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ENERGY TRANSITION TRENDS 2022

— THOUGHT LEADERSHIP

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There remains a narrow window of opportunity for timely action to address the climate crisis and still meet the Paris Agreement targets. The necessary transition from fossil fuels to low-carbon energy sources will require massive and sustained levels of investment in renewable energy, increased electrification, the development of electrofuels such as clean hydrogen, and carbon capture and storage to capture emissions that cannot be prevented. At the same time, the vulnerability of energy systems has been recently highlighted with price spikes, the more frequent occurrence of significant climate events and the impacts of heightened geopolitical tensions on energy security.

The trends that we have highlighted focus on some of the innovations and legal developments that we are seeing in a number of sectors. It's also important to acknowledge the wider context. The COP26 summit in November 2021 underlined that while considerable progress is being made in some areas, the energy transition will not be a straight line, universal or even successful in some places, given the very real countervailing factors. Some of these include concerns about energy security, issues around greenwashing and a lack of coherent government policies which are desperately needed to create reliable revenue streams for project and other forms of financing.

The Glasgow Climate Pact, agreed at COP26, also emphasised the need for a just transition, putting people at its centre. Particularly important for the energy transition are the challenges in regions dependent on fossil fuel. Private sector investors and financiers will need to work alongside governments and public sector institutions to understand how energy transition projects are considering the impact on vulnerable communities, creating opportunities to accelerate the transition in a manner that is just and centred on people and resilience.

So where do we go from here? It's not all doom and gloom. There are many opportunities in places where government support and market conditions come together to make exciting and innovative projects possible. While some first-of-a-kind projects might not be replicable everywhere, they will advance our understanding, encourage investment, enable the energy landscape to continue to evolve and progress to be made towards net zero goals.

1

Small modular reactors (SMRs) are changing the future of nuclear power

The World Nuclear Association has estimated that the market for SMRs could amount to US$300 billion per annum by 2040. These reactors are not just smaller than traditional nuclear plants and less expensive to build and operate, they also offer safety and security advantages and are much more flexible in terms of potential applications. Critically, their scale and shorter payback should enable, in due course, financing options which have not previously been accessible for nuclear projects.

Reported challenges include the lack of consensus on a single technology to help regulatory development and harmonisation, licensing regimes, insurance market gaps and fuel limitations and the lack of a substantial track record of private debt financing of nuclear projects. What will be needed to encourage development and financing of these projects by governments and the private sector?

- Governments promoting these projects, such as the US, China, the UK and Canada will be looking to bridge a number of gaps; for example, support where insurance is unavailable and, at least initially until the levelised cost of energy - the average net present cost of electricity generation for a generating plant over its lifetime - for SMRs reduces, some form of assistance or subsidisation to allow projects to compete with other generation technologies.
- There are around 70 different SMR designs and concepts globally. A consensus on technology will be critical to ensure momentum, both from the perspective of regulatory harmonisation and the potential economies of scale advantages offered by SMRs, for which standardisation will be essential.
- Complex (and divergent) national regulation is typically based on full-scale, land-based nuclear plants and so does not address the specific requirements of SMRs. The International Atomic Energy Agency's regulatory forum for SMRs was established to share regulatory knowledge and experience. It initiated the third phase of its work in 2021 and is expected to publish further reports on licensing issues, design and safety and manufacturing, commissioning and operations. Standardisation of design will assist regulatory alignment. Governments will, of course, also need to ensure that relevant international treaties have been ratified and any domestic regulatory gaps filled. Regulation will need to be flexible and adaptable to the variety of likely technologies, while also covering all possible risks. The increase in factory-built elements of reactors will also give rise to regulatory challenges (for example, over the appropriate location of testing).
- It will be important for governments to ensure that licensing costs for SMR designs are properly adjusted to reflect these smaller projects, rather than mirroring those required for larger reactors.
- Many SMR designs need a fuel that is not yet available on a commercial scale – high-assay low-enriched uranium (HALEU). HALEU enables the smaller reactor designs to achieve more power per unit of volume. The US Department of Energy is working on a number of pilot projects, including methods that involve the recycling of used nuclear fuel. Suppliers in other countries, including France, are also gearing up, and there is growing confidence that this will not cause a bottleneck.
- Increasingly, providers of project finance or investment funds will prioritise projects seen as sustainable, and official taxonomies are likely to be used to determine sustainability. At the beginning of January 2022, the European Commission began consulting on the criteria to allow nuclear activities to be regarded as sustainable under the EU's sustainable finance taxonomy. This proposal is controversial and resistance to inclusion of gas and nuclear appears to be growing. However, if it is adopted, the criteria will need to be sufficiently tailored and/or flexible to ensure that pre- and post- commercialisation SMR activities can qualify as sustainable to maximise the availability of commercial finance.
- In the developing world, especially Africa, SMRs could be an important part of the energy transition. However there are a number of issues to overcome including navigating international nuclear non-proliferation requirements and the disposal of waste.

