are important details revealing new trends which could fundamentally change the world of nuclear energy:

- Currently, the US has the largest generating fleet at approximately 100GW (ahead of France's 64GW). But 60% of new build plants are expected to be in China, indicating that it will overtake the US within10 years.
- The UAE, Turkey, Bangladesh and Egypt are all building their first nuclear plants, and many more countries are actively looking to join the nuclear generation world. Although Russia has been the dominant exporter and player in these new markets over the last 10 years, the invasion of Ukraine has had a considerable impact. With energy security likely to stay high on the political agenda, the competition between the other national champion nuclear technology and fuel suppliers (France, the US, China, Canada and South Korea) is likely to be fierce.
- The overall share of nuclear in the global electricity mix stays at around 10% in the WEO, notwithstanding some of the perceived advantages of nuclear (for example, the relatively small land area required per MW of generation capacity, the lack of intermittency issues, it not being weather-dependent, its long lifespan and its resilience). It also reflects, arguably, the reticence of certain countries (for example, Germany) to revisit their policies on nuclear energy, notwithstanding the ongoing energy crisis.
- Finland is looking to start storing fuel in the world's first deep geological nuclear waste repository in 2024. This is a significant step in an area (permanent disposal without reprocessing) where progress has been viewed as slow.

Nuclear is likely to have a role to play in the rapidly growing hydrogen sector. It is clearly capable of providing the electricity to feed the current generation of large-scale electrolyser technologies (primarily pressurised alkaline and polymer electrolyte membrane (PEM)) operating at ambient temperatures. More interesting, however, is using both the electricity and the significant excess heat produced by nuclear plants – these would facilitate high temperature steam electrolysis in solid oxide cells (as that technology develops) and even provide the heat required to split water into its component hydrogen and oxygen particles thermochemically (although that technology is further off still). These higher temperature techniques use fewer expensive base metals than alkaline/PEM electrolysers and are anticipated to produce hydrogen much more efficiently.

Whilst SMRs will provide many more solutions in due course, large-scale nuclear projects remain very relevant and much-needed, particularly as those nations turning away from fossil fuels cannot meet baseload demand with renewables alone, given their intermittency and the lack of scaled storage solutions. That, in turn, requires countries to think carefully about how such plants can best be financed. The conventional project financing approach used for other forms of power generation is not well-suited to the large capex, unique risks and lengthy construction periods associated with delivering major nuclear projects. We would like to see international take-up of the regulated asset base (RAB) scheme being promoted in the UK, further reducing the cost of financing which would otherwise ultimately be borne by consumers or taxpayers.

Small Modular Reactors

The emergence of numerous Small Modular Reactor (SMR) designs, financed by both the private and public sectors, has continued to garner much media attention and excitement. It is likely that first of a kind commercial projects will emerge and be built by 2035, so the benefits of a SMR market will most likely only begin to play out after that time. As we have seen with renewable technologies, the SMR market will require project pipelines and volume to drive cost reduction. Additionally, the SMR market will necessitate:

- Streamlined regulatory approval processes. The regulatory clearances for new generation major nuclear plants have been complex and hugely expensive. With over 70 SMR designs being brought forward internationally, it is essential to make this process more efficient and with a greater degree of international consensus/ harmonisation on requirements.
- The unlocking of longer-term production of sufficient high-assay low-enriched uranium fuel (HALEU). Most SMR designs are reliant on HALEU production happening and being made available beyond the initiatives currently under way.

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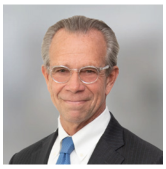

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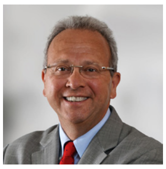

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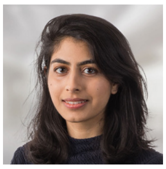

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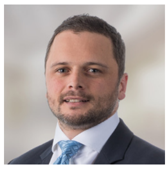

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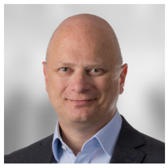

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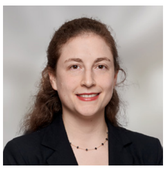

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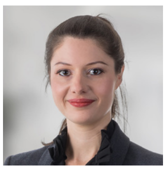

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