None of this is to say that that we have seen the end of large scale nuclear reactors. In fact, there has been a recent resurgence with new projects under development in, among others, the UK, Saudi Arabia, India and Egypt. As always the key to the success of these projects will be securing the necessary financing and we are seeing some interesting new developments in this area, in particular the proposed application of the regulated asset base model to new nuclear in the UK with the Nuclear Energy (Financing) Bill currently undergoing its second reading in the House of Lords.

2

Carbon Contracts for Differences (CCfDs) to kickstart clean hydrogen

Although the electrolyser technology used to produce clean hydrogen is not new, developing it on the large scale currently envisaged will be ground-breaking. Leaving technological challenges to one side, the key challenge facing these big clean hydrogen projects is economic - even at commercial scale, the first generation of clean hydrogen projects will not, by some margin, be price competitive with either "blue hydrogen" or natural gas. Early projects are therefore likely to need significant revenue support and strong and stable long-term hydrogen offtake arrangements, for example with a heavy industry user. This will be important as investors need business models that provide predictable returns to support the level of capital expenditure that will be needed. Various funding tools and support schemes are being launched in jurisdictions around the world to incentivise these early projects, such as tax credits, feed-in tariffs and direct funding to eligible projects. Examples of these are the EU Recovery and Resilience Facility, Horizon Europe, the Just Transition Fund and the Innovation Fund.

In the U.S. the Biden administration's American jobs plan specifically includes clean hydrogen projects, but the administration's willingness to advance tax credits and other financial incentives, such as master limited partnerships used in the oil and gas sector, could play a significant role in making clean hydrogen economically competitive.

Support schemes in the form of Carbon Contracts for Differences (CCfDs) are one of the most promising options to foster the deployment of low-carbon industrial technologies and to bridge the existing cost gap between clean and fossil-based hydrogen. Such schemes could kickstart the clean hydrogen market and support a strong offtake-downstream market. This financial incentive has been touted across the globe as a potential means to support energy-intensive industries in developing and deploying low-carbon technologies and to minimise the revenue uncertainty attached to investments in clean hydrogen. Regulators are also exploring CCfDs – in its New Industrial Strategy, the European Commission recently stated its interest in a European approach for CCfDs in the context of the upcoming revision of the EU ETS Directive. Some countries have already recognised this opportunity, and Germany is a frontrunner – its Federal Ministry of Environment and Nuclear Safety has published a White Paper in which it intends to develop a pilot project for CCfDs.

How do CCfDs work? There are different methodologies, but in essence they are similar to "feed-in premium/tariff" (FIP/FIT) policies, which make renewable energy projects "investible". Producers of low-carbon materials, such as clean hydrogen, are guaranteed a fixed carbon price ("strike price"). The buyer covers the difference between the current carbon price, which, for example, may be calculated as the yearly average price of emissions allowances (EUAs) and the strike price. This mechanism would help to ensure that the CO2 price faced by investors in first-of-a-kind commercial-scale clean hydrogen projects better reflects the true social cost of carbon in the economy and would reinforce the bankability of clean hydrogen projects with very high upfront capital costs.

To manage funding support and limit overly long subsidisation, CCfDs will need to be structured on a market conformity basis, as required under the EU State Aid guidelines, for example. The tender process could be designed in a similar way to the competitive tendering process for renewable energy source (RES) projects in the EU, whereby governments would announce calls for clean hydrogen project tenders, including a request to bid for a specific strike price. Ideally, tenders would be organised in a technology-neutral manner, with different strike prices for different sectors (for example, steel, cement, etc.).

All of the foregoing will need to take into consideration the development of a more fluid, less structured clean hydrogen ecosystem, which will require the arrangements described above to evolve over time. This ecosystem would consist of multiple sellers and buyers of clean hydrogen, in a "merchant" atmosphere. It should develop in areas where a clean hydrogen midstream for transport and storage emerges, such as in Europe via the current initiative of European transmission system operators to build a clean hydrogen backbone pipeline system.

Infratech - how energy transition can be achieved through the integration of technology with infrastructure

3

The resilience of critical infrastructure is a priority for governments across the world as they build back from the global pandemic and prepare strategies to achieve their climate targets. The integration of technologies such as blockchain and other distributed ledger technologies (DLTs) with infrastructure is seen by many as having a key role to play, although it is not without its challenges. Digitalisation will be vital to enable companies in the energy sector to maximise operational efficiency and facilitate the energy transition. Access to good-quality data on carbon emissions will be important, both for monitoring progress towards net zero and helping businesses understand how change can be achieved.

Digitalisation also brings challenges, particularly in integrating advanced digital technologies into existing infrastructure. Cyber security is an increasing risk in more complex systems where personal data is attached to energy use and a proliferation of micro-generators will test grid security.

We expect to see:

- The increased use of asset tokenisation (the conversion of ownership interests in hard infrastructure assets such as buildings or power stations into digital assets through the use of DLT-based tokens), which may unlock new sources of finance, particularly for projects in the developing world.
- Smart infrastructure (such as smart grids, smart cities, roads, ports and power distribution systems) increasingly being used to improve performance and efficiencies. This will be taken to the next level through the metaverse as companies start to reimagine how to use robots to perform tasks for them in any location through metaverse technology. For example, robot avatars performing planned and unplanned maintenance in nuclear power plants or at remote offshore wind farms.
- Continued investment in autonomous vehicles, data centres and technologies like 5G and the Cloud, which have become an integral part of IT systems worldwide.

Regulation is needed so that the right framework is in place to enable the infrastructure sector to make the necessary investment, including structures that provide a revenue stream to support project financing. Some initiatives already announced include:

- In the US, the new Infrastructure Investment and Jobs Act (November 2021) includes a significant investment of US$21.5 billion for the development of energy technology projects, including energy storage, carbon capture projects and research on solar energy technologies.
- The EU's roadmap on the digitalisation of the Energy Sector (July 2021) is currently open for public consultation. The areas of focus include the development of a European data-sharing infrastructure, enhancing the uptake of digital technologies and enhancing the cyber security of the energy sector.
- The UK Government launched an Energy Digitalisation taskforce in 2021 to consider the market design, digital architecture and governance of a modern digitalised energy system. It is due to report in 2022.

We also expect to see an increased focus by stakeholders on the ESG implications of these Infratech transactions – for example, the excessive energy consumption of blockchain validation processes and the electronic hazardous waste they produce. There will also be greater attention paid to the use of sensitive data and personal information that can be a target for espionage, sabotage and foreign interference, leading to increase scrutiny by government on foreign investments in relation to these transactions. Governance arrangements associated with the decentralisation of infrastructure systems will also come under the spotlight, with the collective responsibility of participants in such systems aligning with the increasing awareness of sustainability.

4

Developments in carbon market structures

COP26 in November 2021 saw agreement on key elements of the Paris Agreement Article 6 Rulebook for a new global carbon market mechanism to allow credits from carbon reduction projects in one signatory state to be used to satisfy another state's carbon reduction commitments (or Nationally Determined Contributions). A further mechanism was created to allow bilateral arrangements (so-called co-operative approaches) to achieve a similar end. Although the processes to finalise the rules continue, 2022 will see signatory states beginning to consider how they will participate in these Article 6 mechanisms. Will developing countries allow credits from domestic carbon projects to be traded internationally, or will they wish to retain more control to use such credits for satisfying their own commitments? Will they wish to control voluntary markets more closely and divert credits into the regulatory markets? Will developed countries risk claims about the integrity of their climate commitments by accepting international credits to help satisfy their Paris agreement commitments or will they rely solely on domestic carbon reductions?

More clarity may also emerge over the extent to which the Article 6 Rulebook could apply to the voluntary markets – this may help address some of the concerns evident in the voluntary carbon markets over issues such as double-counting of credits (one of the issues the new Integrity Council for the voluntary carbon market is currently considering). Development of cross-border carbon markets is also dependent on additional clarity as to the legal nature of carbon credits, the applicability of financial regulation frameworks and the accounting treatment of carbon credits, topics that the International Swaps and Derivatives Association (ISDA) and the UK VCM Forum, among other organisations, are considering. For more information on the Article 6 Rulebook, see our briefing: COP26: Article 6 Rulebook For The New Global Carbon Market Mechanism Agreed.

Increasing market activity and carbon price pressure

Increasing regulatory, stakeholder and societal pressure to reduce emissions in all sectors is likely to continue in 2022 in particular with the deepening of nations' carbon reduction commitments under the Paris Agreement. A growing trend for companies to set net zero and other climate reduction targets is likely to lead to a major increase in activity in the voluntary carbon markets and rises in the price of voluntary carbon credits, as supply of carbon credits fails to keep up with demand from corporate offsetters. Energy companies will increasingly look to establish, invest into, or finance, projects to secure a steady supply of reputable credits whilst others will develop trading platforms.

5

Innovation in Carbon Capture and Storage

Carbon capture, utilisation and storage (CCUS) technologies are one of the few solutions to tackle emissions from heavy industry and to remove carbon from the atmosphere. The International Energy Agency (IEA) reports that plans for more than 100 new facilities were announced in 2021, but CCUS development is not yet on track to deliver on Net Zero by 2050 targets.

Momentum is growing, and we expect to see a trend towards CCUS networks, where lower cost, less-complex projects share CO2 transport and storage infrastructure in industrial clusters. Such developments will enable smaller projects to benefit from the economies of scale that large, vertically integrated projects with dedicated downstream transport systems have enjoyed.

More and more countries are including CCUS in their long-term climate policies, and there is also greater range of projects. Three quarters of industrial CCUS capacity currently in operation is natural gas processing, but hydrogen and biofuel production makes up 50% of projects under development (source: IEA). A further 8% of the projects in development comprise CCUS deployment in iron, steel and cement facilities.

There are some interesting innovations on the horizon, including technologies that directly remove CO_2 from the atmosphere, so called direct air capture (DAC). DAC projects are in an earlier stage of development, but could play an important role in balancing out residual emissions that are difficult to eliminate and in continuing to reduce atmospheric CO_2 in the long term. Indeed, the International Energy Agency (IEA) has stated that DAC will need to be scaled up to capture more than 85 Mt CO_2/year by 2030 and ~980 Mt CO_2/year by 2050 in order to hit the net zero by 2050 target.

Supercharging Renewable Investment

6

Even in the jurisdictions that have been most successful in developing renewables at scale, hitting climate change targets will require continued renewables investment at a multiple of current levels for many years to come. The renewables sector has shown a remarkable ability to continue to reduce costs with scale, particularly for PV solar and wind generation technologies and many are confident that this will continue as the sector grows. At the same time, increased commodity prices are placing strain on capital expenditure budgets and a low cost, low inflation world cannot be taken for granted into the future.

To support the required investment, a number of challenges will need to be faced, including:

- Sufficient suitable sites for new projects will need to be found. In a number of jurisdictions the best sites have already been taken and opening up new areas for investment may face significant political opposition as well as raising environmental impact concerns.
- Repowering of existing projects at the end of their working lives will have an important part to play and a helpful planning and regulatory environment for repowered projects will be important. The wind sector will have to find better solutions to deal with old turbine blades than simply burying them in landfill sites.
- Grid expansion and grid strengthening will be needed to support a significantly increased scale of renewable generation that is frequently some distance from the centres of demand. The impact of increased levels of intermittent generation on our power systems cannot be ignored. Regulations need to be fit for purpose to avoid excessive price volatility and grid instability and must support parallel investment in electricity storage and clean baseload power capacity to underpin the system.
- In the next few years floating offshore wind technology is going to be deployed at commercial scale. It has the potential to significantly increase the size of the offshore wind sector in existing jurisdictions like the UK (particularly following the recent Scotwind auction process), as well as kick-starting offshore wind development in a range of new deeper water jurisdictions – including Italy and South Korea. Floating offshore wind will challenge developers, technology providers and supply chains, port infrastructure and their lenders and investors to quickly develop approaches to permit them to replicate the success of the existing fixed foundation projects.
- Floating offshore wind, battery projects, grid solutions and back-up capacity are all likely to require government support, including fit-for-purpose regulations, efficient planning and consenting processes and financial support for new technologies (like floating offshore wind) until they become price competitive. None of this will be cheap and protecting the most vulnerable individuals, and the highest energy using businesses from adverse impacts of higher and more volatile prices is as important a political challenge as encouraging the level of investment that is required.

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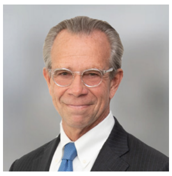

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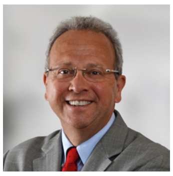

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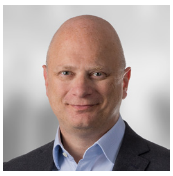

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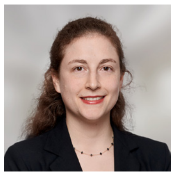

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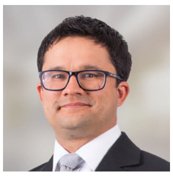

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